

**Short Run Linkage between Inflation and Unemployment
during Pre and Post-Recession : A Study of India**

THESIS

SUBMITTED TO

**BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
(A CENTRAL UNIVERSITY)
LUCKNOW**



FOR THE AWARD OF DEGREE OF

DOCTOR OF PHILOSOPHY

IN

ECONOMICS

UNDER THE SUPERVISION OF

PROF. NMP VERMA

SUBMITTED BY

PRATINIDHI

DEPARTMENT OF ECONOMICS

SCHOOL FOR AMBEDKAR STUDIES

**BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
(A CENTRAL UNIVERSITY)**

VIDYA VIHAR, RAEBARELI ROAD, LUCKNOW-226025 (U.P.), India

ENROLLMENT NO. 079/15

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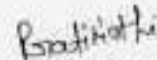


Dedicated To
My
Teachers
&
Parent

DECLARATION

I declare that the thesis entitled "**Short Run Linkage between Inflation and Unemployment during Pre and Post-Recession : A Study of India**" submitted to Babasaheb Bhimrao Ambedkar University, (A Central University), Lucknow, for the award of Doctor of Philosophy in Economics, is my original work and it has not previously been produced for the award of any degree, diploma, fellowship or similar other titles anywhere.

This research study is carried out under the supervision of **Prof. NMP Verma**, Department of Economics, School for Ambedkar Studies (SAS), Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, Uttar Pradesh, India. This is also declared that the thesis is essentially free from all kinds of plagiarism.


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CERTIFICATE

This is to certify that the thesis titled “Short Run Linkage between Inflation and Unemployment during Pre and Post-Recession : A Study of India” submitted by Ms. Pratinidhi is an original research work and has not been previously submitted in part or full for the award of any other degree or diploma to this or any other university.

The thesis submitted to Babasaheb Bhimrao Ambedkar University, Lucknow, satisfies all the requirements as stipulated in the Doctor of Philosophy (Ph.D.) regulations - 1999 as amended in 2013 and it is fit for submission and evaluation for the award of the degree of Doctor of Philosophy of the University.

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3

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Pratinidhi

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LIST OF ABBREVIATIONS USED

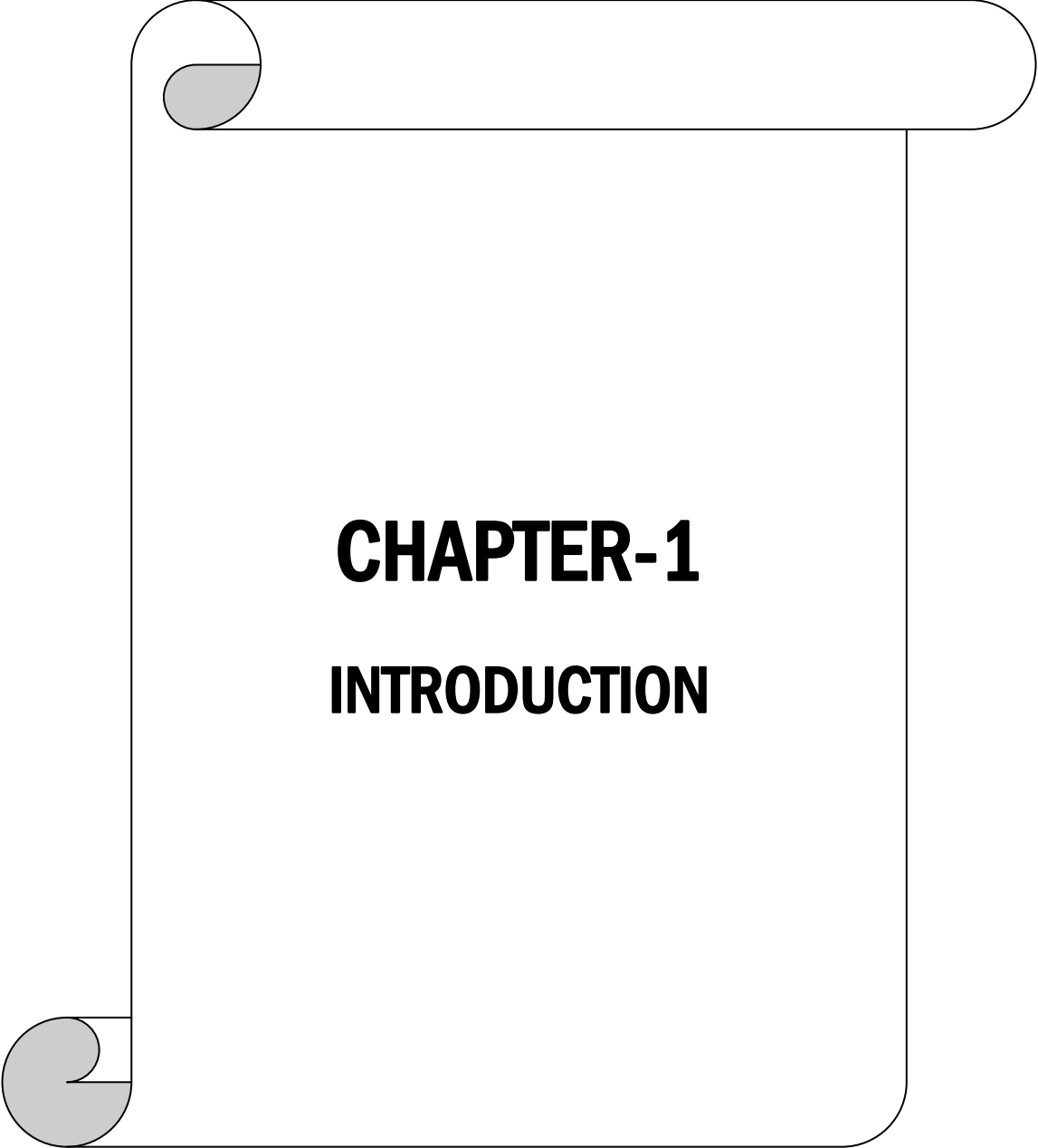
AD	Aggregate Demand
ADF	Augmented-Dickey Fuller
AIC	Akaike Information Criterion
AIG	American International Group
ANOVA	Analysis of Variance
AO	Additive Outlier
ARCH	Autoregressive Conditional Heteroskedasticity
ARDL	Auto Regressive Distributed Lag
AS	Aggregate Supply
CDS	Current Daily Status
CIDP	Chartered Institute of Personnel and Development,
CoS	Committee of Secretaries
CPI	Consumer Price Index
CPI-AL	Consumer Price Index- Agricultural Laborer
CPI-IW	Consumer Price Index- Industrial Worker
CPI-RL	Consumer Price Index- Rural Laborer
CPI-UNME	Consumer Price Index Urban Non-Manual Employees
CSO	Central Statistics Office
CUSUM	Cumulative Sum
CV	Critical Value
CWS	Current Weekly Status
DF	Degree of Freedom
DGET	Director General of Employment and Training
ECM	Error Correction Model
ECT	Error Correction Term

EPWRF	Economic Political Weekly Research Foundation
EUS	Employment-Unemployment Survey
FPE	Final Prediction Error
GDP	Gross Domestic Product
GNP	Gross National Product
HP	Hodrick-Prescott
HQ	Hannan-Quinn Information Criterion
ILO	International Labor Organization
IMF	International Monetary Fund
IO	Innovational Outlier
IRF	Impulse Response Function
JB	Jarque-Bera
LFPR	Labour Force Participation Rate
LM	Lagrange Multiplier
LRPC	Long Run Phillips Curve
MOSPI	Ministry of Statistics and Program Implementation
NAIRU	Non- Accelerating-Inflation Rate of Unemployment
NBER	National Bureau of Economic Research
NRU	Natural Rate of Unemployment
NSC	National Statistical Commission
NSSO	National Sample Survey Organization
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Square
OPEC	Organization of the Petroleum Exporting Countries
PC	Phillips Curve
PIN	Pin Index Number
PP	Phillips Perron

PPI	Producer Price Index
PU	Proportion Unemployed
RBI	Reserve Bank of India
RMSE	Root Mean Square of Error
SBCs	Schwarz Bayesian Criteria
SC	Schwarz Information Criterion
SNA	System of National Accounts
SPCL	Statistics of Prices and Cost of Living
SRPC	Short Run Phillips Curve
SS	Sum of Square
SV	Single Variate
SVAR	Structural Vector Auto Regressive
TAC	Technical Advisory Committee on
TS	Time Series
TS	Test Statistics
UK	United Kingdom
UPSS	Usual principal and subsidiary status
UR	Unemployment Rate
US	United States
US	Usual Status
VAR	Vector Auto Regressive
VECM	Vector Error Correction Model
WPI	Wholesale Price Index
WPR	Working Population Ratio

PREFACE

This research study entitled “***Short Run Linkage between Inflation and Unemployment during Pre and Post-Recession: A Study of India***” was inspired by the author’s intent to add to the policy initiatives taken by the economists to address two travails of every economy which are: Inflation and Unemployment. These two macro variables may threaten to choke the economic aspirations of any country. With most of the economies in the world reeling under the impact of Global Financial crisis, the study also investigates the effects of Recession on inflation and unemployment in India. Basing its rationale on the empirical evidences in the context of the Phillips Curve, the study recommends that policymakers and strategists should allude to the efficacy of Phillips Curve. With the advent of globalization, no economy can remain immune to financial turmoil unleashed in any part of the world. Hence the economists need effective tools as the Phillips Curve to accurately analyse Inflation and unemployment. This study posits to be a repository of solutions that the governments and strategists need to employ to contain inflation while ensuring that every stakeholder in society who is seeking an employment opportunity is not deprived of.



CHAPTER-1

INTRODUCTION

INTRODUCTION

1.0 Introduction

Inflation and unemployment are probably the most pressing concerns for all economies in the world. Economists and policy mappers across the world are consistently devising strategies to overcome the anomalies created through these two macro variables. These variables are perhaps two of the most used economic indicators to gauge how well a country is performing in terms of economic growth. The adverse consequences that inflation and unemployment can cause on the living standards of people cannot be overstated. In its extreme form, unemployment alone can lead to political upheavals and perpetrate a host of social evils. Uncontrolled inflation can cripple economies and retard the industrial output, thus adding to the woes of unemployment. Hence, it is imperative to carefully measure inflation and unemployment. Moreover to contain inflation while ensuring healthy levels of employment in the country, the strategists must enlist the most accurate means to analyse unemployment and inflation.

As early as the mid-1950s, the types of inflation were based on the Caucasian model that was premised on the demand principle. The unemployment in the United States in the period immediately after the war was higher than it was in the late 1950s. Yet it seemed that prices were rising and at the same time the fear of lethargy after the war was taken over by serious apprehensions related to the problem of inflation. The result was that a long debate broke out. On one side of the dispute, cost-push inflation was ideological, which said that there is no excessive demand. On the other side, the demand- pull was ideological related. When the dispute between cost-push and demand-pull ideologies was in full swing in the United States, Phillips developed a very interesting approach to the problem of inflation and the anti-inflation policy (*Johnson, 1970, P. 391*).

The macroeconomics target is to achieve full employment, price stability, high productivity and economic development (Verma, 2017). Inflation and unemployment are crisis areas for all economies, be they developed or a developing one. In fact the health of

a country's economy can be assessed by the rate of inflation and unemployment in the country. Therefore, these variables can lead to drastic fluctuations in the economy. Inflation is the procedure of increasing prices levels of goods and services that cause an increase in the total consumption to expand, a standard measure of the price of inflation rate is the rate where prices escalation over time causing a reduction in the purchasing power of the money (*Parkin, et al., 2005*). According to John Maynard Keynes, a bit of inflation can help in the growth of the economy; the accurate measurement also helps to distinguish between currency values and real values in the economy (*op cit.* 2005).

Inflation is rightly considered as the big enemy of any economy. It reduces consumption, investment and standard of living. This leads to slow developmental process in the economy. It has a negative impact on income distribution. Though the price increase looks to be beneficial for some people, it is detrimental for many others. While the income increases quickly for some earners during high inflation, it is the opposite for most earners who have fixed incomes. Since the real income declines during the periods of Inflation, the earning and the spending potential of many people decreases, thus retarding the economic growth. Inflation also has an effect on the lending and savings. It is usually the borrowers who benefit from Inflation while the lenders and the savers remain disadvantaged. Due to the decline in the saving rate, the investment rate is affected negatively. Inflation also affects the foreign trade of a country. The competitiveness of a country may be affected by Inflation (*Kumar, 2012 P. 11*) which can be measured by the Consumer Price Index (CPI). Inflation is classified into two distinct types, namely, the Demand Pull Inflation and the Cost Push Inflation.

The miasma of unemployment unleashes both economic and social turmoil, more so in a country like India. Unemployment refers to the condition in which the skilled workers who wish to be employed do not find work. According to a report on the impacts of economic slowdown on employment in India, about half million workers lost their jobs during October to December 2008 (GoI, 2009). Unemployment continues to plague India and remains the most critical of our country's problems. Lack of employment is a harbinger of host of economic, political and social ills in the society. An employable individual who is not engaged in work not only suffers monetarily but also faces social

ostracism. When the organisations of a country do not hire, the country risks losing its skilled human resource as unemployed youth often take to illegal means for generating income. This increases the crime graph besides widening the gap between the haves and have-nots. Thus, unemployment is at the root of both social and economic disparity in any country. With limited availability of work, the unemployed often resort to corruption to find work. Frustration due to declining standards of living among the unemployed leads to disenchantment with the social fabric of the nation. Moreover, increased inflation with no earning potential further entrenches poverty in the society, unleashing a vicious circle of economic gloom. With no income to support a household, the members of a family stand to be deprived of adequate healthcare, quality education or at times even nutritious food becomes unaffordable. Lack of income inevitably leads to reduced consumption and this creates recessionary or deflationary situation in the economy. Thus, the two variables of inflation and unemployment are connected by the *Phillips Curve Theory*.

The Phillips Curve theory found an association between the rate of inflation and rate of unemployment in the economy. This theory guides the policymakers about the stability of prices in the economy. According to the Phillips Curve shape, the two variables of inflation and unemployment expand or contract based on the liquidity of economy. Several economists, academicians and researchers still argue about the connection between inflation and unemployment. The Phillips Curve is one of the best known, most debatable and most often used to examine the Macroeconomic relationships. The present study is based on the Financial Crisis 2008, because it was a major crisis in the United States (US). The impact of economic crisis in the USA was not merely confined to United States. The US economy is the biggest economy in the world. United States is the largest exporter, importer and food supplier to the other economies in the world. Hence, any upheaval in the economy of the USA is bound to have a direct or an indirect impact on rest of the world economies. Many people lost their jobs in the wake of the Financial Crisis. The Indian economy was also affected with reduced jobs for skilled labour force. Even the inflation was less as compared to the other normal phases in the Indian economy. As observed by (karuna, 2011), the unemployment rate usually jumps and

inflation falls slightly because the overall demand for goods and services is curtailed during the recession. As stated by (Kose, 2009, P. 53), the house and equity values recession is also associated with the turmoil in financial markets. According to the International Labor Organization (ILO), as many as 51 million workers were fired in 2010 globally, while 30 million more jobs were at risk. Moreover, the United Nations also predicted that 200 million workers, mostly in the developing economies, could be pushed into more poverty. The global unemployment rate was estimated at 7.5 percent in 2010, up from 6.5 percent in 2009 and 6.7 percent in 2008. This implies that the Global Recession was already resulting in a drastic increase in the number of people joining the labor market and swelling the rank of unemployed. As observed by the (ILO, 2010), “*the labor market epidemic downsizing was also a result of the recession*”. According to (Kumar, 2009, P.8), the global economic downturn, which started with the collapse of Lehman Brothers on 23 September 2008, had an immediate impact on the Indian economy. Credit flows suddenly dried-up and, overnight, money market interest rate spiked to above 20 percent and remained high for the ensuing months. Financial Crisis started in 2007 with a problem in the *subprime mortgage market* in the United States. This problem later metamorphosed into an international banking crisis with the collapse of the Investment Bank which was named the Lehman Brothers on September 15, 2008 (Mark, 2010). In the words of Mark, “*the speed of the contagion that spread across the world like a wild fire was rather unprecedented.*” Due to Globalization, the impact of Global Financial Crises spread to the rest of the other economies in the world. The impact of the global crisis was transmitted to the Indian economy through three distinct channels which were: the financial sector, exports and exchange rates (op.cit, 2009). According to (Szabolcs Szentmihályi, & Világi, 2015, P.5), during the prolonged global recession that unfolded due to the Global Financial Crises of 2007–2008, special attention was paid to the issue of the slope of the Phillips Curve. It is significant to note Stock and Watson’s, 2009, remark here which states, “*The Phillips curve framework relating inflation to economic activity continues to be the workhorse model for understanding inflation dynamics, even as it has faced a number of challenges in the past and is confronted with new complexities in the aftermath of the Great Recession*”. Ball and Maunders (2011), found that the Phillips Curve predicts deflation unless the expectations are at least

partially anchored to the Federal Reserve's target inflation rate. The International Monetary Fund observed in 2013 that the Global Financial Crisis caused a significant decline in economic activity. This further reiterates the link between economic activity and price inflation. Elsewhere, while the inflation decline was much less, the very recent downward pressures on inflation seemed to suggest otherwise. There was the general impression that during the *Great Recession*, inflation fell by less than one might expect. This has been attributed variously to long-term inflation expectations being firmly anchored at pre-defined inflation targets (*Matheson, and Star view, 2013*). A flatter Phillips Curve implies a weakening of the tradeoff between rate of inflation and the rate of unemployment (*Kocherlakota, 2010*). *Stock and Watson* also state that with an increase in the Structural Unemployment and a related decline in the potential output, the output gaps were not as negative as they might appear. *Stock and Watson* argue that inflation in the U.S. had been affected by domestic real activity mainly recessions. *Meier, (2010)*, provides more ambiguous evidence for OECD countries; in particular, pointing to difficulties in identifying such a relationship in an environment with very low inflation. The Financial Crisis came about in 2007 and changed to an economic crisis, commonly known as the Great Recession affecting the output produced inflation and unemployment. Many OECD countries entered into a long recession period with a significant decline in Gross Domestic Product and an increase in the unemployment rate. Data on unemployment rate as tallied with NAIRU shows that the unemployment rate was higher than NAIRU and this difference became greater and during the recession period. One of the characteristics of this *last recession* was the great decrease of the output during this period, and the slow growth and the considerable weakness that many countries faced after the recession period. Thus the period of recession and its drastic effect became apparent in the slow growth that led to a downward pressure on prices. This developed into a deflation period (*Fendal, et al. 2008*). A study by *Carlos et al. (2012, P. 1)* states that, “after the collapse of Lehman Brothers Investment Bank in 2008-09, which resulted in a significant loss of output (GDP), there was a large amount of increase in unemployment and a deflationary scare in many countries and the forecasters' expectations of inflation and Gross Domestic Product growth deteriorated in 2008”.

In addition, the present research endeavor has added one more concept which is the Output Gap. This study examines the Philips Curve relationship in the context of the India. In India, there is no regular or yearly data on unemployment. Therefore, we added Output Gap. Output Gap is a difference between the Actual Output and the Potential Output. It provides the idea or guidance for policymakers about the expansion or the contraction of money in the economy. The output gap indicates a summary measure of demand situations in the economy and is a useful indicator of the state of the macro economy. It is also an important input for monetary policy. Conventionally, inflation has been seen as the sole symptom of macroeconomic imbalances in the economy captured by fluctuations in various measures of the output gap (*Rath, 2018*). In other words, output gap demonstrates that how much extra capacity an economy has in case of a chance of a rise in demand.

India is a rich country and the main reason of India's poverty and backwardness is unemployment. Even in the present globalized context, most Indians are still engaged in agriculture and its related work through agro-industry. Unfortunately, the agriculturalists are totally based on monsoon with limited access to advanced knowhow of farming. Lack of better vocational education and the weak structure of our economy further compound the problems. On the other hand, inflation has also increased leading to substantial increase in the general price level of goods and services in our economy over a period of time. Thus, with the increase in the cost of living, there is a dismal decline in the standard of living of the people who are unable to afford the expensive costs of daily utilities. Low purchasing power reduces consumption and depletes saving and further reduces investment. This situation ultimately increased unemployment. Moreover, it also creates ups and down in the economy.

In context of the aforementioned issues and facts, the present Research study intends to examine whether the Philips Curve shape or theory exists or not in the Indian context, particularly during the Global Financial Crisis. Furthermore, we have also mapped the measurement of the Output Gap from 2002 to 2015.

1.1 Introduction of Inflation and Unemployment: A Phillips Curve Approach

The Inflation and unemployment are the most discussed and debatable problems of the Indian economy. High inflation and high unemployment are the major crisis zones of India. Inflation refers to the increase in the general price level of goods and services in an economy over a period of time. There are many direct and indirect effects of Inflation on the economy. In the words of *Dr. Singh, the Former Prime Minister of India*, “*Inflation poses a serious threat to the growth momentum. Whatever be the cause, the fact remains that inflation is something which needs to be tackled with great urgency*” (February 4, 2011, New Delhi).

Unemployment refers to a condition in which the workers despite being skilled do not find any work.

To address the various woes that emanate in the economy due to Inflation and Unemployment, it is extremely important to reduce or eliminate simultaneously both inflation and employment. In fact it would be extremely desirable to cut or wipe out altogether, if possible, the threat inflation and unemployment. This type of relationship is described by the Phillips Curve theory and A.W. Phillips demonstrates this theory.

1.1.2 Introduction of the Phillips Curve theory

The iconic economist *A. W. Phillips* is the proponent of the Phillips Curve theory which he promulgated in 1958. The theory is based on UK Data and describes the relationship between the rate of inflation and the rate of unemployment in an economy. Phillips concludes that there is an inverse relationship between the rate of inflation and the rate of unemployment. As per the theory, when the rate of inflation decreases, then the rate of unemployment increases and vice versa. Phillips asserted that negative relationship between the rate of inflation and the rate of unemployment leads to a stable relationship. Phillips Curve is the most preferred tool of the economists to describe the link between inflation, unemployment price stability and full employment in the economy. Phillips curve assumes a significant and pivotal role in the modern monetary economics.

Furthermore, Phillips also found an inverse relationship between the rate of change in the money wage rate and the rate of unemployment in the short-run (*Hall & Taylor, 1991*). Moreover, the Phillips Curve also takes into account the Output gap. “*The Output Gap estimates can signal the cyclical position of the economy by providing information on inflationary or contractionary pressures*” (*Bukhari & Khan, 2008*). In addition, how much extra capacity does an economy have for a possibility of the rise in demand? How close does an economy have to be for working at its productive potential? Has the recession damaged the economy’s productive potential? These types of questions are essentially related with the output gap. The output gap is an economic measure of the difference between the actual output of an economy and its potential output. *Riley, 2012*, considers the Potential output as the maximum amount of goods and services an economy. The Central Bank of India is mostly used to create the policy implication, financial instability and price stability, by the Phillips curve.

On the other hand, according to *Milton Friedman*, in the long run Phillips curve doesn’t portend an inverse relationship between the rate of inflation and the rate of unemployment in the economy. Due to rational expectations, Phillips curve becomes a vertical slope in the long run. This is termed as the Non- Accelerating-Inflation Rate of Unemployment (NAIRU). Despite the concept of the output gap measures, there is a difference between the inflation pressure and capacity utilization in the economy. In other words, the concept of output gap is the difference between actual output and the potential output. The potential output is referred to as the capacity utilization in the economy. It is the most important indicator for examining the business cycles and the main benefit is that it provides several facts (information). This has led to the formulation of relevant statements about the economy. The positive output gap is generally correlated with the boom period and indicates that the economic activity exceeds capacity and creates pressure on the labour market and on the price levels. A positive output gap is expected to have repercussions towards a lower unemployment and a higher level of inflation. “*While a negative output gap is generally correlated with a recessionary period and the pressure would be in the direction of higher unemployment and low inflation*” (*Bank of Canada, 2012*).

According to *Goyal & Arora (2013)*, the potential output growth should be measured and then used to drive the Indian monetary policy stance. As stressed by *Pybus (2011)* in his study of United Kingdom's historical output gap, estimates of the output gap during comparable stages of previous recessions can be helpful in evaluating the plausibility of estimates of the current level of the gap and how it might be expected to evolve over time. *Titan and Georgescu (2013)*, show that the output gap can be used to investigate macroeconomic stability in general and business cycle dynamics in particular. The potential output and output gap can be used to study specific macroeconomic issues. For instance, *Johnson (2013)* argues that potential output is a key factor for debt sustainability analysis and for developing strategies for growth.

1.1.3 Study of Background of the Phillips Curve

The discussion of the Phillips curve is especially appropriate to think about in the context of the actions initiated by the Central Bank. Several financial publications mentioned the efforts undertaken by the Central Bank to boost or slow the measure of economic activity. Such discussions frequently also touched on the impact of the Central Banks' actions on inflation and on the picture of the modeled inverse relationship between inflation and unemployment that is known as the Phillips curve.

In 1958, *A.W. Phillips* published a paper in which he exhibited, using UK data, the empirical assessment of United Kingdom (UK). Data had been taken from 1861 to 1957, for 100 years. The author found the stable relationship between the nominal wage rate and the rate of unemployment, the higher rate of wage inflation and the lower the rate of unemployment (*Phillips, 1958*).

1.1.4 The Phillips Curve in the 1950s and 1960s

The equation that captures the relationship between developments in inflation and the real economy can be outlined back historically to the study of Phillips (1958). The author found a stable correlation between the nominal wage rate of inflation and the rate of unemployment; the higher wage inflation and the lowest rate of unemployment.

After two years, two economists provided a significant contribution to Phillips curve, thus making it more popular among the academicians and policy makers. Firstly, they restarted the Phillips view by expressing the relationship between rate of unemployment and rate of inflation. Secondly, they also indicated an alternative policy that was based on the combinations of unemployment and inflation rates for policymakers. This means that it is not possible to achieve the economic goals of low inflation and low unemployment simultaneously, thus policy makers can control the level of inflation by sacrificing unemployment in the economy (*Samuelson & Solow, 1960*). By the end of the 1960s, inflation and unemployment trade off introduced by the Phillips curve had become an essential part of the Keynesian approach and used by the policy makers in their economic strategies. However, during the 1970s, Phillips curve started to be questioned on both empirical and theoretic grounds in the late sixties. In 1970, due to oil price shocks, Phillips curve relation did not exist in the economies. That time both the inflation and unemployment were rising simultaneously and this created deflationary situation in economy.

Whether is the similar relationship between inflation and unemployment despairs from the inverse relation between wage inflation and unemployment from two aspects? First, is that the Keynesian theory did not deal with the mechanism of price adjustment, and thus the Phillips curve generated for price inflation could be interpreted as the absent equation.

Second contention is that for the modern economic policy typical of the period, a stable relation between inflation and unemployment would have provided an opportunity to set unemployment to the desired level by dealing with the aggregate demand. Besides, if necessary, to raise the prices to a level higher than before.

1.1.5 Application of the Phillips Curve

It is the most popular tool among the policy makers and is widely used for policymaking. The shape of the curve expands or contracts given the availability of money in the economy. For instance, during the 1960s and 70s, it was a common instrument practice for government around the world to select a rate of inflation that they wanted to achieve and then increase or reduce the economy to achieve the desired target rate. This policy

became known as stop-go and was trusted strongly on fiscal policy to generate the growths and reductions required.

1.1.6 The Breakdown of the Phillips Curve

By the mid-1970s, it looked that the Phillips curve trade-off no longer existed. These no longer looked a stable pattern. The stable relationship between unemployment and inflation looked broken. It was possible to have a number of inflation rates for any given unemployment rate. Phelps (1967) and Friedman (1968), rejected the concept of a short run inverse relationship between inflation and unemployment. Friedman and Phelps added two new independent variables into the Phillips curve equation. First, was the Inflation Expectation and second was the Natural Rate of Unemployment. It is assumed that the Inflation Expectation Adaptively in terms of Past Inflation is called the Adaptive Expectation while the Natural Rate of Unemployment is determined by the real economic factors. According to them, actual inflation is defined as the functions of the adaptive inflation expectation and the gap between natural rates of unemployment.

Phelps and Friedman not only involved two new terms in the Phillips curve, but also changed its policy implications deeply in the framework of expectations-augmented Phillips curve. They introduced that in the long run, the actual unemployment rate could not be below the Natural Rate. Moreover, even if this possible in the short run, whatever the inflation rate is, if the actual inflation is greater than inflation expected, then the actual level of unemployment would be smaller than the natural rate of unemployment.

Thus, in the short run, policy makers could push the natural rate of unemployment by creating a higher inflation rate than expected inflation by the public. However, in the long run inflation expectations will be the adjusted upward and equalized to the actual level while the actual unemployment rate ultimately returns to its natural rate at the higher rate of inflation.

1.2 The Review of Literature

In this study, we have collected literature that is based on the past studies at both the international and the national level. These studies provide evidence in favour of significant interactions between Inflation and Unemployment in macro economy, more so in the period of the Global Financial Crisis.

The International Level

Few examples are:

- *Szomolanyi, et al. (2012)*, states that the Phillips curve is a basic tool to understand relations between the growth rate of money wage and unemployment rates.
- *Jaromir(2013)*, states that there was a sharp increase in unemployment accompanied by a relatively muted inflation during the Great Recession.
- *Rafery et al. (2010)*, this study doubts the validity of the Phillips curve with the aid of dynamic model averaging. The authors' study aims to highlight that the existence of a systematic relation between real activity and inflation is blurred due to the failure to capture inflationary pressures, by means of a single measure of economic activity and second is the existence of a nonlinear response of inflation to the driving variable based on data for the USA and other G7 countries.
- *Murphy and Robert (2013)*, attempted to ascertain whether the Phillips curve could explain the behavior of inflation in the United States. The authors modified the traditional Phillips curve to explain time variation in its slope and showed that the modified model was more conversant a tool to analyse the recent behavior of inflation without relying on set expectations.
- *Bersch & Tara (2013)*, in their study compare the output gap estimates based on a number of difficult methods.
- *Layzian& Shahrer (2014)*, their study presents three models to estimate the output gap for the Malaysian economy; univariate, multivariate and structural.
- *Simionescu (2014)*, examined the reality and stability of the Phillips curve for Romania. The Data has been taken over from 1990 to 2013, using ARDL and DOLS.

- *Alichi (2015)*, in his study, focused on the gap between potential and actual output.
- *Hulej & Grabek (2015)*, following Nyman's work (2010), provide an indicator of resource utilization (RU) for the Polish economy based on survey and labor market data. The indicator is subsequently used to identify output gap.

Some Empirical Review of Literature on the Indian Economy

- *Singh, et al. (2010)*, this empirical study is based on the data taken from 1997-Q1 to 2010-Q3. This study examines the empirical existence of the Phillips curve in the Indian economy.
- *Dholakia (2011)*, in this study, the author estimates the short run aggregate supply curve for the Indian economy from 1950-51 to 2008-09. The study employs the technique of estimating adaptive expectations, constrained estimation consistent with long run equilibrium, and also introduces the extended Phillips curve.
- *Ray (2011)*, analyses the empirical existence of the Phillips curve in the Indian economy.
- *Das & Martin (2013)*, this study used three different estimates of the output gaps to obtain estimates of the Phillips curve based on the Indian data.
- *Kotia (2013)*, analyzed the inflation and output dynamic of Indian economy and estimate a Phillips curve in India from 1997 quarter one to 2012 quarter three.
- *Dua (2013)*, this study investigated the determination of inflation in the framework of an economies that were both forward looking as well as conventional backward – looking and analysed the Phillips curve for eight Asian countries – Japan, Korea, Hong Kong, Singapore, Philippines, Thailand, China and India.
- *Singh and Verma (2016)*, this study analyzed the short run tradeoff between inflation and unemployment for the Indian economy from 2009 to 2015.

1.3 Research Gap

This research study has reviewed many relevant research articles related to the present study area at both the international and national level. At the international level, many studies have been done on short-run linkages of inflation and unemployment during the

recession period. However, no studies have been done on the developing countries like India during the Pre and Post-recession periods. Many studies have been conducted on Inflation and Unemployment but are based on different dimensions in India. Therefore, under this study, we will show short run linkages between Inflation and Unemployment in three phases which are, the Pre- Recession, during Recession and Post-Recession periods with special reference to the Indian context. We will try to fulfill the research gap of this dimension. Hence, this Research Endeavor's intent is to investigate an aspect of the Indian economy which was not undertaken before by any other researcher. In short, after an in-depth review of literature, the present study has tried to validate of Phillips curve relationship in the Indian economy taking account of the financial crisis.

1.5 Need for the Study

In macroeconomics, Inflation and Unemployment are always current and debatable issues in each economy. This cause and effect relationship fluctuates around the economy and these two variables are effective facets for measuring the health of an economy. Inflation is a monetary phenomenon, while Unemployment is a real phenomenon. In other words, Inflation is the cause of Unemployment. Thus, it is very necessary to reduce these problems together. Both these problems are connected by the Phillips Curve theory. Phillips Curve is the most important tool for policymakers for mapping policies or plans in order to achieve price stability and full employment in the economy. This theory is very help for understanding the expansion and contraction of money in the economy. Hence, the present study aims at examining the Phillips curve theory taking into account the Global Recession of 2008. It is also helpful if economy faces slow down or recessionary condition.

1.6 Contribution of the Study

- The research study contribution is more inclined around the temporal factors of recession unlike the other major works that focused more around the current scenario.

- The examination will prove a help to the economy to better judge whether the Phillips curve is best applicable in such recessionary situation in Indian environment with its shocks included. Any unlike situation would divert our attention towards search of better measures on fiscal terms.

1.7 This research study has been conducted with the following objectives

1. To examine the comparative study between inflation and unemployment (2002-07) Pre-Recession, (2008-09) During-Recession and (2010-15) Post-Recession period.
2. To examine the impact of the global financial crisis on macro-economic variables.
3. To examine the Philips curve shape & the output gap from 2002-2015 for 14 years.
4. To study the policy implications of targeting inflation and unemployment in India

1.8 The Hypothesis of the Study

The following hypotheses have been formulated as the basis for the study:

1. H_0 : There is no impact of global financial crisis on trends of inflation, unemployment and other macro-variables
2. H_0 : Output gap fluctuations are negatively associated with the pre and post-recession and over the total period of the study.
3. H_0 : Inflation and unemployment are positively associated with recession or over the period of the study.

1.9 Data and Methodology

The present Study is wholly based on the secondary data. The study uses time series database, taken from authentic data source such as the published official reports and data. Following are the reference points for collecting data:

1. Report on Inflation published by the Reserve Bank of India.
2. Annual Report published by the Ministry of Labour and Employment Labor Bureau, the Government of India.
3. Ministry of Statistics and Program Implementation (MOSPI), the Government of India.
4. Handbook of Statistics on Indian Economy via the Reserve Bank of India.
5. National Sample Survey Organization (NSSO) India.
6. Economic Political Weekly Research Foundation (EPWRF)
7. World Bank Database

We have used quantitative and time series data such as monthly, quarterly and annual data on Wholesale Price Index, Consumer Price Index, Gross Domestic Product and unemployment rate. The present study has taken data pertinent to the time period from 2002 to 2015. This study has been divided into three sub periods.

The table 1 is given the below:

Table 1: Sub-Categories of Study Period

First Period	Second Period	Third Period
Pre-Recession Period	Duration of Recession	Post-Recession Period
2002;M1 to 2007;M12	2008;M1 to 2009;M12	2010;M1 to 2015;M12
We considered this period is pre-recession period. It shows the trends of inflation and unemployment, impact of recession on macro variables, to examine the Phillips curve relationship and output gap in this period.	We considered this period as the recession period. It shows the trends of inflation and unemployment, impact of recession on macro variables ¹ .	We considered this period as the post-recession period. It shows the trends of inflation and unemployment, impact of recession on macro variables, to examine the Phillips curve relationship and output gap In this period.

¹Recession period is considered only in the third and fourth chapters. Further we have not considered this period due to lack of observation (annual data) and we have replaced this period by the overall period.

After collecting of data, according to the objective of this research, we present the data in various ways and various graphs such as the *bar chart, trend line, histogram and pie-chart and descriptive statistics*. This study uses some statistical tools and techniques. In addition, we have used econometrics method and models which are: the Least Square method, Simple Regression Model, Vector Error Correction Model (VECM), Vector Autoregressive Model (VAR), Auto Regressive Distributed Lag Model (ARDL), Chow test, Kim & Perron test and Hodrick Prescott Filter (HP) method. To find the estimation of the different models mentioned above we have used various software like: Microsoft Excel 13, Stata 13, Eviews 10, Minitab, 16 and Amos, 22.

Description of Different Tools

1. Least Square Method: It is widely used for trend analysis because this method provides more authentic and realistic information than the other methods. In the broad way, least square is a method of fitting curve for a given data. It is the most prevalent method used to determine the position of the trend line of a given time series. The trend line is technically called the best fit.
2. Regression Model: It provides the cause and effect relationship among the variables as well as it indicates whether the whole information is statically significant or not. In regression models, two factors that are complicated in a simple linear regression analysis are chosen as *x variable* and *y variable*. We can write this in equation form of:

$$y = (\beta_0 + \beta_1 + \varepsilon_t)$$

The equation that demonstrates how *y* is related to *x* is known as the regression model.

The linear regression model also contains an error term that is represented by ε_t . The error term is used to account for the variability in that cannot be explained by the linear relationship between *x* and *y*.

3. Vector Auto Regressive/Vector Error Correction Model/Auto Regressive Distributive Lag: All these models are also called VAR family models. It demonstrates the short run causality and long run causality between the variables. In other words, it specifies

that variables fluctuate due to demand pressure and supply pressure. It determines whether the economy is in equilibrium condition or not. We applied these models according to assumption, requirement of analysis and data's nature. In addition, also applied chow test and Kim & Perron test for structural breaks.

4. Double Log Model: A log transformation is a comparatively common process that permits linear regression to perform curve fitting that would otherwise only be possible in nonlinear regression. We have used double log model because we have taken both side logs which are the dependent and independent variable.
5. Polynomial Regression Model: When the data is not linear then we can try to use the polynomial regression to fit a polynomial line so that we can achieve a minimum error or minimum cost function. Polynomial provides the best approximation of the relationship between the dependent and independent variable. This model provides the significance of curvilinear relationship between dependent and independent variables.
6. Hodrick Prescott Method: It is widely used for output gap estimation and we have used this method because we have taken only one variable which is named GDP, therefore, the Hodrick Prescott method is very useful for univariate analysis. The Hodrick-Prescott (HP) filter refers to a data-smoothing technique. The HP filter is commonly applied during analysis to remove short-term fluctuations associated with the business cycle. Removal of these short-term fluctuations reveals long-term trends. This can help with economics or other forecasting associated with the business cycle. The HP filter is often used to produce new time series such as potential GDP and the output gap that are useful in macroeconomic modeling and monetary policy research.

1.10 Significance of the Study

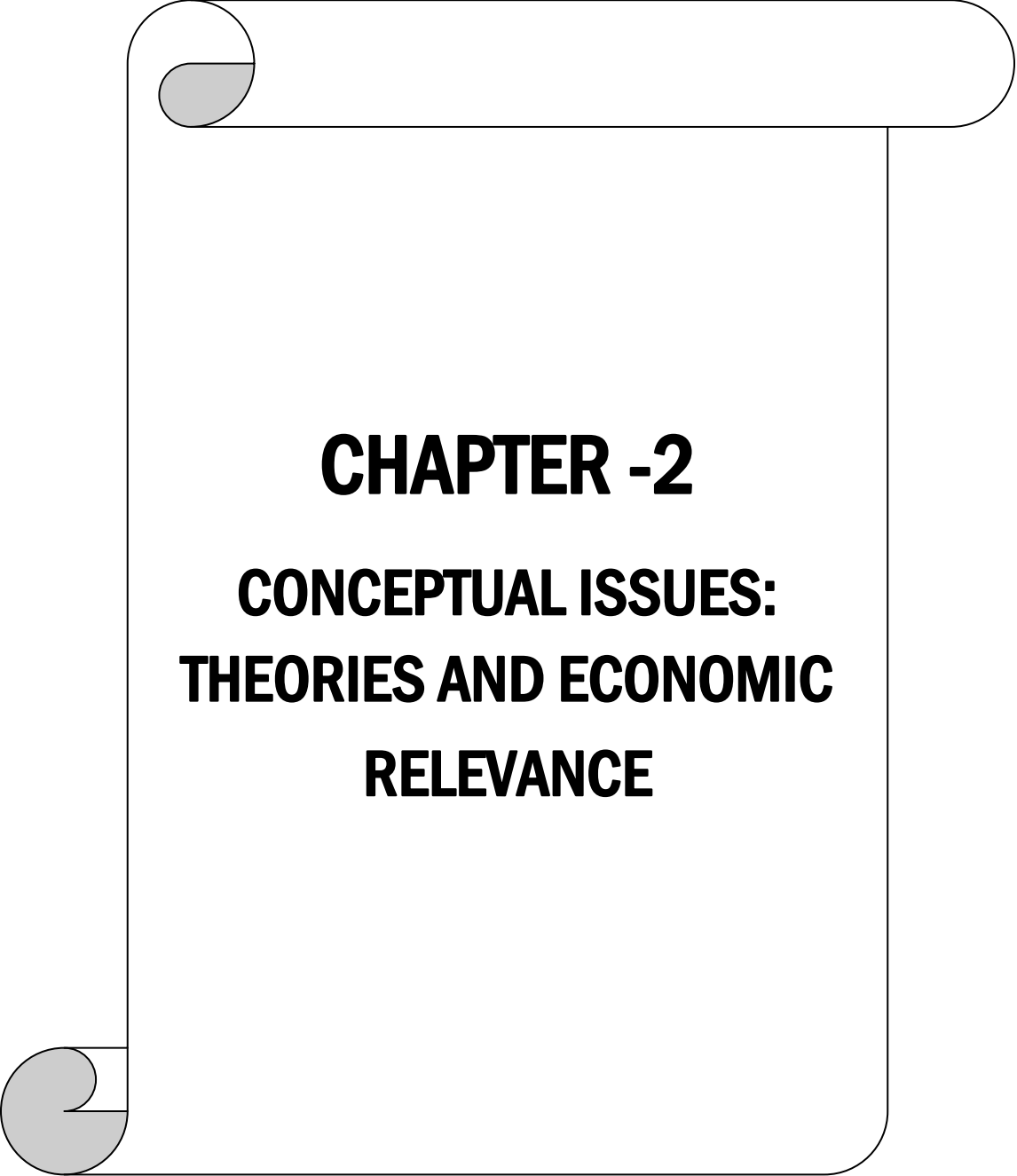
The Phillips curve is the core theory in this inductive study and it establishes the relationship between inflation and the unemployment rate from 2002 to 2015 in India. The significance of this present study is in determining how the policymakers can formulate effective strategies to ensure employment while containing inflation. Undoubtedly, inflation and unemployment have played a central role in monetary policy. The Central banks have tried to use this relationship by influencing unemployment through their inflation policy. Theory of Phillips curve is not only strong theoretically,

but is also important for political foundations. The central banks' objective has always been to use their monetary policies to keep inflation and unemployment low, but they could only do so at the expense of high unemployment. On the other hand, an acute knowledge of the nature or relationship of inflation and unemployment in the short-run enables the policy makers to outline policies to minimize the harmful effects of inflation and unemployment for the society. Additional approach, the output gap is an important variable for monetary policy and it is a key source of inflationary pressures in the economy. When the demand for goods and services is high, then economy has the capacity to produce while influencing high pressures on prices. When the rate of inflation actuates higher than expected, it is typically a sign that demand for goods and services are pushing against the limits of capacity. When the rate of inflation always ends lower than expected, it is generally a sign of weak demand and of spare or unused capacity.

1.11 According to the objectives of this study, the following chapters have been envisioned

The present study entitled as “**Short Run Linkage between Inflation and Unemployment during Pre and Post-Recession: A Study of India**” consist of seven chapters, the **first** chapter deals with the introduction parts enlisted in the background of the study, research objectives, hypothesis, data and methodology, significance and limitations of the study. The **second** chapter discusses about the conceptual and theoretical framework of inflation and unemployment with relevance to Phillips curve analysis. While in **third** chapters deals, the trends of Inflation is dealt along with concept of inflation and trends of (inflation) with two measurement approaches such as the Wholesale Price Index and Consumer Price Index. This has been analyzed by the econometric tools such as least square and regression model which are used for trend estimation and analysis. The **fourth** chapter deals with trends of unemployment and impact of recession on macro variables. It analyses the impact of Global Financial crisis on three macro-variables such as export, lending rate and inflation rate. There is empirical analysis to determine if the short run causality or long run causality exists in this study or not. In addition, the concepts of unemployment, measurement approaches and comparative and descriptive analysis have been discussed by referring to the three

Quinquennial National Statistics Survey Organisation, rounds. ***Fifth*** chapter discusses about the Wholesale Price Index based Inflation, Linkage with Unemployment. It also provides the short run linkage between inflation and unemployment such as Phillips curve relationship. The ***sixth*** chapter deals with linkages between inflation and real Economy. It discusses the output gap and the potential output gap that is related to the Phillips Curve theory. In addition, this chapter also examines whether the short run and long term relationship exists or not between inflation and output gap. The final chapter deals with major findings of the study, conclusion and policy implications along with summary of the present study. In addition, to this, there are some other formalities including reference, annexure and glossary.



CHAPTER -2

CONCEPTUAL ISSUES: THEORIES AND ECONOMIC RELEVANCE

CONCEPTUAL ISSUES: THEORIES AND ECONOMIC RELEVANCE

2.0 Introduction

This Chapter discusses the theoretical conceptual framework of macroeconomic variables which are: Inflation, Unemployment and Gross Domestic Product which is also connected to the Global Financial Crisis. These macro variables have been connected by Phillips curve theory and the concept of output gap. In addition, it also discuss the business cycle theories and present the linkages between inflation and unemployment during the financial crisis 2008, hence making this study more pertinent to the present scenario of research on both unemployment and inflation basis.

2.1 Inflation

The issue of inflation continues to be a perennial problem in all economies. The problem of inflation has received more focused attention from the early 1970s. A continuous rise in the general price level over a long period of time has been the most common feature of both developed and developing economies who are facing the problem of rate of inflation (around 5 percent) even though the US economy was facing recession. Similarly, India which is a fast developing nation growing at the rate of 9% per annum, also faced a high rate of inflation of 12% in the second half of 2008. This had severe economic, social and political consequences for the country (Deweidi, 2010, P. 439).

2.1.1 The Concept and Definitions of Inflation

Inflation means an increase in the price level of essential goods and services in the economy for over a time period. According to Samuelson, “*Inflation indicates an escalation in the general level of prices*”. This definition of inflation is used to analyse the price behavior. For instance, the rate of price rise in India during April-May, 2009 was below 1% and it went down to 0.13% in May 2009 which was the lowest in 30 years.

This almost zero rate of rise in the general price was called inflation in the public report. This is practice across all countries and has been adopted by the International Organization like the World Bank and IMF as well (*Samuelson & Nordhaus, 1995, P. 574*). *Durnberg and MacDougall* further highlight inflation as a continuous increase in prices as measured via the Consumer Price Index (CPI).

2.1.2 Theories of Inflation

Several theories and concepts have been propounded for analyzing and estimating inflation. This study has attempted to profile a few of them below.

2.1.2.1 The Classical Theories of Inflation

As defined by the classical economists, *Jean Bodin, Richard Cantillon, David Hume, Adam Smith and William Petty*, Inflation is the continuous rise in the general price level of essential commodities. However this definition is not premised on any systematic theory of rising prices. Irving Fisher was the first among the classical economists to formulate a systematic theory of inflation which was known as the Classical Theory of Inflation. In the words of Irving Fisher, *“Inflation comes in direct proportion to increase in money supply given the point of output”*. *If money supply increases then it will also increase price level of economy. The classical theory of inflation is derived immediately from the Fisher’s quantity theory of money* (Fisher, 1926)².

2.1.2.2 The New Classical Theory of Inflation

The Neo-classical theory of inflation was the genesis of Cambridge economists who postulated that increase in demand for money as the causal agent of inflation (*Pigou, 1917*) as explained by: $m_d = kPQ$

2.1.2.3 The Keynesian Theory of Inflation

According to Keynes, an increase in general price levels of inflation is created by an increment in the aggregate demand which is over and above the increase in mass supply

²In Fisher’s Quantity Theory ($MV = PT$), where is M = money of circulation, V = velocity of money, P = Price level and T= time.

when the given economy is at its full employment output level. An increase in government expenditure (G), private consumption (C) and private investment (I) will create an increase in aggregate demand. This leads to increase in the general price and the inflationary gap becomes the cause of inflation. The inflationary gap generates only money income without creating the parallel real output because the economic system is in full employment equilibrium. The money income would produce a multiplier effect depending on the Marginal Propensity to Consume.

2.1.2.4 The Monetarist View of Inflation

The monetarist view on inflation is an improvised version of the definitive theory of inflation, especially the one based on Fisher's quantity theory of money. In fact, the modern monetarism is also referred to as the '*modern Fisherism*' and was visualized by Milton Friedman, the leader of the monetarist school (Friedman, 1970, P. 24) This view of inflation states that general level of prices rise only due to the increase in money supply.

2.1.3 The Modern Theory of Inflation

The modern and inventive approach to inflation follows the theory of price decision. According to the modern theories of inflation, "*The general price level is defined by the aggregate demand, aggregate supply and mutation in the aggregate price level is caused by mutation in the aggregate demand and aggregate supply*".

The detailed analysis of inflation shows that both demand side and supply side cause rising prices factors. Inflation essentially has two forms, the demand side factors are referred to as the demand-pull factors and supply side factors which are called the cost-push factors.

2.1.3.1 Demand Pull Inflation

The demand-pull inflation is the increase in the general price level when aggregate demand increases more quickly than the aggregate supply. Demand pull inflation is the conventional and most prevalent type of inflation. It happens when the aggregate demand grows and the supply of commodities decreases.

Demand pull inflation is caused by monetary factors, given the money supply and the level of output. If this price point is a reasonable one, it is neither inflationary nor a deflationary situation. As convincingly observed by (Dwivedi, 2010, Pp. 467-469) monetary expansion in excess of the growth in real output is one of the most significant factors causing demand-pull inflation. The monetarists stress the use of money on the demand-pull inflation and state that when the money supply is increased in order to increase production and engagement, it creates an inflationary situation within an economic system. Demand pull inflation is caused by material factors, the real factors or the non-monetary factors that cause demand to pull inflation, thus resulting in upward shifts in the IS Curve.

2.1.3.2 Cost push inflation

The cost of production rising prices is caused by the monopoly power exercised by some monopoly groups of the company and this is usually witnessed in firms that are part of monopolistic and oligopolistic market setting which can control the prices of production. Strong labor unions force the employers to increase wages and this can lead to increase in the prices. This kind of rise in the price level is called wage- push inflation (*Op. cit 2010, p. 471*).

2.1.3.2.1 Wage push Inflation: The wage push inflation is often caused by monopoly power of the labor unions to raise their wages above the competitive labor market salary rate. Labor unions force the employers to increase their wages. In the context of the wage push inflation, the wages are increased above the competitive level without a parallel growth in labor productivity. Growth in money wages causes an equal growth in the price of production. The increment in the price of production causes the aggregate supply curve shift backward. A backward shift in the aggregate supply leads to an increase in the price level. This is called wage push inflation (*Op. cit 2010, Pp. 471- 472*).

2.1.3.2.2 Profit Pushes Inflation: This is yet another phenomenon caused by the supply side factor that leads to inflation in the use of monopoly power by the monopolistic and oligopolistic firms to raise their price to enhance their net margin. This has a reactionary effect on other prices which leads to inflation (*Op. cit 2010, P.475*).

2.1.3.2.3 Supply Shock Inflation: This is another form of cost push inflation. Supply shock is an abrupt decrease or lack of availability in the provision of major commodities or key industrial inputs. The supply shock inflation usually happens due to a sudden rise in the prices of high weightage items in the Price Index Number. This would include abrupt rising of prices of food due to crop failure and also here to rising prices of coal, steel, cement, petroleum and basic chemicals. The rise in the prices may be caused by problems in the supply in the domestic economy or any disruption caused by international events. Hence, the shortage of supply leads to high inflation. The most relevant example in this case is that of the sudden voluminous increase in the oil prices. For example, the upsurge in the OPEC oil prices during 1970s due to Arab Israel war is an apt case in point. During the mid and late 1970s, the problem of inflation had become a worldwide phenomenon because the OPEC had quadrupled the oil prices between 1972 and 1974 (*Arabian Lights/ Dubai*).

2.1.3.2.3 Structural Inflation: Also known as *mixed inflation* and is a combination of demand pull and cost pull inflation. The theory of structuralism emphasizes rigidities in supply as the key force in the hypothesis. The contention is that inflation will stay as long as the structures are not ruled out. The obstacles are in production, institutional and social culture dimensions.

2.2 The Impact of Inflation on the Indian Economy

Inflation affects both the nation's economy and the all the income groups of the society besides unleashing a host of social and economic disparities. Following are the ramifications of Inflation which need a concerted mention here:

- 1. Social Effect:** Inflation widens the gulf between the rich and the underprivileged. As the poor of the nation get poorer, the rising prices bring about discontentment among the masses.
- 2. Business:** All types of business gain during inflation, due to the increase in the costs of commodities and services. Hence, a section of the nation reaps benefits further entrenching the economic disparity.

3. **Debtors and Creators:** During inflation debtors (borrowers) gain profits and creators (lenders) loss. This is because, while their incomes remain fixed, the value of money remains to fall with rising costs.
4. **Reduction in Savings:** When prices are rising, the propensity to save declines because people need more money to spend on goods and services.

2.3 Methods of Measuring Inflation

2.3.1 Measuring inflation by Pin

There are two general methods of measuring inflation; first is the percentage change in Price Index Numbers (PIN), and the second is a change in GNP deflator. There are many price index numbers, but mostly two PINS are widely used for measurement of inflation which are the Whole Price Index (WPI), also called producer price index (PPI) and the Consumer Price Index (CPI). WPI is used to measure the general rate of inflation and CPI is used measure the change in the cost of living.

$$\text{Consumer Price Index (CPI)} = \frac{\text{Current Price Index}}{\text{Base Year Price Index}} \times 100$$

Measuring inflation by GNP deflator

The GNP deflator is the proportion of nominal GNP to the real GNP of the same year, i.e.

$$\text{GNP deflator} = \frac{\text{Nominal GNP}}{\text{Real GNP}}$$

Where Nominal GNP is GNP at current prices and real GNP is GNP at constant prices.

2.4 Types of Inflation

2.4.1 Perfectly Anticipated Inflation: When the inflation can be predicted it is called perfectly anticipated inflation. Say, for instance, if an economy has been experiencing a given rate of inflation at 6 percent, so the people will predict that the pace of rising prices will continue to be at 6 percent. Hence all contracts would be done on the basis of

expected 6 percent inflation rate. During inflation, debtors gain and creators will lose. To avoid this, nominal interest rates are raised by 6% by lender.

2.4.2 Imperfectly Anticipated Inflation: This phenomenon is a rare one. In fact, actual inflation is different from the expected inflation. When the inflation rate is higher or more depressed than the expected level, it is the unanticipated rate of rising prices. When the rate of inflation is not predictable as in the case of unanticipated inflation, it can be an extra element of risk for any economy.

2.4.3 Types of Inflation along with the rate of Inflation are noted below

2.4.3.1 Creeping Inflation: The rate of creeping inflation is 3 percent. This type of inflation promotes economic development and maturation.

2.4.3.2 Walking or Trotting Inflation: The pace of walking inflation is in between 3 to 6 percent and it is the initial state of alarm for an economic system.

2.4.3.3 Running Inflation: The rate of running inflation is in between 10 to 20 percent and this type of inflation has a drastic impact on poor the middle-income groups.

2.4.3.4 Hyper Inflation: The rate of hyperinflation exists between 20 to 100 percent leading to zero savings.

2.4 The Concept of Unemployment

Unemployment is one of the most noticeable indicators of economic action in a nation. The rate of unemployment typically rises considerably during recessions and then falls as the economy recovers. Unemployment can render people economically deprived and socially marginalized besides retarding their standard of living. Hence, the media rightly publicizes high unemployment as a great social problem (*Jeffrey Parker, 2010*).

2.4.1 Unemployment: Unemployment has no accurate definition in the economics literature and unemployment would mean lack of jobs for those who are able and willing to work for the stipulated wage.

Definitions of Unemployment

1. **International Labor Organization:** *“The labor force of a country consists of the persons in the age group of between 15 65 years who are employed and those who are unemployed but are looking for a job, labor force doesn't include full time students, full time house wife's and retired persons”.*

Unemployment would mean any individual who is skilled and is able to work and looking for work but does not find one. Unemployment is a complex phenomenon and has many connotations for the economists.

2.4.1.1 Theories of Unemployment: In the economics literature, there are many theories of unemployment. Classical and Keynesian theories of work and unemployment begin from a general theoretical account. The classical and Keynesian theories of unemployment have been briefly discussed below.

2.4.1.2 The Classical Theory of Employment or Unemployment

Classical theory gained base by the contribution of the economists of the 18th century and the noted amongst them were *James Mill, Adam Smith or David Ricardo*. These economists advocated a full employment labor market (*Rodriguez, 2015, P. 5*).

According to classical economists, when an economy is working at full employment level and there is no inflationary pressure on the economy, then the full employment situation is normal. In such a scenario, if unemployment is created because of any minor reason, it would automatically rest able because unemployment in this context would be a temporary condition. Moreover, nominal deduction in the wages would ensure that the economy is in the equilibrium phase.

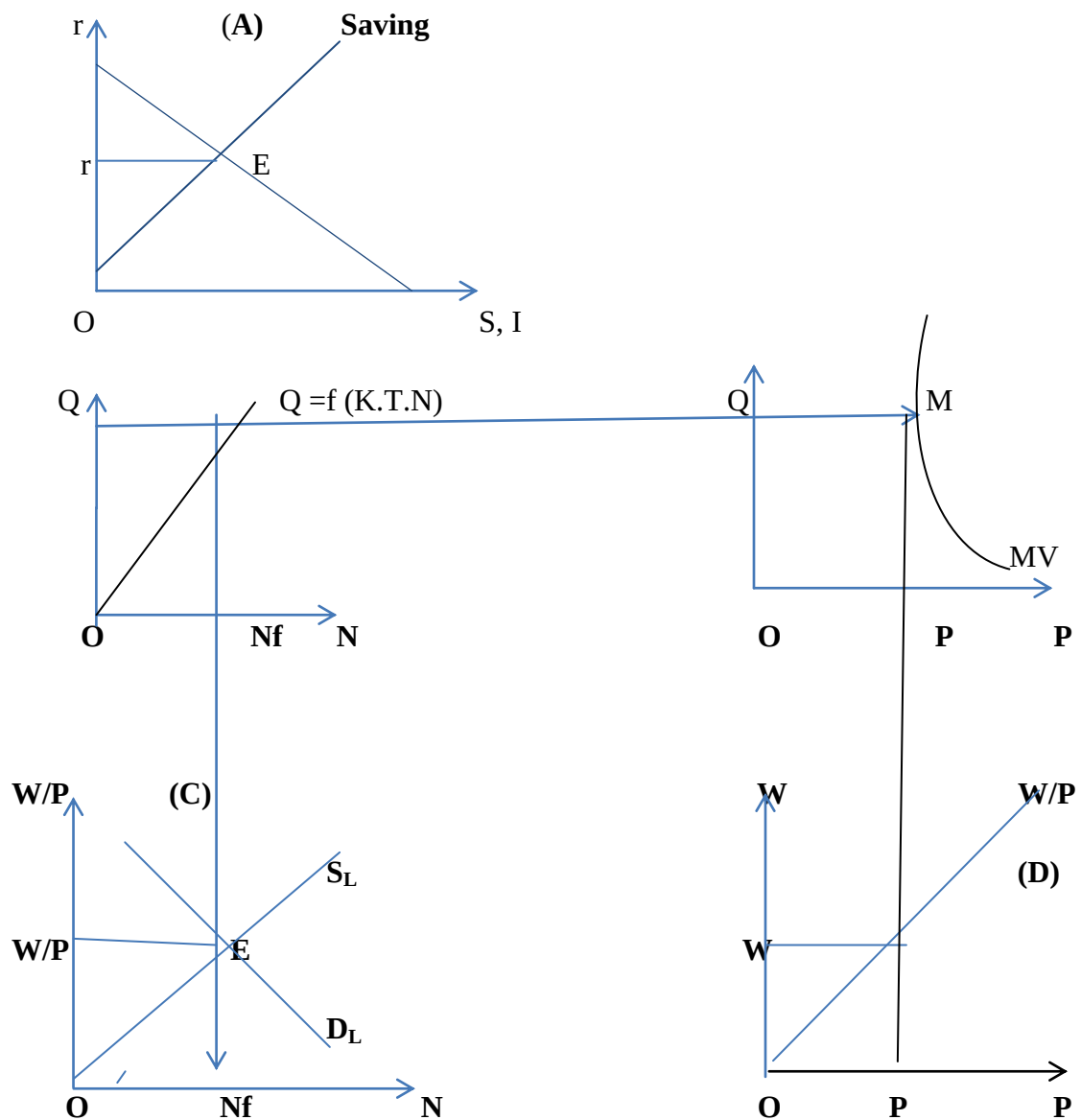
In the classical theory, the determination of employment and production is done on the basis of three types of markets. These are: the labour, goods and money market in the economy.

Labour Market is driven by the employment created due to the demand of labour and supply of labour.

Goods Market is and the equilibrium point which is determined by the investment and savings which are inversely related.

Money Market is an equilibrium point is that gauged by the demand of money and supply of money and this is also explained by quantity theory of money. This shows the direct relationship between price level and quantity of money for example, $MV=PT$. The diagram below illustrates the concept:

Figure 2.1: Classical Theory of Employment



Source: ML, Jhingan, Marco-Economics, P. 73

The diagram 2 above depicts the Classical Model. Diagram A indicates equilibrium of E between investment and saving, which is assessed by the mechanism of interest rate in the case of full employment when there is equal level of demand of goods and demand of supply. Diagram B demonstrates the employment and production level. The aggregate production, labour of supply and labour of demand can be equated as $Q = f(K, T, N)$. Diagram C demonstrates that in the labour market, employment and production is assessed by demand of labor and demand of supply. E is the intersection point between demand of labour and supply of labour. The equilibrium wage rate is at full employment level ($D_L = S_L = N_F$). Diagram B, E and D are connected with each other at money market equilibrium. In the money market, the equilibrium is established by the demand of money and supply of money. This is explained by the quantity theory of money and has been given by Fisher ($MV=PT$). MV = supply of money and PT = demand of money. Money market equilibrium, price level gives equity with production and full employment that is connected to MQ line from E and B. Determination of price level (OP) by the total production (Q) and quantity of money (MV) is demonstrated in the diagram B and E. Diagram D shows the w/p curve which indicates direct relationship between price level and money wage rate. As the diagram depicts, the real wage rate has decreased and there is no impact of production on employment. Given this analysis, it can be concluded that to achieve full employment, there should be wage price flexibility. This is also suggested by the classical economists.

The classical theory, as analyzed by *Pigou* (1933) and *Solow* (1981), argues that the labor market consists of demand and supply of labor. Demand for labor is a derived demand, obtained from the declining portion of the marginal product of labor. The demand curve is a negative function of real wage. That is, if the wages increase, the quantity demand for labor will decline and the opposite is correct. The supply of labor is derived from worker's choice whether to spend part of time working or not working. Supply hours of work is a positive function of the real wage because if the real wage rises, workers supply more hours of work. In equilibrium, demand and supply of labor are intersected at a clear point that determines the equilibrium real wage rate and full employment (*Mouhammed, 2011*).

2.4.1.3 The Keynesian Theory of Unemployment

According to Classical Theory, unemployment is due to wages being unnaturally kept above the equilibrium through minimum wages. While the classical theory posits the solution for unemployment to be to deduct wages and allow wages to clear up, the Keynes contends that this is impractical.

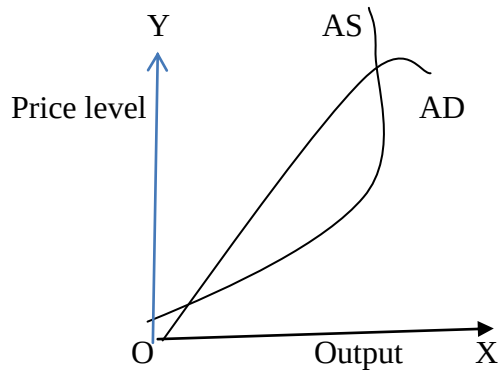
In 1936, *John Maynard Keynes* presented his hypothesis in '*The General Theory of Unemployment, Interest and Money*'. This report etched a cornerstone in modern economy and promoted a new school of opinion, the Keynesian school of thought (Op. cit 2015, P. 10). The necessary element of Keynesian economics is the idea that the macro economy can be in disequilibrium (recession) for a considerable time. Keynesian economics describes government interference to help overcome the lack of mass demand to cut unemployment and increase growth (Tejvan Pettinger, 2013).

The Keynesian theory of unemployment was premised on the short run position. Keynes's cited that in the short run, the factors of production like the capital goods, supply of labor, technology and efficiency of labor remain constant while gauging the level of employment. Keynes emphasized that the level of unemployment is dependent on the national income and output. In addition, Keynes postulates that if there were an increase in the national income, there would be an increase in the degree of work and vice versa. Thus, Keynes theory of employment is also too known as the *Theory of Employment Determination* and *Theory of Income Distribution*

2.4.1.3.1 Principle of Effective Demand

The nodal aspect associated with the setting out points of Keynes's theory of engagement is the principle of effective demand. Keynes propounded that the degree of work in the short run is dependent on the aggregate effective demand of goods and services.

Figure 2.2: Effective Demand Curve



The Figure 2.2 shows the effective demand curve, *Y-axis* denotes the price level of the economy and *X-axis* denotes the output level of economy and *O* represents origin. There are upward slopes of *AS*, *AD* curve. The aggregate demand curve is intersecting the aggregate supply curve. This point represents the effective demand curve or equilibrium point of economy. If there is any condition of disequilibrium, the economy faces the upheavals of recession.

2.4.2 Types of Unemployment

2.4.2.1 Unemployment: It refers to the workers' choice of not opting to work at the prevailing wage rate and this could be regarded as a national waste of human energy.

2.4.2.2 Frictional Unemployment: Frictional unemployment is a temporary phenomenon and may result when some workers are temporarily out of work while changing jobs. It may also result when the work is suspended due to strikes or lockouts. To some extent, frictional unemployment is also done by the imperfect mobility of labor.

2.4.2.3 Casual Unemployment: It is usually seen in daily wage earners who work on contractual hours in construction, logistics or agriculture, etc., and are employed on a day-to-day basis. These contracts are prone to termination and render the worker unemployed.

2.4.2.4 Seasonal Unemployment: It refers to those job opportunities that are available only for a specified time period in year. Thus the term seasonal and relevant examples in this context are that of jobs in agriculture, catering in holiday resorts, agro driven

activities like sugar mills and rice mills. Since people who are associated with such work have a very limited earning potential, seasonal unemployment is a major debacle.

2.4.2.5 Structural Unemployment: Morphological changes in the economic system lead to structural unemployment which is created by a decrease in demand for production in a particular industry. During this phase, there is a marked decrease in the need for manpower and increased possibilities of disinvestment.

2.4.2.6 Technological Unemployment: As manufacturers and industry, units introduce new machines or automated systems to boost production and minimize the cost invested, the demand for manual labour declines. So, the skilled labour is retrenched and replaced by improved technological means. Thus the term technological unemployment have been seen in maximum cases of present day automotive industries where manual work is being replaced by robots in manufacturing auto parts.

2.4.2.7 Cyclical Unemployment: It is caused by the cyclical pattern of the recessionary and depressionary phases of the Trade Cycles. Due to the decrease in demand in the contraction phase, there is a decline in the production, and on the other hand, there is more disinvestment. However, cyclical phases are transient and hence cyclical unemployment is debilitating for a short span only. The apt solution to tackle this unemployment is to introduce measures for increasing total spending in the economy. More spending potential would create more demand, thereby increasing the industrial output. Hence, easy monetary policy and promptly introduced fiscal measures like deficit financing would be effective to counter the debacle of cyclical unemployment.

2.4.2.8 Chronic Unemployment: Identified by its long presence in a country's economy where unemployment becomes a sustained feature. Very often the underdeveloped countries are worst affected by this due to the ills of poverty, paucity of resources for development, dearth of educational means and the overall abyss in technological knowhow which prevents astute utilization of the available resources. This gap is compounded further because of high population growth and low or limited capital formation.

2.4.2.9 Disguised Unemployment: Disguised unemployment is the allusion to a place of work where some employees have zero or marginal productivity. Such employees are usually retrenched as they are not required for the given job and their leaving would make no difference to the production levels. This is a common feature in the underdeveloped economies with high population which often leads to overcrowding in a specific occupation.

2.4.3 Measurement of Unemployment

The Rate of Unemployment is measured by the following formula.

$$\text{Unemployment Rate} = \frac{\text{Labor Force} - \text{Employed Labor}}{\text{Labor force}}$$

There are three primary measures of Employment and Unemployment.

2.4.3.1 Usual Status: This measurement estimates the number of persons who may be chronically unemployed. This measure generally gives the lowest estimate of unemployment, especially for a poor economy because only a few can afford to remain without work over a long period.

2.4.3.2 Current Weekly Status: This estimate reduces the reference period, i.e., the period for which data has been accumulated in one workweek. According to this estimate, a person is said to be employed in a week, even if he is employed only for a weekday during that week.

2.4.3.3 Current Daily Status (CDS): This is the day activity status of the worker over the week. For working out the rate of unemployed person days, the aggregated count of unemployed days during the reference weeks constitutes the numerator and the aggregated of the total number of labor force days constitutes the dominator.

2.5 Inflation and Unemployment: A Phillips Curve Approach

In 1920s, an American Economist Irving Fisher noted that there was the Phillips curve relationship between Inflation and employment. However, the Phillips curve's original curve only described the behavior of Money wages. The concerns of the Phillips curve

were mainly related to the policies of central bank and how it guided their initiatives to control inflation. We have noticed that many financial publications talk about central banks endeavors to boost or slow the pace of economic activity. This discussion also focuses on the impact of the central banks' activities on inflation illustrations on the proposed contrary relationship between inflation and unemployment that is known as the *Phillips curve* theory. William Phillips, an economist from New Zealand, deliberated his theory in "*The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom*" in the Quarterly Journal Economics in 1958. The data mapped was from 1861 to 1957.

A.W. Phillips's seminal study was premised on the concept that there was a negative relation between Money wage rate changes and Unemployment in the British economy in the time period chosen for the study. Furthermore, Phillips's empirical evidences concluded that there was an opposite relationship between the Rate of change in the Money Wage Rate and The Rate of Unemployment. called the Phillips Curve. Phillips established this curve through an empirical study which proved that there was an (trade-off) negative association between the Rate of Unemployment and the Rate of inflation.

This implies that Inflation reduces Unemployment. In addition, other economists found similar pattern. In 1960, *Paul Samuelson and Robert Solow* took Phillips work and made explicit the link between Inflation and Unemployment. When Inflation was high, then Unemployment was low and vice versa.

The general conclusion that is drawn from the Phillips empirical finding is that a rise in Money wage Rate reduces The Rate of Unemployment and a fall in Money wages increases The Rate of Unemployment. Besides, from a policy point of view, Phillips curve reveals that there exists a trade-off between The Rate of Unemployment and The Rate of change in money wage rates, that is, a lower Rate of Unemployment can be achieved only by allowing Money wage rates to increase up to a certain level.

2.5.1 The Extension of the Phillips Curve

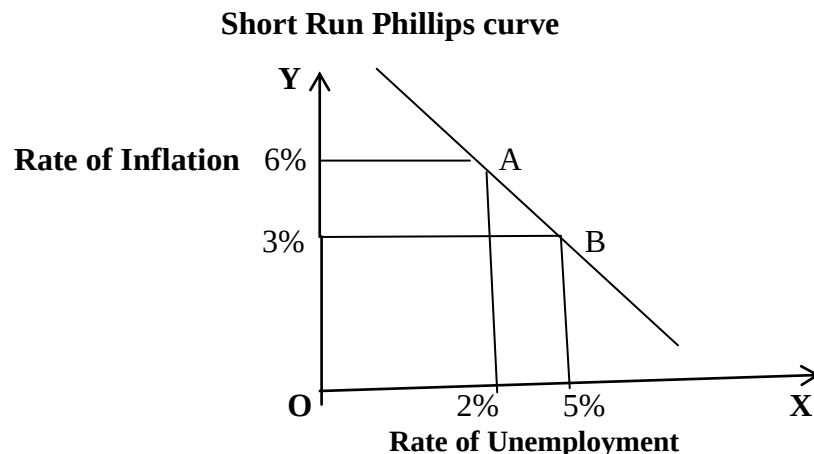
Although Phillips had traced the relation between the rate of change in money wages and the rate of unemployment, his analysis was subsequently expanded to analyze the

relationship between the rate of rising prices and the rate of unemployment. A plausible cause for this might be the fact that trends in wages and prices are interlinked and they go in the same way. Under this interpretation of the curve, some economic experts have used the US data to verify the Phillips curve in the short run phases of different periods (*Op. cit 2010, P. 499*). For example Durnberg used US data for the period 1951-61, Dornbusch and Fisher for 1961 – 1969, Ackley for 1955-69, and Glahe for 1961-70. They all find Phillips curve relationship to be consistent with the US data in the short run. Their Phillips curve shows a positive relationship between the rate of inflation and the rate of employment.

2.5.2 Modifications in the Phillips Curve theory

The Phillips curve short run phenomenon is only valid for a short run period. In the long run, Phillips curve keeps shifting up on the downward. For example, the subject fields which were held out on the foundation of the US data for the 1060s, 1070s, and 1080s confirm the existence of the Phillips curve only in the short run. The Phillips curve has found to be relevant only for 1961-69, for the 1970 and for late 1980s, though at different rates of inflation and unemployment. Only when the entire unemployment and wage data for 1961-93 is plotted together, it brings out a Phillips curve that keeps switching up and down in the long run in a spiraling way (*Sameulson, 1994, P. 588*). Hence, it can be concluded that there exists either no relationship or a weak one between the rising prices and unemployment in the long run.

Figure 2.3 The Short Run Phillips Curve



Source: Jhingan, Macroeconomics, p. 502

The figure 2.3 shows the short-term relationship between the inflation rate and the unemployment rate. Y-axis is a vertical line representing the rate of inflation and x-axis horizontal line represents the rate of unemployment. When the rate of inflation is 2%, then the rate of unemployment is at 3%, the equilibrium point is A and the shift of inflation rate is 6%. The rate of unemployment is 5%, the equilibrium point is B. When the point of A and B are added, we can gauge a downward slope, this curve is called the Phillips curve. As conclusively drawn by the Phillips curve theory, if there is increase in the liquidity of money in the economy, it would create more job opportunities because people would be interested in making investments. More investments would generate more demand in the economy due to multiplier effect. With the upsurge in demand, the production levels would get a boost and to achieve the production targets, the production units would hire more workers. Thus, employment would see a major upscale in the economy.

Another explanation shows that the inverse relationship between inflation and unemployment rate as represented by Phillips curve is only a short-term relationship and unstable because it prevails for a limited period. Many economists continue to be intrigued by the reasons for fluctuations in the Phillips curve in the long run. *Edmund Phelps and Milton Friedman* attempted to address this pattern of the Phillips curve. The envisions are explicated in the ensuing section.

2.5.3 The Theory of Natural Rate of Unemployment: Milton Friedman

Milton Friedman integrated the logic of short run Phillips curves into the macroeconomic theory and explained the spiraling Phillips curve. In the process he made a long run Phillips curve. Friedman began by showing graphically that the Phillips curve holds only in the short run. Friedman asserts that there is always a rate of unemployment in the long run, irrespective of the inflation. Friedman marked out such unemployment with what he termed as the *Natural Rate of Unemployment*. The natural rate of unemployment was later denoted as the “*Non- Accelerating- Inflation Rate of Unemployment*” (*NAIRU*). As per Friedman’s contention, NAIRU sustains even when the labor market is realized and it aligns with the potential level of turnout. Even the government’s expansionary and remedial fiscal strategies cannot eradicate NAIRU. The expansionary policies would

increase inflation and cause an upward shift in the Phillips curve showing a higher degree of unemployment and inflation rate. Hence in Friedman's final estimation, the Phillips curve becomes a vertical line (Friedman, 1968). Friedman's theory of Natural Rate of Unemployment underscores that in the long-run there is no inverse relationship between inflation and unemployment. Furthermore, there is a direct relationship between the pace of rising prices and the rate of unemployment. In this situation Phillips curve slope becomes a vertical line.

Figure 2.4: Long Run Phillips Curve



Source: Jhingan, Macroeconomics, p. 505

The figure 2.4 shows the long term relationship between the rate of inflation and the rate of unemployment. The Y-axis is the vertical line and represents the rate of inflation and the X-axis is the horizontal line that represents the rate of unemployment. The shift of the short run Phillips curve happens because people do not have any money illusions. Hence, there is direct relationship between the rate of inflation and the rate of unemployment rate, in other words the actual inflation rate and the expected inflation rate are equal. Phillips curve slope becomes a vertical line in the long-run, which is called the natural rate of unemployment.

2.5.4 Gross Domestic Product

The most widely use macroeconomics variables is Gross Domestic Product (GDP). This is the aggregation of all market transactions and government expenditures. The market transaction includes domestic use of commodities and services. GDP measures the money

value of the market prices or cost prices of government services, of all paid goods and services in an economic system. Hence, the GDP measures of the economy exclude all unpaid goods and services that are provided by society and nature. Gross Domestic Product (GDP) is gauged as the amount of the market value of all final goods and services produced in a nation during a given time frame and it is a major economic indicator.

2.5.5 Concept of Output Gap

The actual output gap represents what the economic system actually grows. An important related concept is potential output. Potential output is what the economy would produce if all resources, land, labor and productive capacity were fully employed at their normal levels of utilization. This concept is also referred to as potential income and is sometimes called full employment or high employment income. Output gap measures the difference between what would have been produced if full employment, GDP had been produced and what is actually produced, as measured by the current GDP. The output gap is calculated by subtracting potential GDP from actual GDP ($y - y^*$). Where y is the actual GDP and y^* is the potential GDP.

When the potential GDP exceeds the actual GDP, the gap measures the market value of commodities and services that could have been produced if the economy's resources had been optimally employed. The goods and services that are not produced when the economy is running below potential output are permanently lost to the economic system. Because these losses occur when employable resources are idle, they are frequently called the *Dead Weight Loss of Unemployment*. When the economy is operating below its potential level of output, the negative output gap is called a *Recessionary Gap*. In booms, actual output may exceed the potential output, causing the output gap to become positive. When the actual GDP exceeds the potential GDP, there is generally an upward movement of the prices. Hence, the positive output gap is often called the inflationary gap (*Lipsay & Christal, 2012, P. 339*).

2.6 Concept and Theories of Business or Trade Cycle

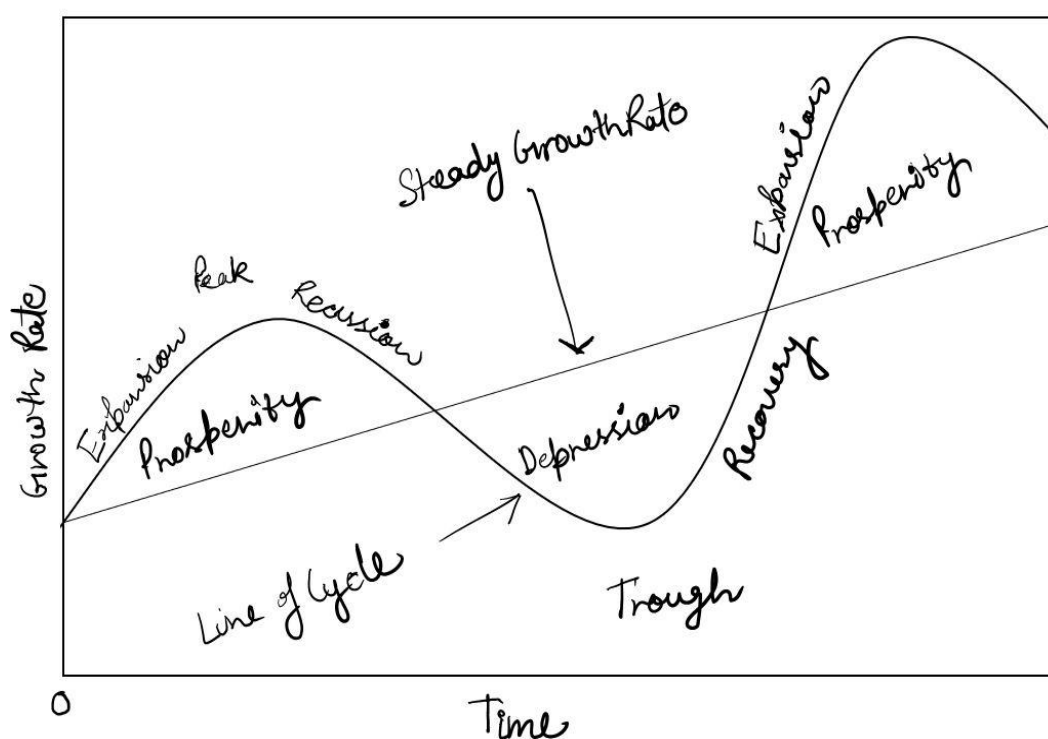
The present Global Financial crisis yet again marks out several limitations that the economists have to contend with in explaining and estimating accurately the business cycle mechanism. More essentially, in absence of a conclusive analysis, there solutions posited to deal with the crisis become ineffectual. Several theorists have introduced main research paradigms in this context. The New Classical economists analyzed the business cycle within the market-clearing model. The New Keynesians cited market failures happened because of business fluctuations. The Austrian economists analyzed the cycle in terms of inter-temporal disequilibrium. From yet another set of theorists, there has been an attempt to understand if the monetary business cycles could influence the cyclical behavior observed in the economy (*Dobrescu, Badeab and Paicuc, 2012*).

Kaya and Engkuchik (2013), attempted to explain the mechanisms of business cycle and their bearing on the workings of an economy. Business cycles map “ups and downs” in the economic activity and depict the periodic phases of expansion or recession. From the macro prospective, the industrial output and employment see a marked increase in the expansionary phase vis-à-vis an apparent downswing in the recessionary period. Economy witnesses a major upsurge in growth when the cycle is in expansion whereas the economy contracts on all indices of production, sales, and employment when its recession. Kaya & Engkuchik’s study also addresses queries pertaining to the prediction of business cycles to contain business fluctuations and aid in formulating effective macroeconomic policies.

The Business Cycles were the trusted recourse to characterize the free enterprise industrial world for over a century and a half. The Great Depression of 1930 was also explicated through this purview. However, between 1930 to about 2008-09, a financial crisis of a similar magnitude had not been seen by the global markets. Thus the 80 year long gap led to many economists assuming that Business Cycle, as a measurable entity, had become dysfunctional. Nevertheless, with the advent of the Global Financial Crises of 2008-09, the prevalence of business cycle and its significance in understanding the economic fluctuations gained strong impetus. In this context, it is important to reckon that all growth theories also indicate that the possibility of instability cannot be negated completely. Furthermore, it would not be possible to maintain the critical balance between the various growth variables such as saving, investment, capital output ratio, rate of increase in labour force and money supply at all times. According to *Sameulson and*

Nordhaus, “A business cycle is a swing in total national output, income and employment usually lasting for a period of 2 to 10 years, marked by a widespread expansion or contraction in most sectors of the economy” (Samuelson & Nordhaus, 1995, P. 551). The upward and downward momentums outline different phases of a business cycle. Though there are two phases: *Prosperity* and *Depression*, economists also consider the intermediate stages between prosperity and depression which are: *Expansion*, *Peak*, *Recession*, *Trough*, *Recovery* and *Expansion*. These phases are depicted in the figure below.

Figure 2.5: Phases of Business Cycle



Data source: Macroeconomics, Dwivedi, 2010, p. 499

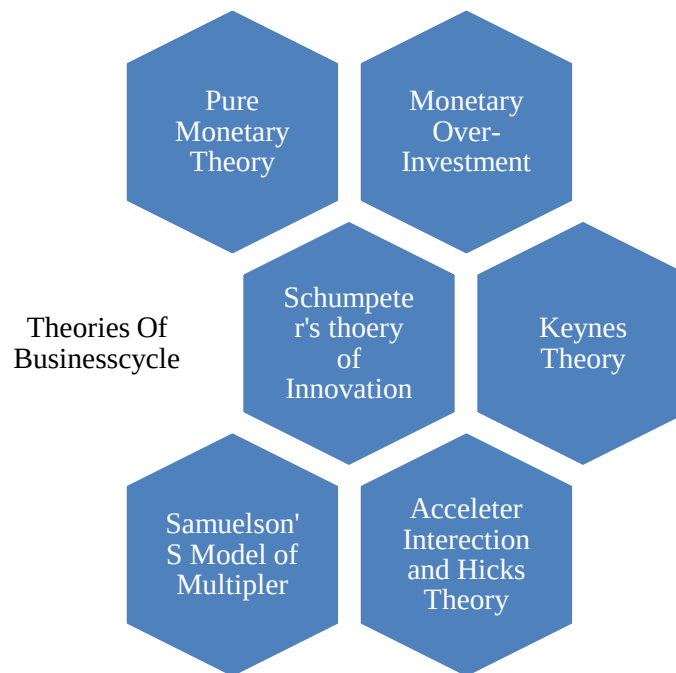
As per the figure 2.5: Y-axis is the growth rate and the X-axis is the time. The first steady growth line marks growth of the economy, increase in national resources and no economic fluctuations. The different phases of cycles are shown by the *line of cycle* as it moves up and down the steady growth line. The line of cycle moving above the steady growth line marks the start of the *Expansion* or *Prosperity* in the economy. Expansion is output, employment, investment, aggregate demand, sales, profits, bank credits,

wholesale and retail prices, per capita output and rise in standard of living. The growth rate eventually slows down and reaches the peak. The *Peak Phase* refers to the highest level of prosperity and downward slide in the economic activities starts from the peak point onwards. The *Recession Phase* commences from the downward slide in the growth rate becoming rapid and steady. This phase witnesses a decline in the output, less employment, though the realized growth rate might still remain above the steady growth line. Till the time the actual growth rate exceeds or is equal to the expected steady growth rate, the economy enjoys the period of prosperity high and low. When the growth rate falls below the steady growth rate, it marks the beginning of depression in the economy. The growth rate at times may fall to zero or even below zero. This was the case of the GDP of many developed countries during the Global Recession 2008-09. *Trough* is that phase of depression during which the downtrend in the economy slows down and finally stops. From this point onwards, the economic activities once again show an incline (Op. cit, 2010, Pp.409-410)

2.6.1 Theories of Business Cycle

A number of theories has been developed by the economists to explain the Business Cycle. However, in the Nineteenth century many of the classical economists such as Adam Smith, Mill and Ricardo did a convincing study on business cycles. They linked economic activities with the Say's law that postulates that supply creates its own demand. These economists opined that stability of an economy was dependent on the market forces. After that, many other economists, such as Keynes and Hicks provided a framework to understand business cycles. For instance, Pure Monetary Theory, Monetary Over-Investment Theory, Schumpeter's Theory of Innovation, Keynes Theory, Samuelson's Model of Multiplier Accelerator Interaction and Hicks's Theory.

Figure 2.6: Theories of Business Cycle



The **Business** or **Trade Cycle Theories** are divided into two schools of thoughts: **The Monetary theories** or the **Non-monetary theories**. This doctoral study focuses only on the Monetary Business theories because the study's objective is premised on the Financial Crises of 2008.

The traditional business cycle theorists based their findings on the monetary and credit system of an economy to investigate the business cycles. Hence, the theories propounded by the traditional theorists are called the Monetary Theory of Business Cycle.

2.6.1.1 The Pure Monetary Theory: It is theory cites that business fluctuations are caused by the instability of the monetary and credit system. The oscillations in the supply of money and bank credit are the basic factors at work in the cyclical process. **Hawtrey**, the architect of the Pure Monetary theory, advocates that business cycles are the alternate phases of inflation and deflation. Hawtrey asserted that changes in the level of economic activities were caused by the changes in money flows. When the money supply is more, the prices increase bringing in more profits, thus creating advents for increase in the industrial output. In a reverse situation, when the supply of money falls, the prices

decline and profits dwindle. This norm translates into low levels of production. Hawtrey relied on the quantity theory of money to explain the price behavior.

2.6.1.2 The Monetary Over-Investment Theory: F.A. Hayek instituted this theory in which he cited that when there is more investment in capital than in the consumer goods industry, it is a cause of imbalance and instability. This theory emphasises that to keep the economy in equilibrium, investment pattern must align with the pattern of consumption and for any economy to remain in stable equilibrium, it is necessary that voluntary savings are equal to the actual investment. As long as this equilibrium is maintained, the economy would witness a spell of stability. The changes in the money supply and the saving investment relations are the key reasons for disrupting this equilibrium. The saving investment relation might change due to the increase in investment without an equivalent increase in the voluntary savings. Investments may increase due to the increase in marginal efficiency of capital, fall in the rate of interest, over optimism about the future prospect. Very often, when new investments are financed through increased bank credit, it could lead to over investment. This is a usual feature in capital goods industries. Though there is expansion of investment, there is no contraction in consumption. New investments coupled with sustained levels of consumption and increased employment generates a climate of increase in money supply. This phase eventually leads to a rise in the general price level. As the prices rise, there is a consequent decline in the purchasing power. For this reason, the real demand does not increase at the rate of increase in the investments.

2.6.1.3 Schumpeter's Innovation Theory of Trade Cycle: Joseph A. Schumpeter postulated that innovations in the industrial and commercial organisations were the main reason for the phenomenon of Business Cycles. Innovation includes changes at various levels that could be improvisation in the methods of production and transportation or changes in industrial organisations. Innovation as a strategy would also involve the commercial application of new techniques, new material or new source of energy. Schumpeter developed a model in two stages which he termed as the first approximation and second approximation. First approximation dealt with the initial impact of the

innovative ideas. The second approximation depicted the deals with the subsequent waves that were created by the application of innovation (Op. cit, 2010, Pp. 410-415).

2.6.1.4 Keynes Theory: Keynesian theory is premised on the fact that increased investments accelerate demand. To meet this demand, production levels increase thus leading to an upsurge in employment levels. However, due to the probability of overproduction, the chances of recession become strong. Such a scenario calls for effective policy to restore equilibrium. In this situation, Keynesian theory contends that accelerator principle must be implemented. This implies that at some point, the investment needs to be done for producing capital goods as in plant or machinery instead of investments in consumer goods production to overcome the recession due to overproduction (Kates, 2002). The intent was to rely on total demand for determining the various economic factors like income, employment, and output. The total demand is understood to be the demand in both the consumer and capital goods. Keynes referred to the expected rate of profit as the marginal efficiency of capital. Expected rate of profit is the difference between the expected revenue generated by the capital employed and the cost incurred to employ that capital. As viewed from the perspective of Keynes theory, **Expansion Phase** encourages an optimistic outlook for investors who invest more because they overestimate the rate of return from an investment. The rate of return keeps increasing till the full employment condition is achieved. The phase in which the economy meets the ideal mark of full employment, is denoted as the **Boom Phase**. In the boom phase, the investors are unable to determine the reduction in the marginal efficiency of capital and are not mindful of the rate of interest also. In this backdrop, the profits from investments start declining due to the increase in the cost of investment and production of goods and services. This leads to *Contraction* or *Recession* in the economy. Recession sets in because the rate of decrease in the marginal efficiency of capital is more than that of current rate of interest. Moreover, the climate and avenues for investment also contract. Due to the paucity of funds, the banks are also unable to provide credit. Banks are not also able to provide credit because of the lack of funds. Because the Current rate of interest is higher, people are wary of investing and prefer to save. There is an apparent decrease in the demand for both the consumer and capital

goods. Low demands, less consumption together with retarded production shelves the employment opportunities and the economy is pushed into the phase of Depression.

Keynes suggested a triad of Propensities to explain the business cycles. These three types being: *Propensity to save*, *Propensity to consume*, and the *Propensity of marginal efficiency of capital*. Keynes also propositioned that the expansion of business cycle occurs due to increase in marginal efficiency of capital. This enables a climate of increased investments by individuals and enterprises alike. Organizations boost productions and open forms for hiring. More jobs enhance purchasing power and propel consumption. With more sales, business enterprises register profits and the chain of investments and increased income further accelerates. This marks the **Recovery** phase of the economy. Thus the three propensities coordinate to unravel the mechanisms of business cycles, demonstrating how they affect the economy.

2.6.1.5 Samuelson Model of Accelerator Interaction Theory of Business Cycle: J.M.

Clark underlines the role of acceleration in business fluctuations. The theorist's model is reckoned as the first step in the direction of integrating the Theory of Multiplier and the Principle of Acceleration to explicate the business cycles. Samuelson's model portrays how multiplier and acceleration interact with one other to create an impetus for generating additional income, consumption and investment demands more than expected. Model also explains the concept of the economic fluctuations. For a better understanding of Samuelson's Model, it is integral to be apprised of the difference between the Autonomous and Derived Investments. Autonomous investments are those that are done in external factors, as in investing in new inventions in technology, production process, production methods, etc. Derived Investment comprises those investments that are done in the capital equipment to meet the increase in consumer demand. More autonomous investments lead to rise in the incomes, thus resulting in the process of multiplier effect. Increased incomes create more demand for the consumer goods. To fulfill the rising demand and to sustain the momentum of more production, the firms undertake new investments. Thus, rising levels of consumption determine the demand for investments. This is termed as the Derived Investment. This marks the beginning of the Acceleration Process. So, a chain of various scenarios becomes evident as the derived investments

increase and the enhanced incomes propel the demand and growing capacity for consumption. This becomes an ideal backdrop for both multiplier Process and the Principle of Acceleration integrating with each other. A noticeable common feature in this case being that these phases see a marked growth in income levels which is better than expected³.

2.6.1.6 Hicks's Theory: Hicks associates the Business Cycles with the *Growth Theory of Harrod- Domar*. Hicks contends that Business Cycles and economic growth are simultaneous phenomena. Hence, both should be understood and analysed as an integrated pattern for formulation of policies.

2.7 The Concept of Recession

Recession is an economic phase when several aspects of the economy reflect working at the bottom for at least two-quarters of a calendar year. Recession is marked by declining investments, more unemployment, income decline, falling the growth rate, asset values collapse, reduced consumption and GDP falls for at least two consecutive calendar quarters. According to the National Bureau of Economic Research (NBER), Recession is also termed as “contraction” or “slump”. Recession is often followed by a boom, i.e., expansion, and thus this reverses the effects of a recession. In a recession, there is a reduction in productivity resulting in high unemployment. During the boom, however, there is a rapid rise in prices. The period of recession to recovery and boom is called a business cycle. There are short-term macro problems, but these do not last long because of corrective measures taken by one or many market players, including interventions by the government ⁴ (NMP and Dutta, 2013). The demand and supply shows the parameter. The growth in demand indicates the level of consumers' satisfaction who feel secure in investing. The reduction in demand implies that the general consumer does not intend to brook expenditure. Therefore, it can be supposed that when the demand falls, then supply chain is also affected due to the initial stage of decay. Economic recession depends on demand. Unemployment in a recession is like a cyclical unemployment, which is caused

³businessjargons.com/multiplier-accelerator-interaction-theory.html

⁴Recession is an economic instability that touches every person, the economy and society. It ultimately also affects other economies depending upon the volume of cross- country integration openness and trading.

by fluctuations in many macro variables. There is a fall in aggregate demand for goods and services in the national boundaries (Op. Cit, 2013, P. 3). Although there are four types of recession, this Study only pertains to the financial crises.

A fiscal crisis is a usual feature of market based economic systems. Market failure at medium intervals is inevitable in a capitalistic economic system. Such failures may not be viewed in a serious light in the short-run because the marketplace adapts to demand through hoardings of inventory or import of needed commodities and services. The market also adjusts in the long run to demand through the expansion of industrial output and also by the entry of new firms in the market. The important variable is cost, which also adjusts the commodity and project market. A problem comes up when there is over production and over capacity. Excess liquidity and excess supply of money, and a change in demand because of changes in taste and habits of consumers, and the public are other factors in the reckoning. Every economy is likely to face it sometimes and all these create knife-edge disturbances in the economy. Hence, these variables need adjustment by, *“utilization and the development of the population, saving propensity, technology exhaustion of existing inventory, and monetary and fiscal policy”*⁵The Global Financial Crises started with the US subprime mortgage problem in mid-2007. Since the crises had originated in the heart of the world economy, its contagion effect spread very quickly first to Europe and then the rest of the world.

2.7.1 What happened in the Recession of 2008?

The big recession in the USA began in December 2007. With it formally ending after 18 months (June, 2009), it was considered to be the largest economic contraction since the great Recession. The 16 month recession of 1973 – 1975 and the 1981- 1983 also were not as detrimental as the Global Recession of 2008. The situation in 2008 worsened because of the federal government’s refusal to rescue the collapsing investment giant i. e. the Lehman brothers. Considering the depth and duration of the new recession, it led to freezing of the credit marketplace. Giant financial institutions like the Citi Group, bank of America, and the American International Group (AIG) were in imminent risk of

⁵Verma, NMP, ed., 2013, P. 257.

insolvency. Within 2 years a significant gap (8%) opened between the economy's possible and actual output despite efforts of the monetary and fiscal policy makers to turn the decline (*Upadhyay and Mason, 2013, P. 23*).

The United States is the largest economy of the world. It had harmful impact on both the developed and developing country. Many people lost businesses due to decrease in consumption, investment and savings. U.S. is also the world's largest food supplier, exporter and importer. Therefore, when there was decline in the USA's business activity, caused a negative impact that began to percolate on the developing countries.

2.7.2 The Process of Globalization

The global economic system is the international web of individuals, business, governments, multilateral organizations and civic society groups that collectively make decisions around the production and distribution of goods and services.

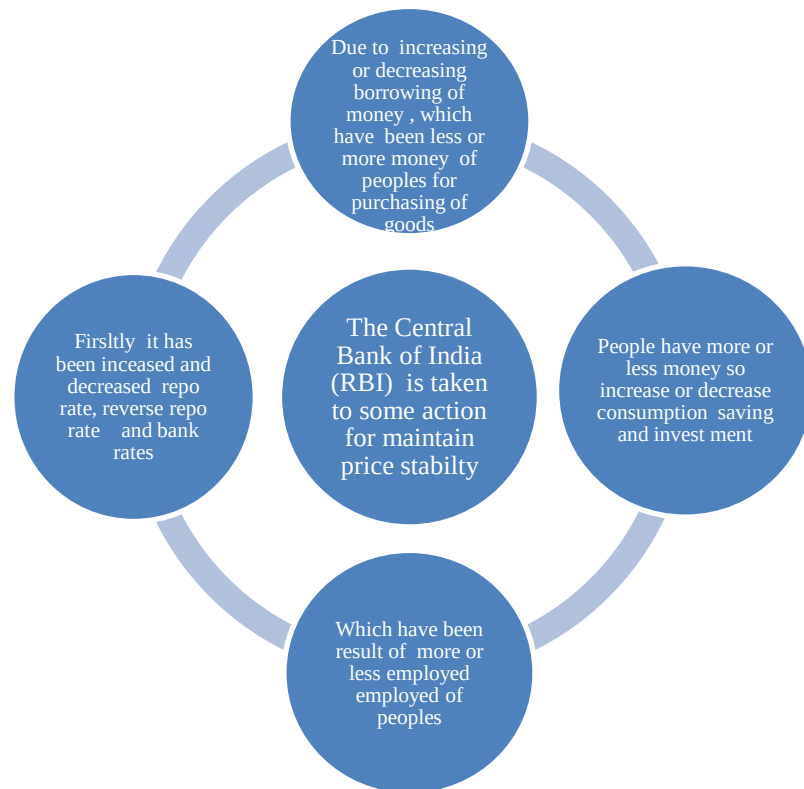
Since 1850s, the global economic isolation gave way to the globalization process which promoted economic integration. The two modern forms of globalization took place from 1850 to 1914 and from 1946 to the present. The pillars of modern economic globalization include the free cross border movements of goods and services, foreign direct investment, financial capital, labor and technology. Globalization also absorbed the economic ills that occurred from 1914 to 1945 in the wake of the two world wars. The above period in the era of globalization in the world's economy witnessed during retrenchments and a prolonged Global Depression. The big recession in the USA started in December 2007. Due to globalization, it had a noticeable impact on both the developed and developing countries (*Basanta, 2013, Pp. 233-234*). However, India was affected partially by the Global Financial crisis.

2.9 Link of the Phillips Curve Theory with the Global Financial Crisis in the Present Work

This study's main focus is on macroeconomic variables of inflation and unemployment, specifically addressing the time periods before, during and after the Recession. Many studies found that the rate of inflation and the rate of unemployment based on Phillips

curve theory did not exist in the recession period and concludes Phillips curve shape to be flat in the recession period in other countries. So this study examines the Phillips curve theory in the recession period with an intent to gauge the extent of the change in the Phillips curve shape and determine whether it was vertical, horizontal or flat in the Indian context during Global Recession. Another is to examine the output gap in the same periods.

Figure 2.7: Mechanism of the Effects of Inflation on Unemployment



Source: Authors' Compilation

The figure 2.7 presents the mechanism of the effect of the rate of inflation on the rate of unemployment. The central bank of India, the RBI, takes periodic actions for price stability in economy. The first step of central bank is to decrease the Repo rate and Bank rate. The Repo rate is a short-term instrument and the Bank rate is a long-term instrument for maintaining the price stability in the economy. If the RBI increases the repo rate, then it creates more liquidity in the economy. Due to this the people have been more money to purchase goods and services. This leads to increase in consumption, saving and

investment in the economy. These variables create of employment for people in the economy. This is a cause and effect relationship between the Rate of Inflation and Unemployment. We can write the equation like-

$$UNEM = F (In) \text{ Inflation}$$

Inflation is an independent variable that has been denoted by (I) and unemployment is a dependent variable, denoted by (U). This is a cause and effect relationship.

What causes changes in the rates of inflation and unemployment? How is the price level and degree of unemployment related? These have been key questions plaguing economists for at least forty years (*Marco et al. Pp. 1*). The Phillips curve is the most useful approach for showing the link between the unemployment rate and the inflation rate. That is why the policymakers enlist the aid of the Phillips Curve Theory.

The statement of the problem is that loss of output, increasing inflation and high unemployment are major problems of Indian economy. The present study adds to these indicators the impact of the recession on inflation, unemployment and the output gap in the wake of the 2008 Global recession. The empirical evidence in the Study would also show the short-run linkages between inflation and unemployment during the recession.

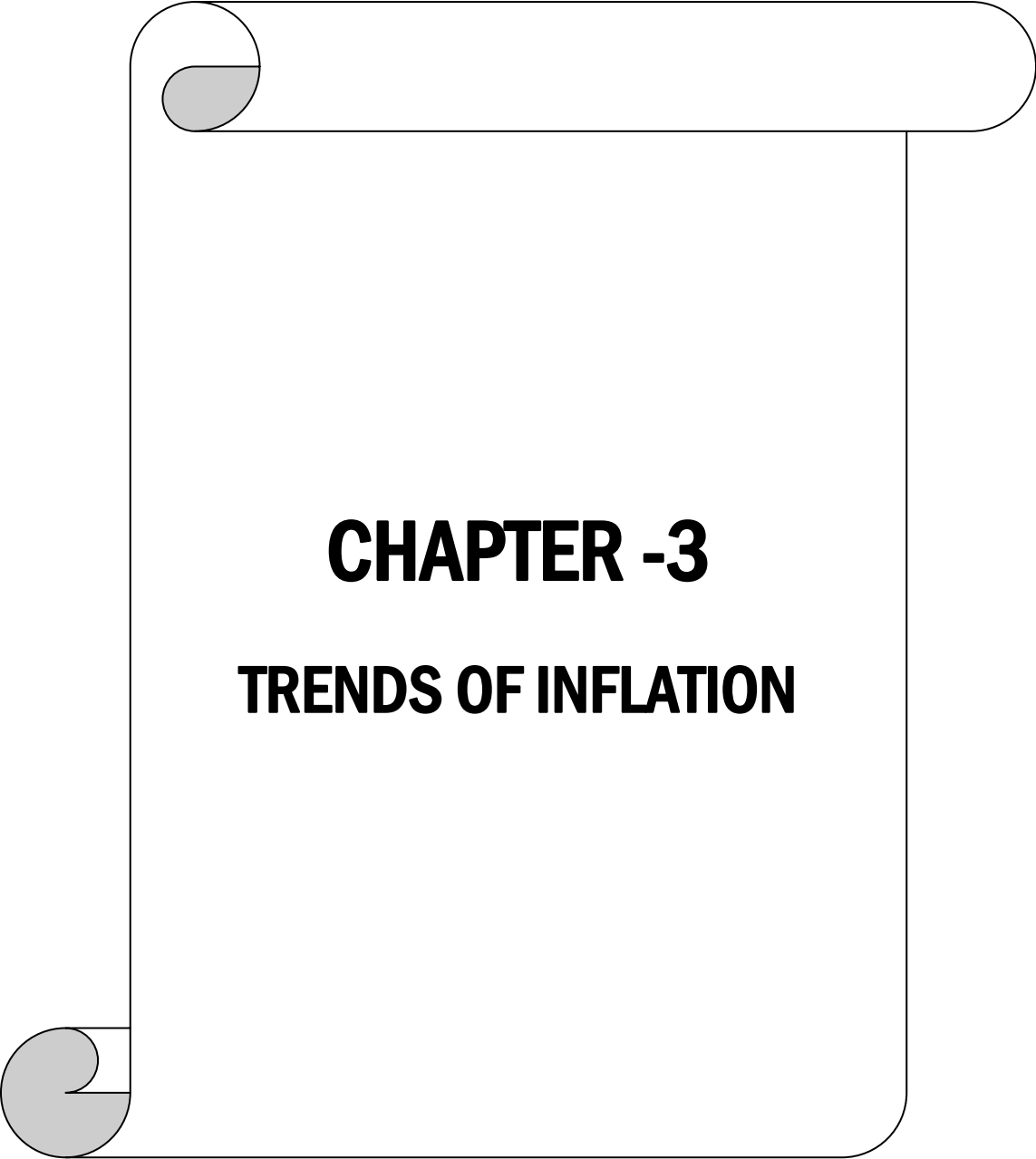
This study also seeks to fulfill the research gap wherein no study has yet been attempted to analyse the impact of Global recession on the Indian economy from the perspective of the Phillips curve theory. In macroeconomics, the short run is the period during which the economy maintains a deviation of actual from potential output, or output gap. This difference is associated either with the existence of spare capacity and unemployment, in the case of recession, or unstable output and rising prices, in the instance of a boom (Op.Cit., 2012, p. 341).

In the context of the reasons mentioned above, this study is linked to the Phillips curve because, this is a single theory that offers the combination of two variables (dependent and independent) between inflation and unemployment. In other words, it has provided the theoretical framework of the relationship between inflation and unemployment.

The mechanism that drives the Phillips curve theory is the demand-pull factor and wage push factor. As in, when the rate of inflation is increasing, it creates employment in the economy because creeping (moderate inflation) inflation is helpful for the growth in the economy. Hence, the present study examines the Phillips curve relationship in during, pre and post-recession moreover the output gap of recession 2008. On the other hand, the study also estimates the actual capacity of economy and the level of employment as less or optimum.

2.10 Concluding Facets

This chapter clearly establishes that inflation and unemployment are the macroeconomic variables and these variables create huge problems in any economic system. These variables cause fluctuations in the economy. This concerned chapter introduces the conceptual framework of inflation and unemployment. It demonstrates the short run linkages between inflation and unemployment by the theory of Phillips curve. First is short run period; the inverse relationship between the money wage rate and the rate of unemployment. When the money wage rate is decreasing, then the rate of unemployment is increasing. When the money wage rate is increased then the rate of unemployment is decreasing. It will be there in any variance of inflation and unemployment; this is more aptly described as the *knife-edge balance or equilibrium*. Another is the long run period. In this period there is no inverse relationship between the rate of inflation and the rate of unemployment. In other words, there is direct relationship between the rate of inflation and the rate of unemployment. The Long run Phillips Curve is vertical.



CHAPTER -3

TRENDS OF INFLATION

TRENDS OF INFLATION

3.0 Overview

The chapter 3 discusses and analyse about the trends of inflation. Since 1991, with a transformation India has become into a globalized economy. India also became highly vulnerable to shocks or other calamities. Therefore, the era proves interesting to be examined the trends of inflation in the present study and gauged if there is any impact of Global Recession of 2008 on the trends of inflation in the Indian economy or not. In political economy, inflation means a continuous hike in the prices of goods and services in an economy over a point of time and thus this is measured by the various price index number and deflator. This study has selected just two criteria that are the Wholesale Price Index and the Consumer Price Index. Since these two specifics capture the true picture of the rising prices in the economy, the Government of India has also chosen them as the nodes for decisions on policy implications. This chapter shows the trends of rising prices in the context of the Indian economy for 14 years. The period of the study is from 2002M1 to 2015M12. Further, this study has been divided into three periods. The beginning period is from *month one 2002 to month twelve 2007*, it represents the Pre-Recession period. The second period is from *month one 2008 to month twelve 2009*, which corresponds to the duration of Recession period. Third period is from *month one 2010 to month twelve 2015* the Post-Recession period.

Least square method has been enlisted to determine whether, the trends of all commodities and sub-groups under the Whole sale Price Index and Consumer Price Index resulting from inflation is increasing and decreasing with respect to time.

3.1 Introduction

Inflation is the most pressing problem in Indian economy. Inflation as an issue is the purview of both the rich and the underprivileged whose lives and standard of living revolves around the prices of essential commodities that they consume or use. Whenever

the finance minister presents the budget in the Parliament, every person can predict that the increase of fiscal deficit, oil price, cost of production would increase the inflation in future.

The notion of price stability as defined in modern theory and central banking practice today is fundamentally associated with a moderate rate of price inflation (*Ansari and Sbordone*, 2014, p. 1). In case of India with a large percentage of the population which is poor (42 percent in 2005) and (*Chen and Ravallian*, 2008) based on food price, inflation can be especially significant. This is because the poor spend a big ratio of their income on food. The National Sample Survey Organisation (NSSO)'s round in 2004-05 noted that 50 percent of income was spent on food. Hence, inflation results in loss of value of money. In other words, it reduces the purchasing power of money. For instance, if the price of five kilo gram (Kg) of rice is 100 rupees on a given week at a shop, then because of inflation, after a week at the same shop, only 4 Kg rice can be bought in Rs. 100. Due to inflation, the consumers are paying more money, but receiving fewer goods.

The rate at which the prices of goods and services increase over a particular period of time normally a year are termed as inflation rate. Different school of thoughts provides different perspectives on what really causes inflation. However, there is a general agreement amongst economists that economic inflation may be caused by either an increase in the money supply or decrease in the quantity of goods being supplied. Keynes defined inflation as a phenomenon of full employment. Pointing to the Neo Keynesian economic theory, demand-pull inflation, inflation due to high demand for GDP and low unemployment also known as Phillips curves inflation. Another is cost-push inflation, nowadays termed supply shock inflation is due to an effect of a sudden increase in the cost of petroleum. The monetarist theory described that when the money supply is increased in order to produce or increase production and utilization, it creates an inflationary situation within an economy, Structuralism described that the chief cause of inflation is the inelasticity in the social organization of the economy (Jain, 2015, P. 2).

The main question is that, what is the desirable rate of inflation, which is a contributing factor in developmental processes in the economy. Nevertheless, we have no clear-cut

solution to this query. It all depends upon the economic situation prevailing in a country at a particular time.

According to, International Monetary Fund (IMF), The Desirable Rate of Inflation in Developed Countries is (2.3 Percent) and Developing Countries are (4.6 Percent). As regards the desirable rate of inflation in India, According to Chakravarty Committee (1985), set up by the Reserve Bank of India to review the monetary system of a country, considered 4 percent rate of inflation in India socially desirable and conducive to economic growth⁶. According to Tarapor Committee, the Desirable Rate of Inflation in India 3.5 percent, on the other hand according to C. Rangrajan it is around 5.6 percent.

3.2 Objectives of the study

1. To examine the trends of the Wholesale Price Index in all commodities that includes primary articles, fuel & power and manufactured products.
2. To examine the trends of the Consumer Price Index in all categories that includes CPI-IW, CPI-AL and CPI-RL from 2002 to 2015.

3.3 Hypothesis of the study

1. **H₀**: WPI has increased trends in pre - recession period, decreasing in trend in duration and post-recession periods.
2. **H_a**: WPI has decreasing trends in pre - recession period, increasing in trend in duration and post-recession periods.
3. **H₀**: Consumer Price Index is decreasing trends in all categories such as CPI-IW, CPI-AL and CPI-RL in pre, duration and increasing trends in post-recession period.
4. **H_a**: Consumer Price Index is increasing in trend in all categories such as CPI-IW, CPI-A Land CPI-RL in pre, duration and shows decreasing trends in post-recession period consumer.

⁶ Shapiro, A. (1994), '*Macroeconomics Analysis*', Galgotia Publishers, New Delhi, P. 468.

3.4 The Meaning of Trend

A form of gradual modification in a condition, yield, or process, or an average or general tendency of a serial publication of data points to a move in a certain way over time and that is represented by a line or curve on a graph.

3.5. Methodology of the Study

The present study uses Least Square method to estimate the long-term trend, i.e., the secular trend. Reasons for employing this method are:

1. This is the most significant method of trend estimation.
2. It gives the best-fit line and provides the linear regression equation.

Least Square Method

Fitting the straight trend line

A straight line can be expressed by the following equation.

$$Y = \alpha + bX$$

Where, Y = trend values, X = unit of time, α is the y-intercept and b is the slope of the line.

Direct method- A straight line is defined by the equation.

$$Y = \alpha + bX$$

Two normal equations are

$$\sum y = N\alpha + b \sum X \dots\dots\dots 1$$

$$\sum XY = \alpha \sum X + b \sum X^2 \dots\dots\dots 2$$

The Second model is a Simple Linear Regression Model:-

This is a statistical tool which tells us the cause and effect relationship between two variables and summarize relationship within two continuous (quantitative) variables. One

variable represents an independent or explanatory variable while the second variable Y represents the dependent variable. This simple regression equation model is given below.

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon_t$$

Where y is termed as the dependent or study variable and X is termed as independent or explanatory variable. The terms β_0 and β_1 are the parameters of the model. The parameter β_0 is termed as intercept term and the parameter β_1 is termed as slope parameter. These parameters are usually called as regression coefficients. ε_t is observed as independent and identically distributed random variable with mean zero and constant variance 2σ . Later, we will additionally assume that ε is normally distributed.

3.6 Measurement of Inflation in the Indian Economy

The official price indices in India are calculated by using the Laspeyres's formula. The Laspeyres's price is calculated by using producers, consumers and wholesale prices. The index is determined for each of the three sets of prices for different purposes. The producer index measures the average selling prices received by domestic producers of goods and services. The Consumer Price Index (CPI) measures the average price from the consumer's perspective. Sellers' and consumers' prices may differ because of taxes levied or subsidies offered and distribution costs entailed. The Wholesale Price Index measures the average prices in the wholesale market, i.e., where goods are sold in bulk. These price indices are used to measure the average change over time in the selling prices received by producers (PPI-inflation) or prices paid by consumers (CPI- inflation) or the average price changes in the wholesale market (*Mishra & Roy, 2011, P. 5*). In the Indian economy, inflation can be measured in three ways: the Wholesale Price Index, Consumer Price Index and Gross Domestic Product (GDP) deflator. Each parameter has been explicated in the next section.

3.6.1 Wholesale Price Index in India

In the Indian context, the WPI is the basic entity for measuring the price rise. The WPI measures the cost of a collative basket of wholesale goods and details the price movement in the most comprehensive manner. It is widely practiced by the government

and the bank industry. The Department of the Industrial Policy and Promotion, Ministry of Commerce and Industry, the GOI, compiled the WPI and released it through an official publication. The Index No. of wholesale prices, with base week ending in August 19, 1939=100, for the week commencing from January 10, 1942 was the very first release of WPI. Since 1947, the Index is being issued regularly (WPI., Compilation, Manual, 2010, P. 1).

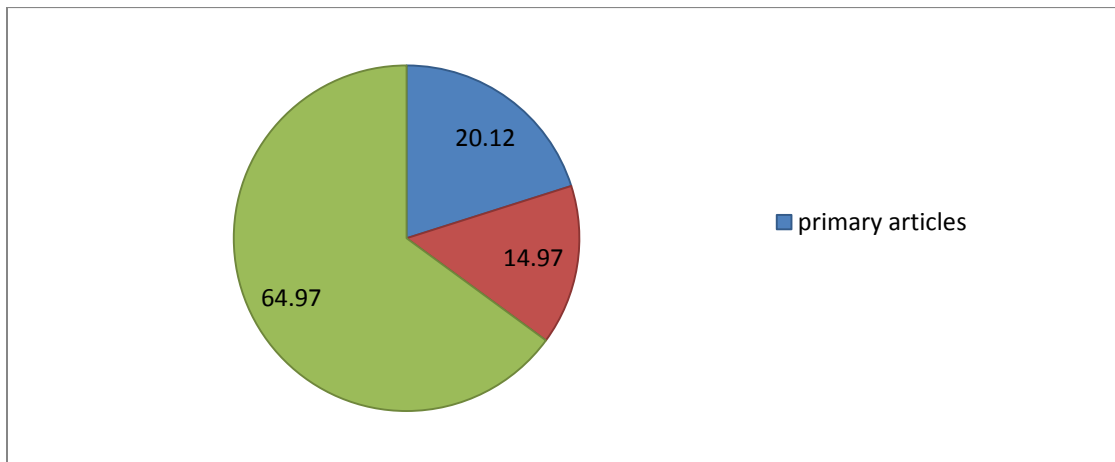
The modern version of Whole Price Index has been performed by shifting base year from 1993- 94 to 2004-05. A working group was instituted under the Chairmanship of Prof. Abhijit Sen, Member Planning Commission, for the revision of WPI services. The report presented by the committee recommended that the base year should be altered from 1993-94 to 2004-05. Technical advisory committee on statistics of prices and cost of living (TAC on SPCL) chaired by the Director General, Central Statistical Office at its meeting on 31.12.2009 gave the approval for the new base year, selection of commodity basket and derivation of weighting diagram. A committee of Secretaries (Cos) consented to the release of a new series in its meeting on 19th August, 2010. The report was finally released on 14th September 2010. The WPI of the new serial publication (with base year 2004-05) was launched on 14th September 2010 (Whole Price Index, Compilation, Manual, P. 10).

The report was estimated by the bureau of the Economic Advisor, Department of Industrial Policy and Promotion, Ministry of Commerce and Industry and it was released on the basis of three time phases of weekly, monthly and final list in every two months. Firstly, it is on the weekly basis on every Thursday for primary articles and fuel group. Second is the monthly basis on the 14th of every month for all commodities and Third, final list is released every two months (eight week). This Report provides an authentic price data for all commodities in the Indian economy⁷.

⁷Wholesale price index in all commodities is divided under three major groups namely, first is primary articles (20.12) percent of total weight) second is fuel and power (14.91) percent and third is manufactured production (64.97 percent) and these major groups are again divided into subgroups. Primary articles included in the computation of WPI include food articles, non-food articles and minerals. In the fuel, power, includes lights, lubricants; electricity, coal mining and mineral oil are included. This is represented by graphs.

Figure 3.1: Weightage of Wholesale Price in India

The figure 3.1 through the pie chart shows that the WPI has been divided into three main broad categories such as primary articles, fuel & power light and manufactured products and as well as how much are weightages of these categories.



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, Government of India

Table-3.1 Major Groups, in Wholesale Price Index in India

1. Primary Articles
I. Food articles
II. Non- food articles
III. Minerals
2. Fuel, Power, Light, Lubricants
I. Coal
II. Mineral oils
III. Electricity
3. Manufactured Products
I. Food products
II. Beverages, Tobacco and Tobacco Products
III. Textiles
IV. Leather and Leather Products
V. Wood and Wood Products
VI. Paper and Paper Products
VII. Rubber and Plastic Products
VIII. Chemicals and Chemicals Products and Several other
IX. Non- Metallic Mineral Products
X. Basic Metals, Alloys and Metal Products

XI.	Machinery and Machine Tools
XII.	Transport Equipment's and Parts
XIII.	Other Industries

Sources: Office of Economic Advisor, Ministry of Commerce and Industry, <http://industry.nic.in/>

Table 3.2: Comparative Statement of Weights, No. of Items & No. of Quotations between the Old Series & New Series.

Major Groups	Weights		No. of Items		No. of Quotations	
	2004-05	1993-94	2004-05	1993-04	2004-05	1993-94
All Commodities	100.00	100.00	676	435	5482	1918
Primary Articles	20.12	22.02	102	98	579	455
Fuel and Power	14.91	14.23	19	19	72	72
Manufactured Products	64.97	63.75	555	318	4831	1391

Source: Office of Economic Advisor, Ministry of Commerce and Industry (WPI, Compilation, Manual, 2010, pp10)

Table 3.3: The Evolution of WPI in India

Base year	Year of Introduction	No. of Items	No. of Price Quotations
The week ended 19 th August 1939	10 th January, 1942	23	23
End August 1939	1947	78	215
1952-53 (1948-49 as weight base)	1952	112	555
1961- 62	July, 1969	139	774
1970 – 71	January, 1977	360	1295
1981- 82	July, 1989	447	2371
1993-94	April, 2000	435	1918
2004-05	September, 2010	676	5482

Sources: Office of Economic Advisor, Ministry of Commerce and Industry (WPI, Compilation, Manual, Pp10).

A Basket of Commodities

The new series with 2004-05 as the base has 676 items in the commodity basket. A comparison of the number of items and price quotations in the story of the groups in the previous and the existing as well as in the revised base series is shown in table (4). There has been a significant addition in number of items and price quotations for each detail, especially in the manufacturing segment to not only better reflect the structural shifts but also to make WPI more broad based.

Table 3.4: Comparative Statement of Commodities and Price Quotations

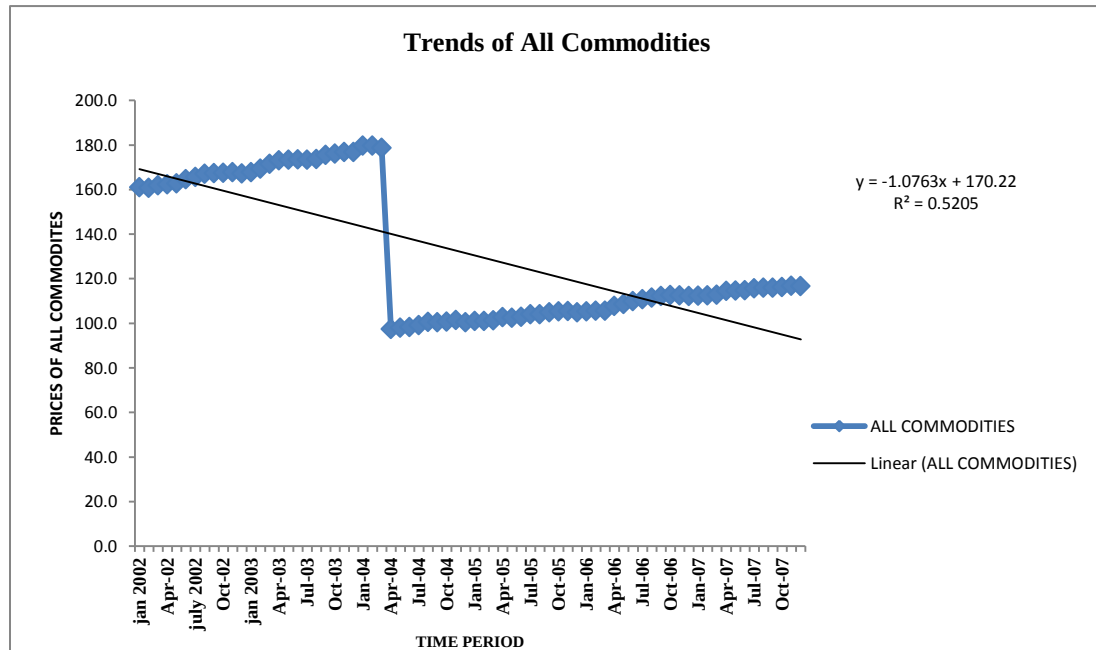
Major Groups	No. of Commodities				No. of Price Quotations			
	1970-71	1981-82	1993-94	2004-05	1970-71	1981-82	1993-94	2004-05
All Commodities	360	447	435	676	1295	2371	1981	5482
Primary Articles	80	93	98	102	411	519	455	579
Food Articles	39	44	54	55	264	320	340	431
Non-Food Articles	26	28	25	29	115	132	96	108
Minerals	15	21	19	18	32	67	19	40
Fuel and Power	10	20	19	19	30	73	72	72
Manufactured Products	270	334	318	555	854	1779	1391	4831
Food Products	37	35	41	57	117	231	168	406
Beverages Tobacco and Tobacco Products	8	7	11	15	19	39	49	102
Textiles	12	27	29	55	99	120	100	457
Wood and Wood Products	4	2	2	10	13	14	9	64
Paper and Paper Products	4	11	11	18	16	74	67	138
Leather and Leather Products	4	3	1	13	18	26	9	91
Rubber and Plastic	7	13	15	45	42	73	55	351
Chemical and Chemical Products	67	77	69	107	182	428	276	1111
Non-Metalic Mineral Products	21	22	9	26	63	125	42	225
Basic Metals, Alloys and Metal Products	42	57	53	69	125	235	203	696
Machinery and Machine Tools	35	44	56	107	104	266	312	903
Transport Equipment	21	22	21	33	39	118	101	287

Sources: Office of Economic Advisor, Ministry of Commerce and Industry, <http://eaindstry.nic.in/> (WPI.,
Compilation, Manual, 2010, pp.14-15)

3.7 Trends of all Commodities at Wholesale Price Index (All Groups) in India

❖ Pre-recession Period

Figure 3.7.1: Trends of Wholesale Price Index-All Commodities



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India

The line chart 3.7.1 illustrates the trends of all commodities in the (January 2002 to December 2007) pre-recession period. Y-axis indicates the prices of all commodities and X-axis indicates time. Blue color line represents the prices of all commodities and black color line indicates the trend line of all commodities. Prices of all commodities started at high 161.0 value after that it gradually increased from Feb 2004, value at 179.8. There was a sudden decrease at 97.5 value in April as well as crossed trend line due to the hardening of international oil prices as well as domestic food prices responding to a deficient monsoon in the previous year fuelled a spurt in inflation in India during the first half of 2004-05 (**Lok Sabha Secretariat, No. 6/RN/Ref./2013**). This becomes even lower in the series and crossed the trend line in May 2005 value at 102.9. After that it gradually increased and again it crossed the trend line in June, 2006 with the value of (109.0). Thereafter, it increased with the upward prices in Dec, 2007 with the 116.0 value. While the trends of all commodities declined with respect to time.

Explanation and Interpretation of Regression Model

α is intercept depicting all commodities when the explanatory variables are equal to zero.

α and β_1 are the co-efficient or parameters attached to the explanatory variables. Next line the inclusion of the stochastic term (ui or ut) in the above model is to capture the impact of other variables that are not included in the models.

3.6 Statistics Description

Evaluation based on statistical criteria

The R^2 (coefficient of determination): The R square shows the goodness of fit of the regression. It indicates how well or to what extent the explanatory variable (regress or) explains the variation (regressed). **The t- test (student-t):** The t test shows the dependent variables and its usefulness to the model. A two tailed test is concluded at the 5 % level of significance, under the n-K degree of freedom, where K is the number of samples. **The f- test:** The f test is used for the overall significance of the regression model. It will also be carried out at 5% level of significance.

Table 3.5: Interpretation of ANOVA

Source	SS	DF	MS
Model	36017.5438	1	36017.5438
Residual	33191.5775	70	474.776357
Total	69209.1214	71	974.776357

The ANOVA (analysis of variance) table splits the sum of squares into its components.

Total sum of square = residual (error term) sum of square + regression (all commodities) sum of square.

Table 3.6: Analysis of Regression Coefficient

Intercept	Coef.	Std. Err.	T stat	P >(t)	Upper	Lower
Time	-1.07195	.1234806	-8.72	0.000	-1.322469	-8299203
Allcommodites	170.2144	5.18643	32.82	0.000	159.8704	1805584

Let all commodities denote the regress and co-efficient of the regressor (time)

Column “coefficient” gives the least squares estimates of time. Column “standard error” gives the standard error (i.e. the estimated standard deviation) of the least squares estimates α . Column “t stat” gives the computed t-statistics for H_0 : decreasing trends of all commodities of (WPI) in the pre-recession period = H_0 against H_a : decreasing or not decreasing trends of all commodities of (WPI) in $\neq 0$. Column “P value” gives the P-value for the test of H_0 : decreasing trends of all commodities of (WPI) in the pre-recession period = H_0 against H_a : decreasing or not decreasing trends of all commodities of (WPI) in $\neq 0$. This equals the $\Pr \{(t) > t\text{-stat}\}$ where t is a t- distribution random variable with $n-k$ degrees of freedom and t-statistics is the computed value of the t- stat given in the previous column. Column “lower 95 percent” and “upper 95 percent” values define a 95 percent confidence interval for all commodities.

Table-3.7 Interpretation of Regression Statistics

	Value	Explanation
No of observation	72	No of observation used in regression (n)
F test	75.96	The F test compares the variance of two samples so as the two test hypothesis.
P value	0.000	To find out for significance level
R-squared	0.5204	Coefficient of determination, the overall goodness of fit- measures, i.e. R^2 (0.5204)
Adj- R- squared	0.5136	Adjusted R^2 used for more than x (dependent) variables
Root MSE	21.775	It is the best measure of goodness fit of the correlation coefficient.

Sources: Authors' Estimation from the Secondary Data

3.7 Statistical Significance of Trends of All Commodities

The regression analysis is based on secondary data which have been taken by MOSPI. There are 72 observations that have been used for analysis. Study time period is from 2002 to 2007. It has been used in monthly data on the base of wholesale price index. There are two variables used in this, analysis which is dependent variable and independent variable, time is independent variable and all commodities are the dependent variable.

The model can be written in a functional form as follows:

$$\text{ALLCOMMO} = f(T)$$

ALLCOMMO = All Commodities of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An econometric model, by including the stochastic term (u_i), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = all commodities of wholesale price index, α = intercept of y (constant coefficient),

β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{All commodities} = 2.22815 + -.0033633_{\text{time}} + \varepsilon_t$$

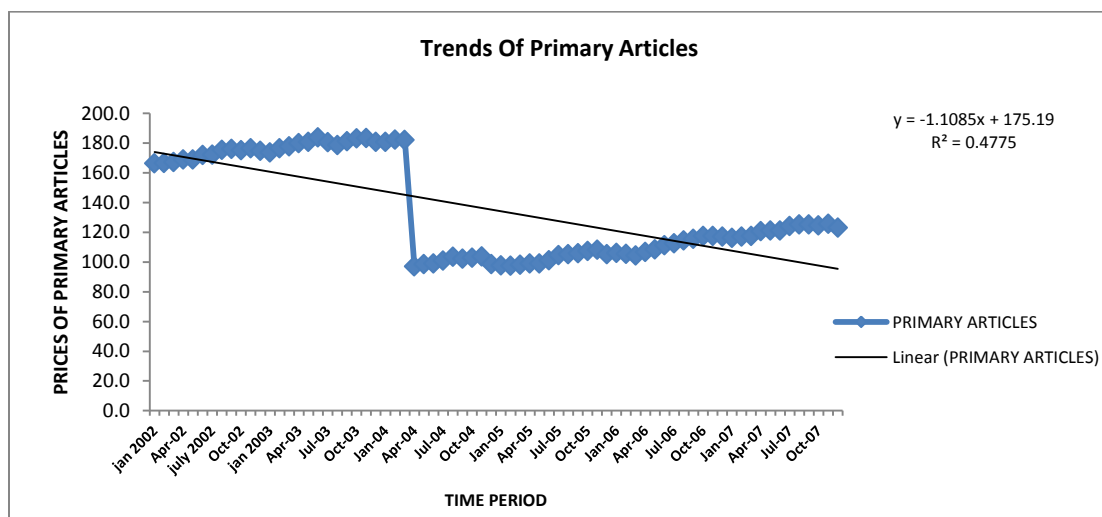
According to the statistical model, one unit change in time will affect one unit change in all commodities of (WPI) but as noted on the model, coefficient value of time is negative. Therefore, in pre-recession period, trends of all commodities of wholesale price index are

negatively associated with time. In other words trends of all commodities decreased and the prices increased.

Analysis of Regression coefficient: The coefficient value is (2.22815), Standard. Error. (.0004066). T stat (-8.27) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of all commodities in pre-recession period and $H_0 \neq 0$. While the p value is more than tstat ($0.000 > -8.27$) but it is significant at 1 percent level of significance. Therefore, null hypothesis is rejected at the 1 percent level of significance and it concludes an inverse relationship between the trends of all commodities with pre-recession time.

Figure 3.7.2: Trends of Primary Articles



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India

The line chart 3.7.2 illustrates the trends of primary articles in the (2002 -07) pre-recession period. Y-axis indicates the prices of primary articles and X-axis indicate time. Blue color line shows the prices of primary articles and black color line indicates the trend line of primary articles. Prices of primary articles starts at high value of 166.4, after which it gradually increases from Feb 2004 to 182.4 from there a sudden decrease at 97.0 value is observed April as the prices crossed trend line, due to the hardening of international oil prices as well as domestic food prices. This could be response to a deficient monsoon in the previous year that fuels a spurt in inflation in India during the first half of 2004-05 (Lok Sabha Secretariat, No. 6/RN/Ref./2013). After that, the prices

of primary articles gradually increases with continuous fluctuations occurring May 2004 with the value of 123.2 to Dec 2007 with the value of 123.2 and subsequently crossing the trend line in May 2006 with the value of 108.4. The trend of the primary articles shows decreasing trend with respect to time.

Statistical Significance of Primary Articles

The regression analysis is based on the secondary data which has been taken by MOSPI. There are 72 observations which have been used for analysis. Study time period is from 2002 to 2007. It has been used in monthly data on the basis of WPI. There are two variables used in this analysis, which are the dependent variables and the independent variables where time is independent variable and primary articles are the dependent variables.

The model can be written as a functional form as:

$$P. A. = f(T)$$

P. A. = Primary articles of wholesale price index

T = Time

f = functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = primary articles of wholesale price index, α = intercept of y (constant coefficient),

β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

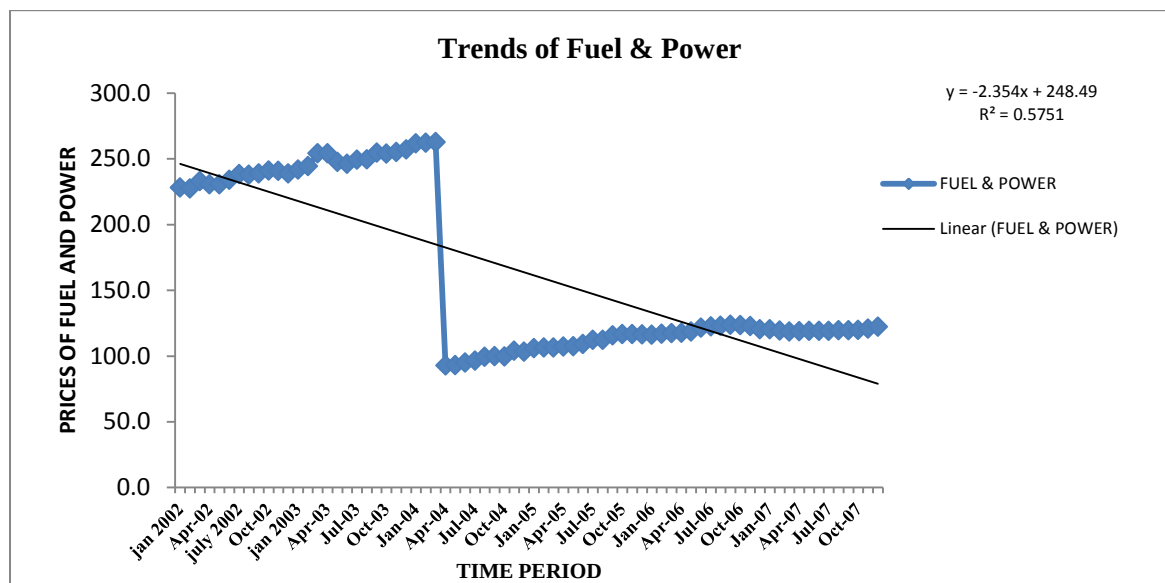
$$\text{Primary articles} = -.0033439 + 2.238436_{\text{time}} + \epsilon_t$$

According to the statistical model, one unit change in time will affect the one unit change in primary articles of (WPI) but as noted in the model, coefficient value of time is negative. Hence, in pre-recession period, trends of primary articles on wholesale price index are negatively associated with time. In other words trends of primary articles decreased and the prices increased.

Analysis of Regression coefficient: The coefficient value is (-.0033439), Standard Error. (.0004538). t stat (-7.37) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of primary articles in the pre recession period and $H_0 \neq 0$. While the p value is more than the t-stat value. But P value is significant at 1% level of significance therefore null hypothesis is rejected at the 1% level of significance (0.000 > -7.37) and it concludes an inverse relationship between the trends of primary articles with pre-recession time.

Figure: 3.7.3: Trends of Wholesale Price Index-Fuel and Power



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India.

The line chart 3.7.3 illustrates the trends of fuel and power in the pre-recession period. Y-axis indicates the prices of fuel and power and X-axis indicate time. Blue color line shows the prices of fuel & power and black color line indicates the trend line of fuel & power. Prices of fuel & power starts at high value of 228.1, after that it increases continuously from Feb 2004 and reached to 262.2. Then it shows a sudden decrease with the value of 92.8 in April as well as

crossed trend line, due to the hardening of international oil prices as well as domestic food prices. This could be in response to a deficient monsoon in the previous year that fuels a spurt in inflation in India during the first half of 2004-05 (*Lok Sabha Secretariat, No. 6/RN/Ref./2013*). After that, prices of fuel & power continuously increased from May 2004 with the value of 93.0 to Dec 2007 with the value of 122.1 and subsequently crossing trend line in March, 2006 with the value of (117.3).the trend of fuel and power shows decreasing trend with respect to time.

Statistical Significance of Trends of Fuel and Power

The regression analysis is based on the secondary data which has been taken by MOSPI. 72 observations are used for analysis. Study time period is from 2002 to 2007. The monthly data on the base of the WPI has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and fuel and power are the dependent variables.

The model can be written as a functional form as follows:

$$F. \& P. = f(T)$$

F. & P. = Fuel and Power

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = fuel and power of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

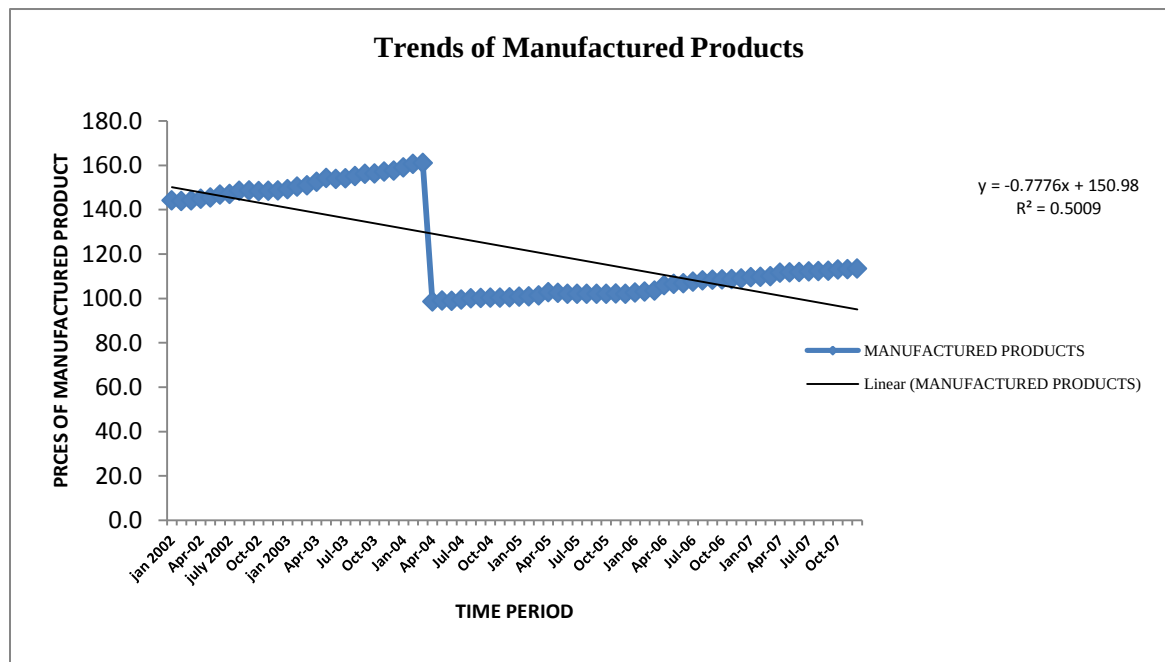
$$\text{Fuel \& power} = -.0058482 + 2.39182_{\text{time}} + \epsilon_t$$

According to the statistical model, the unit change in time will affect one unit change in fuel and power of (WPI) but as noted in the model coefficient value of time is negative. Hence, in pre-recession period, trends of fuel and power of wholesale price index are negatively associated with time. In other words trends of fuel and power decreased and the prices increased.

The coefficient value is (-.0058482), Standard. Error. (.0006476). t-stat (-9.03) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of fuel and power in the pre recession period and $H_0 \neq 0$. While the p value is more than t-stat but P value significant at 1% level of significance. Hence null hypothesis is rejected at the 1% level of significance and it concludes an inverse relationship between the trends of fuel and power with pre-recession time.

Figure 3.7.4: Trends of Wholesale Price Index-Manufactured Products



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, Government of India

The line chart 3.7.4 illustrates the trends of all manufactured products in the (January 2002 to December 2007) pre-recession period. Y-axis indicates the prices of manufactured products and X-axis indicates time. Blue color line shows the prices of all commodities and black color line indicates the trend line of manufactured products.

Prices of manufactured products starts at high value of 144.2 in Jan 2002. After that, it continuously increases from Feb 2004 to 160.4. From there a sudden decrease at 98.6 value is observed in April and it crossed trend line, due to the hardening of international oil prices as well as domestic food prices. This could be in response responding to a deficient monsoon in the previous year that fuels a spurt in inflation in India during the first half of 2004-05 (*LOK SABHA SECRETARIAT, No. 6/RN/Ref./2013*). After that, prices of manufactured products gradually increases with continuous fluctuations occurring from May, 2004 with the value of 99.0 to Dec 2007 with the value of 113.5 and subsequently crossing the trend line in May 2006 with the value of 106.5. The trend of manufactured products shows decreasing trend with respect to time.

Statistical Significance of Trends of Manufactured Product

The regression analysis is based on secondary data which have been taken by MOSPI. 72 observations have been used for analysis. Study time period is from 2002 to 2007. It is based on the monthly data for the WPI. There are two variables used in this analysis, the dependent variable and independent variable, time is independent variable and manufactured products are the dependent variable.

The model can be written as a functional form as follows:

$$M. P. = f(T)$$

M. P. = Manufactured Products of Wholesale Price Index

T = Time

f = Functional Relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (u_i), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

Y = manufactured products on wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

$$\text{Manufactured products} = 2.17696 + -.0026229_{\text{time}} + \varepsilon_t$$

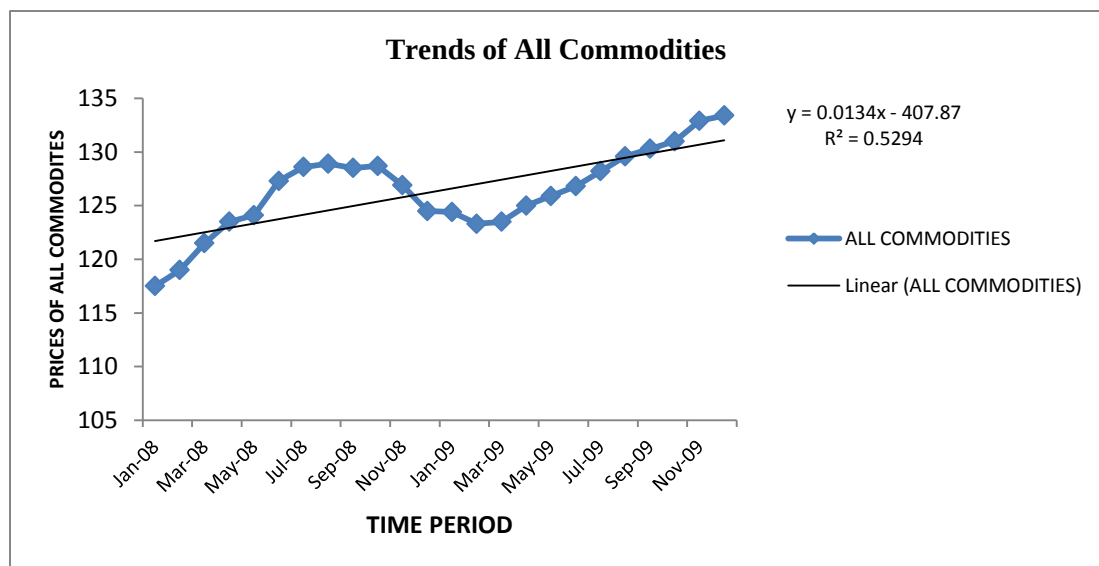
According to the statistical model, the one unit change in time will affect the one unit change in manufacturing products of (WPI) but as noted in the model, coefficient value of time is negative. Hence, in pre-recession period, trends of manufactured products on wholesale price index are negatively associated with time. In other words, trends of manufactured products were decreasing and the prices were increasing.

Analysis of Regression Coefficient: The coefficient value is (2.17696), Standard. Error. (.0003245). t-stat (-8.08) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of manufactured products in the pre-recession period and $H \neq 0$. While the p value is more than t-stat but p value significant at 1 %level of significance ($0.000 > -8.08$) Therefore, the null hypothesis is rejected at the 1% level of significance and it concludes an inverse relationship between the trends of manufactured products with pre-recession time.

Duration of Recession

Figure: 3.7.5: Trends of Wholesale Price Index-All Commodities



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India.

The line in chart 3.7.5 illustrates the trends of all commodities in the recession period (2008-09). Y-axis indicates the prices of manufactured products and X-axis indicates time. Blue color line shows the prices of all commodities and black color line indicates the trend line of all commodities. Prices of all commodities started are lowest value 117.5, January, 2008. After that, it crossed the trend line and its fluctuation was cyclical from January, 2008 to December, 2009. While the trends of all commodities increased and it showed a flatter line.

Statistical Significance of Trends of all Commodites

The regression analysis is based on secondary data taken by MOSPI. There are 24 observations in analysis. Study time period is from 2008-M,1- to 2009-M,12. Monthly data on the base of the wholesale price index has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and all commodities are dependent variables.

The model can be written as a functional form as:

$$ALLCOMMO = f(T)$$

ALLCOMMO = All Commodities of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = all commodities of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

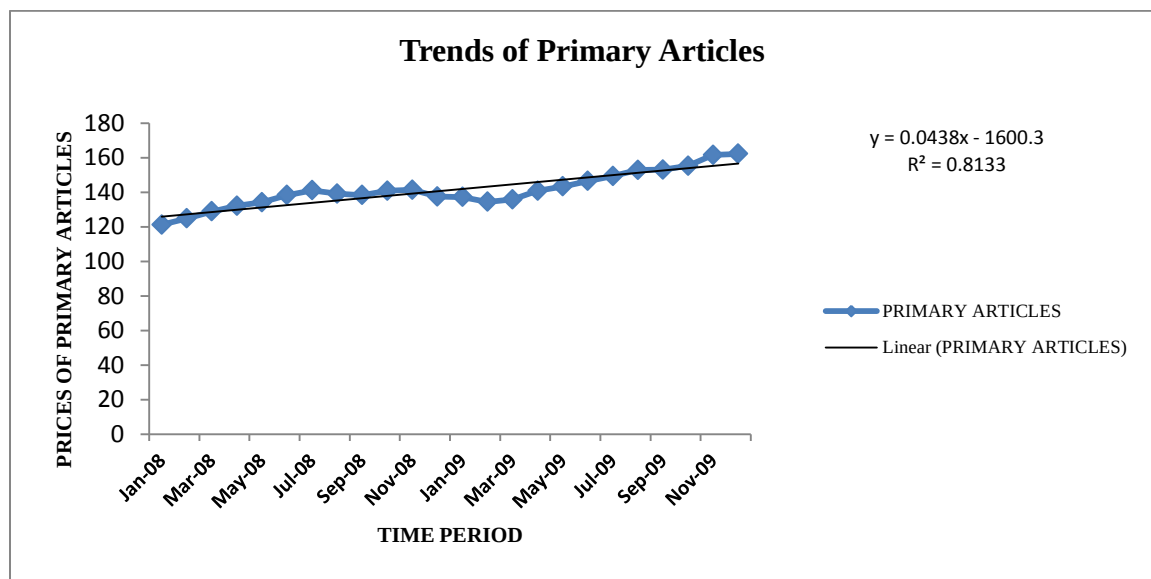
$$\text{All Commodities} = .0014103 + 2.083868_{\text{time}} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect of one unit change in all commodities of (WPI). Therefore, in duration-recession period, trends of all commodities of wholesale price index are positively associated with time. In other words, trends of all commodities and prices are increased of same direction with time.

Analysis of Regression coefficient: The coefficient value is (.0014103), Standard. Error. (.0002844). t-stat (4.96) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of all commodities in duration of recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 4.96$) therefore null hypothesis is rejected at the 1% level of significance and it concludes there is a positive relationship between the trends of all commodities (WPI) with recession time.

Figure 3.7.6: Trends of Wholesale Price Index-Primary Articles



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, GOI

The line chart 3.7.6 illustrates the trends of primary in the recession period (2008-09). Y-axis indicates the prices of primary articles and X-axis indicates time. Blue color line shows the prices of primary articles and black color line indicates the trend line of all primary articles. Prices of primary articles were upward and during the entire period, it touched the trend line from January, 2008 to December, 2009. The prices of primary articles increased but the trend line became flatter.

Statistical Significance of Trends of the Primary Articles

This regression analysis is based on secondary data taken by MOSPI. There are 24 observations for analysis. Study time period is 2008 to 2009 based on the monthly data of WPI. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and primary articles are the dependent variable.

The model can be written as a functional form as follows:

$$P. A. = f(T)$$

P. A. = Primary Articles of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

Y = primary articles on wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

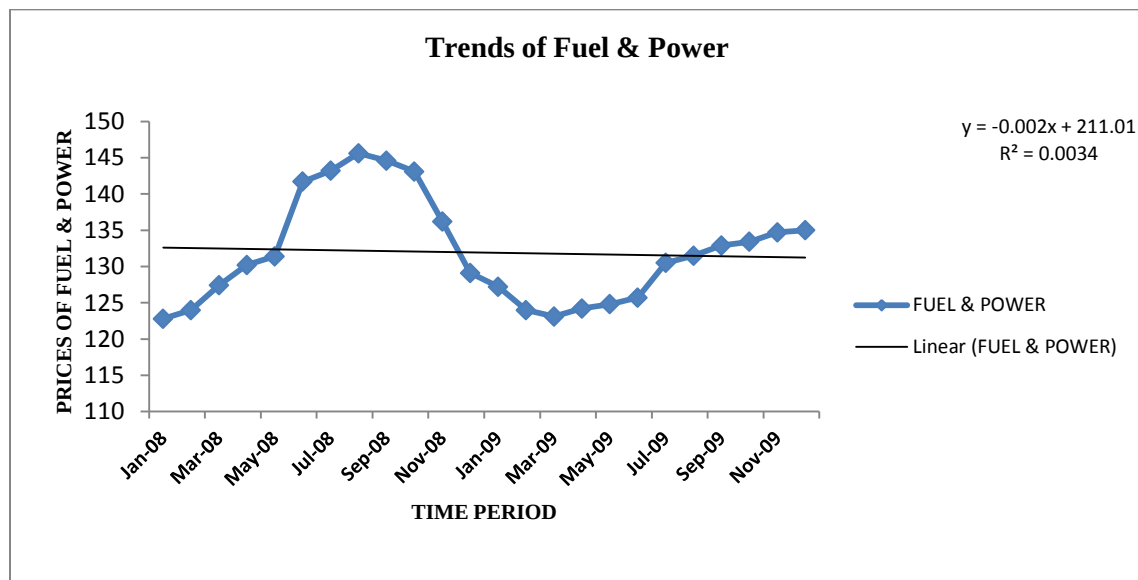
$$\text{Primary Articles} = .0040752 + 2.097934_{\text{time}} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect the one unit change in primary articles of (WPI). Therefore, in duration-recession period, trends of primary articles (wholesale Price Index) are positively associated with time. In other words, trends of primary articles and prices are increasing in the same direction with recession time.

Analysis of Regression Coefficient: The coefficient value is (.0040752), Standard. Error. (.0004146). t-stat (9.83) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are decreasing trends of all primary articles in duration of recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 9.83$) therefore null hypothesis is rejected at the 1% level of significance. There is a positive relationship between the trends of primary articles (WPI) with recession time.

Figure 3.7.7: Trends of Wholesale Price Index –Fuel and Power



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, GOI.

The line chart 3.7.7 illustrates the trends of fuel and power in the recession period (2008-09). Y-axis indicates the prices of primary articles and X-axis indicates time. Blue color line shows the prices of fuel and power and black color line indicates the trend line of all fuel and power. Prices of fuel and power starts the lowest value of 122.8 in January, 2008 and its highest peak point was in August in 2008 with the value of 145.6. After that, it crossed trend line and its fluctuation in cyclical from January, 2008 to December, 2009. While the trends of fuel and power shows side trend (horizontal line).On the other hand, the trends of fuel and power were found to be flatter.

Statistical Significance of Trends of Fuel and Power

The regression analysis is based on secondary data taken by MOSPI with 24 observations for analysis. Study time period is from 2008 to 2009 based on the monthly data of WPI. There are two variables in this analysis dependent variable and independent variable, time is independent variable and fuel and power are the dependent variable.

In the ongoing, the model can be written as a functional form as follows:

$$F. P. = f(T)$$

F. P. = Fuel and Power of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (u_i), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = fuel and power of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation.

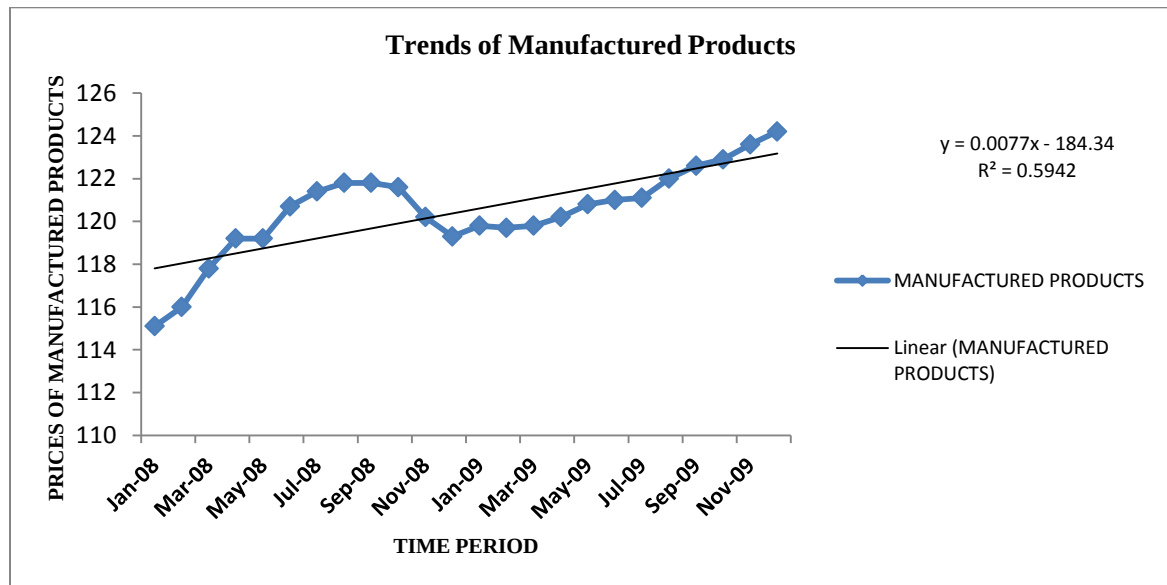
$$\text{Fuel \& Power} = 2.121729 + -.0001612_{\text{time}} + \varepsilon_t$$

According to the statistical model, one unit change in time will affect one unit change in fuel and power (WPI). Therefore, in duration-recession period, trends of fuel and power of wholesale price index are negative associated with time. In other words trends of fuel and power and prices are increasing in the opposite direction with time.

Analysis of Regression coefficient: The coefficient value is (2.121729), Standard. Error. (.0007148). t-stat (-0.23) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are increasing trends of fuel and power in duration of recession period and $H_0 \neq 0$. While the p value is more than t-stat but pvalue is significant at 1% level of significant which rejected null hypothesis at 1 percent level of significance and it concludes there is negative relationship between the trends of fuel and power (WPI) with recession time.

Figure 3.7.8: Trends of Wholesale Price Index- Manufactured Products



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, Government of India

This figure 3.7.8 shows the trends of manufactured products from 2008 to 2009 (duration recession period) in context of Indian economy. The Y axis represents the wholesale price index and x axis represents a time period. The blue line represents the prices of manufactured products and black line represents trends. This series shows the cyclical fluctuation prices of manufactured products. Lowest prices of manufactured were at 115.1 value in January, 2008 and it increased, crossed the trend line in April, 2008. It reached at peak 121.8 value in August, 2008. Then the prices of the manufactured products decreased and again crossed the trend line in November, 2008. After that the prices again increases from Jan, 2009 to December, 2009 and crossed trend line in September, 2009. On the other hand, trends of manufactured products were found to increase with an upward trend.

Statistical Significance of Trends of Manufacture Products

The regression analysis is based on secondary data taken by MOSPI. There are 24 observations for analysis. Study time period is 2008 to 2009 based on the monthly data of WPI. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and manufactured products is dependent variable.

The model can be written as a functional form as follows:

$$M. P. = f(T)$$

M. P. = Manufactured Products of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

Y = manufactured products on wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

$$\text{Manufactured products} = .0008443 + 2.070337_{\text{time}} + \epsilon_t$$

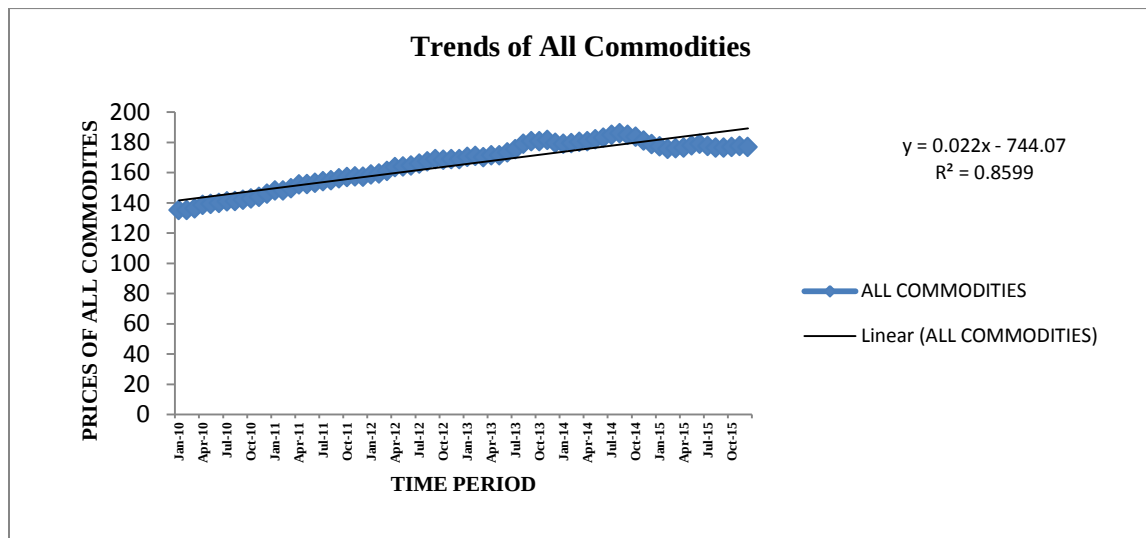
According to the statistical model, the one unit change in time will affect the one unit change in manufactured by (WPI). Therefore, in duration-recession period, trends of manufactured products (Wholesale Price Index) are positively associated with time. In other words, trends of manufactured products and prices are increasing in the same direction with recession time.

Analysis of Regression coefficient: The coefficient value is (.0008443), standard. Error (.0001494). t stat (5.65) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of manufactured in duration of recession period, and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 5.65$) therefore null hypothesis is rejected at the 1 percent level of significance. It concludes a positive relationship between the trends of manufactured products (WPI) with recession time.

❖ Post-recession Period

Figure 3.7.9: Trends of Wholesale Price Index-All Commodities



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, GOI.

The line chart 3.7.9 illustrates the trends of all commodities in the post-recession period (2008-09). Y-axis indicates the prices of all commodities and X-axis indicates time. Blue color line shows the prices of all commodities and black color line indicates the trend line of all commodities. Prices of all commodities touched the trend line from January, 2008 to June, 2015 after that it gradually decreased until December, 2015 with the value of 176.8. While the trends of all commodities increased with flatter line.

Statistical Significance of Trends of All Commodities

The regression analysis is based on secondary data which taken by MOSPI. There are 72 observations for analysis. Study time period is from 2010 to 2015. Monthly data based on

the WPI has been used. There are two variables in this analysis. Dependent variable and independent variable, time is independent variable and all commodities are dependent variable.

The model can be written as a functional form as:

$$\text{ALLCOMMO} = f(T)$$

ALLCOMMO = All Commodities of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = all commodities of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

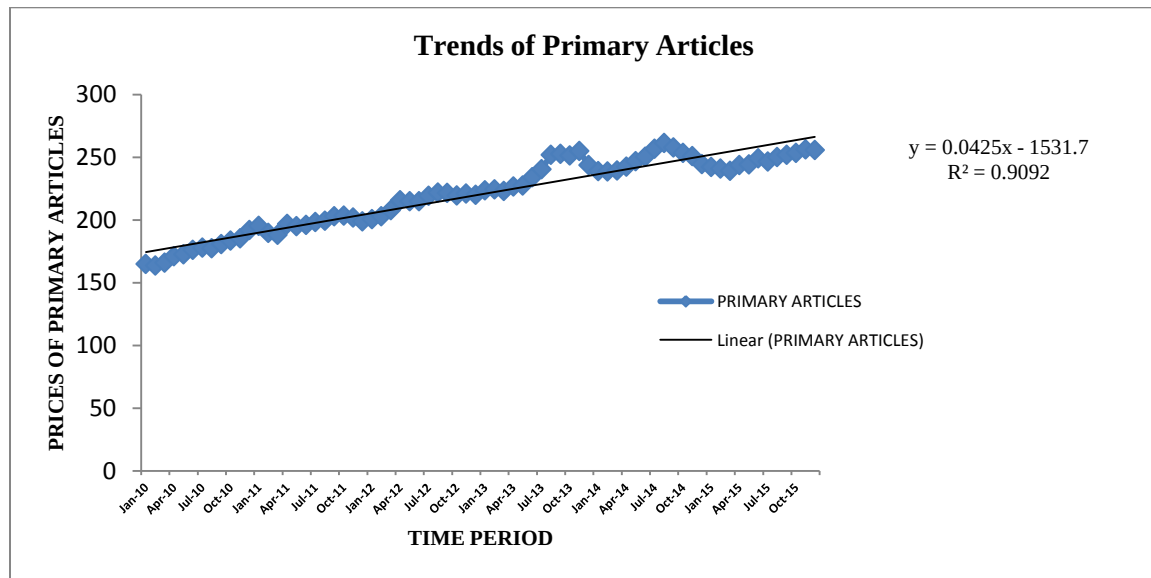
$$\text{All Commodities} = .0018114 + 2.150699 \text{ time} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect the one unit change in prices of all commodities (WPI). Therefore, in post-recession period, trends of all commodities (Wholesale Price Index) are positively associated with time. In other words trends of all commodities and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (.0018114), Standard. Error. (.0000896). t stat (20.21) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are decreasing trends of all commodities in post recession period and $H_0 \neq 0$. While the p value is less than tstat ($0.000 < 20.21$). Therefore, the null hypothesis is rejected at the 1% level of significance. it concludes there is a positive relationship between the trends of all commodities with the post-recession time.

Figure 3.7.10: Trends of Wholesale Price Index- Primary Articles



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, Government of India

The line chart 3.7.10 illustrates the trends of primary articles in the post-recession period (2008-09). Y-axis indicates the prices of primary articles and X-axis indicates time. Blue color line shows the prices of primary articles and black color line indicates the trend line of primary articles. Prices of primary articles touched and crossed the trend line from lowest value 164.9 January, 2010 to 255.6 December, 2015 but highest value (261.2) was in August, 2014. While the trends of all commodities increased with flatter line.

Statistical Significance of Trends of Primary Articles

The regression analysis is based on secondary data taken by MOSPI. 72 observations have been used for analysis. Study time period is from 2010 to 2015. It is based on monthly data on the of WPI. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and primary articles are dependent variable.

The model for the above can be written as a functional form as follows:

$$P. A. = f(T)$$

P. A. = Primary Articles of Wholesale Price Index

T = Time

f = functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (u_i), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

Y = primary articles on wholesale price index, α = intercept of y (constant coefficient),
 β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

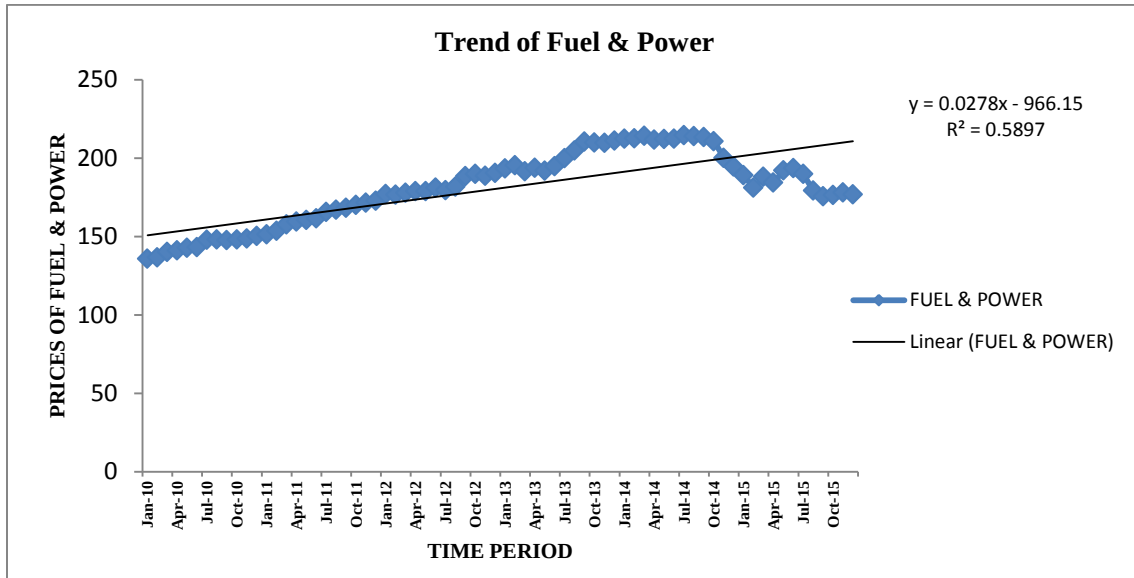
$$\text{Primary Articles} = .0026281 + 2.243395 \text{ time} + \varepsilon_t$$

According to the statistical model, the one unit change in time will affect the one unit change in primary articles of (WPI). Therefore, in post-recession period, trends of primary articles on wholesale price index are positively associated with time. In other words trends of primary articles and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (.0026281), Standard. Error. (.0001044). t stat (25.18) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of all primary articles in duration of recession period, and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 25.18$) therefore null hypothesis is rejected at the 1% level of significance. It indicates there is a positive relationship between the trends of primary articles with post-recession time.

Figure 3.7.11: Trends of Wholesale Price Index-Fuel and Power



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India

The line in chart 3.7.11 illustrates the trends of fuel and power in the post-recession period (2010-15). Y-axis indicates the prices of fuel and power and X-axis indicates time. Blue color line shows the prices of fuel and power and black color line indicates the trend line of fuel and power. Prices of fuel and power starts at the lowest value 135.8 in January, 2010. It crossed trend line in February, 2011, with the value (153.5), after that it continuously touched the trend line until March 2013, with the value 191.6. It again crossed trend line in downward way in September, 2014 with the value 213.4 and it was value 178.1 in December, 2015. While the trends of all commodities increased with flatter line.

Statistical Significance of the Trends of Fuel and Power

This regression analysis is based on secondary data taken by MOSPI. 72 observations are used for analysis. Study time period is from 2010 to 2015. It is based on monthly data of WPI. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and fuel and power is the dependent variable.

The model can be written as a functional form as follows:

$$F. P. = f(T)$$

$$F. P. = \text{Fuel and Power}$$

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = fuel and power of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

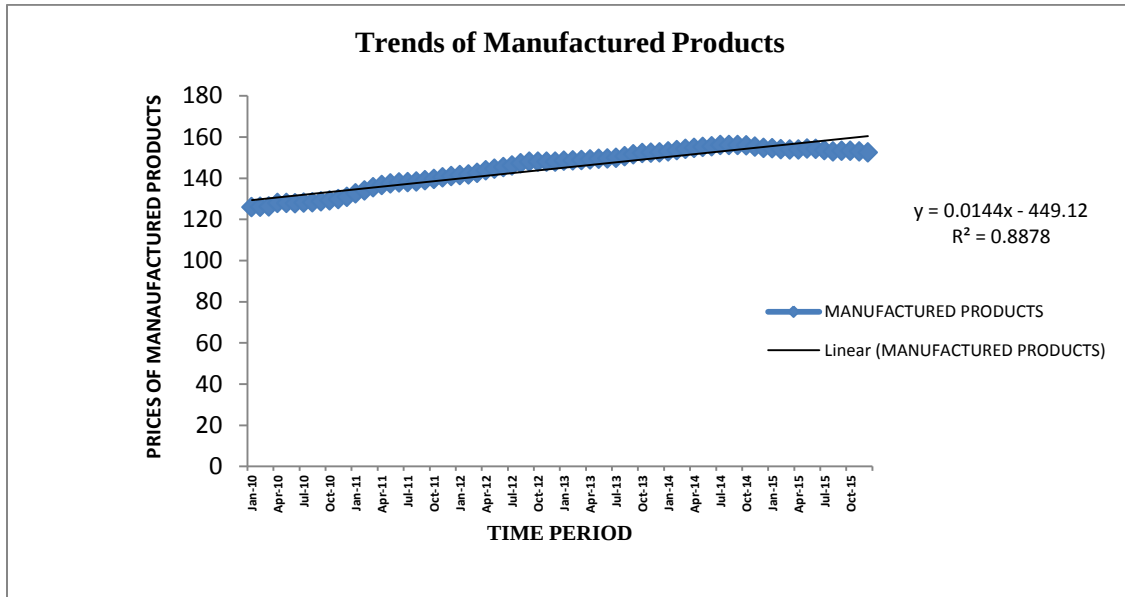
$$\text{Fuel \& Power} = .0021306 + 2.175606 \text{ time} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect the one unit change in fuel and power (WPI). Therefore, in post-recession period, trends of fuel and power (Wholesale Price Index) are positively associated with time. In other words trends of fuel and power and prices are increasing in the same direction with time

Analysis of Regression coefficient: The coefficient value is (.002306), standard. Error. (.0002036). t stat (10.46) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of fuel and power in the post recession period, and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 10.46$) therefore null hypothesis is rejected at the 1% level of significance. It concludes here is a positive relationship between the trends of fuel and power with post-recession time.

Figure 3.7.12: Trends of Wholesale Price Index- Manufactured Products



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India

The line in chart 3.7.12 illustrates the trends of manufactured products in the post-recession period (2010-15). Y-axis indicates the prices of manufactured products and X-axis indicates time. Blue color line shows the prices of manufactured products and black color line indicates the trend line of manufactured products. Prices of manufactured products start the lowest value of 125.9 in January 2010. It increased continuously with upward rate and touched the trend line from the period of January, 2010 to July 2015, with the value of 153.0 in December, 2015. The trends of manufactured products increased but with a flatter line over the same period. In this series, the interesting thing is that the prices of manufactured products and trend line moved together in the upward (slope) direction.

Statistical Significance of Trends of Manufactured Products

The regression analysis is based on secondary data take by MOSPI. There are 72 observations, used for analysis. The study time period is from 2010 to 2015. Monthly data of WPI is used. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and manufactured products is dependent variable.

The model can be written as a functional form as follows:

$$M. P. = f(T)$$

M. P. = Manufactured Products of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots \dots \dots \text{equation}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

Y = manufactured products on wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{Manufactured Products} = .0013397 + 2.111376 \text{ time} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect one unit change in manufacturing products of (WPI). Therefore, in post-recession period, trends of manufactured products (Wholesale Price Index) are positively associated with time. In other words trends of manufactured products and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (.0013397), Standard. Error. (.0000596). t stat (22.48) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of manufactured products in the post recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 22.48$) therefore null hypothesis is rejected at the 1% level of significance. It concludes there is a positive relationship between the trends of manufactured products with post-recession time.

3.8 Problems with the Wholesale Price Index

As common people do not purchase any commodities available at the wholesale prices; therefore, this index does not capture the real situation of the amount of pressure of increasing prices on the common people. They purchase all commodities at the retail prices on a daily basis. As discussed by *Srinivasan (2008)*, according to the National Statistical Commission (NSC, 2001), “*in many cases, they refer to prices at the level of farm gate, factory gate or mine head prices; and in many other cases, they refer to prices at the level of primary markets. There is Secondary market or other wholesale and retail market*”. However, the increase in wholesale price does affect the retail price and, hence, gives only some indication of the consumer prices.

In addition to the CPI, four Consumer Price indices are also officially published and these correspond to different segments of the population viz. Industrial workers (CPI-IW, base year 2001), agriculture, labor (CPI-AL, base year 1986-67) rural labor (CPI-RL, base year 1986-67) and urban non-manual employees (CPI-UNME, base year 2001). A nationwide measurement of CPI that combines rural and urban areas became available only from January, 2011, base year, 2010). The weights used for new CPI have been derived from the 61th (2004-05) Round of the *National Sample Surveys*. The officially published CPI-IW includes only six sub-indices which are: clothing, food, fuel, light, housing, tobacco, intoxicants and miscellaneous. CPI-AL and CPI-RL are published with only five sub-indices, and exclude housing. The commodities coverage for the latest CPI measures has been broadened and now includes 23 items. In addition to housing, six sub-categories of services have been included. The most important thing is that, CPI gives a much better weight to food compared to WPI (*Mishra and Roy, 2011, Pp.5-7*).

3.9 Consumer Price Index in India

The Consumer Price Index is a measure of change in retail prices of goods and services consumed by defining population group in a given area with reference to a base year. The Consumer Price Index measures changes only in one of the factors prices.

This basket of goods and services represents the level of living or the utility derived by the consumer at given levels of their income, prices and tests. This index is an important economic indicator. It is widely considered as a barometer of inflation, a tool for monitoring price stability and as a deflector in national accounts.

The Consumer Price Index is used as a measure of inflation in around 157 countries. The dearness allowance of government employees and wage contracts between labor and employers is based on this index. The formula for calculating consumer price index is Laspeyers with base year 2010.

It is calculated by the Central Statistics Office (CSO) in the Ministry of Statistics and Program Implementation (MOSPI). It is brought out on a monthly basis for urban, rural and all India and also annually with a lag of one month. State /UTs response CPI is also released if they provide 80 percent of the required data.

CPI is calculated by collecting the retail cost of represent a time products or services from the following categories for non-manual employees.

- ❖ Food
- ❖ Fuel and light
- ❖ Clothing, bedding and footwear and
- ❖ Miscellaneous.

Table 3.9.1: All India Subgroup/group-wise of Consumer Price Index (Rural) and (Urban) and Consumer Price Index (Combined)

Group Code	Subgroup Code	Description	Rural	Urban	Combined
	1.1.01	Cereals and products	12.35	6.59	9.67
	1.1.02	Meat and fish	4.38	2.73	3.61
	1.1.03	Egg	0.49	0.36	0.43
	1.1.04	Mills' products	7.72	5.33	6.61
	1.1.05	Oils and fats	4.21	2.81	3.56
	1.1.06	Fruits	2.88	2.90	2.89
	1.1.07	Vegetables.	47.46	4.41	6.04

	1.1.08	Pulses and products	2.95	1.73	2.38
	1.1.09	. Sugar and confectionery	1.70	0.97	1.36
	1.1.10	Spices	3.11	1.79	2.50
	1.1.11	Non-alcoholic beverages	1.37	1.13	1.26
	1.1.12	Prepared meals, snacks, sweets etc.	5.56	5.54	5.55
1		Food and beverages	54.18	36.29	45.86
2		Pan, tobacco and intoxicants	3.26	1.36	2.38
	3.1.01	Clothing	6.32	4.72	
	3.1.02	Footwear	1.04	0.85	5.58
3		Clothing and footwear	7.36	5.57	0.95
4		Housing	----	26.67	10.17
5		Fuel and light	7.94	5.58	6.84
	6.1.01	Household goods and services	3.75	3.87	3.80
	6.1.02	Health	6.83	4.81	5.89
	6.1.03	Transports, communication	7.60	9.73	8.59
	6.1.04	Recreation and amusement	1.37	2.04	1.68
	6.1.05	Education	3.46	5.62	4.46
	6.1.06	Personal care s effects	4.25	3.47	3.89
6		Miscellaneous	27.26	29.53	28.32
		All Groups	100.00	100.00	100.00

Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, the GOI

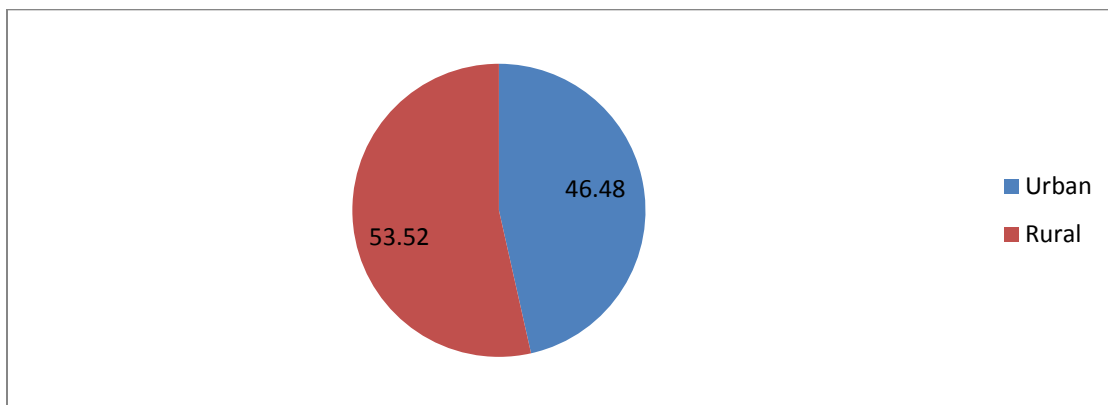
Table 3.9.2: Comparison Weighting Diagrams between of Old and Revised Series of Consumer Price Index.

Group Description	Old Series of (Weights Computed on the Basis CES (2004-05))			Revised Series of CPI Weights Computed On the Basis CES (2011-12)		
	Rural	Urban	Combined	Rural	Urban	Combined
Food and Beverages	56.59	35.81	47.58	54.18	36.29	45.86
Pan, Tobaccos Intoxicants	2.72	1.34	2.13	3.26	1.36	2.38
Clothing and Footwear	5.36	3.91	4.73	7.36	5.56	6.53
Housing	-----	22.54	9.77	----	21.67	10.07
Fuel and Light	10.42	8.40	9.49	7.94	5.58	6.84
Miscellaneous	24.91	28.00	26.31	27.26	29.53	28.32
Total	100.00	100.00	100.00	100.00	100.00	100.00

Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, GOI

The weightage of CPI has been divided in two main categories rural and urban in India. This has been represented by pie chart.

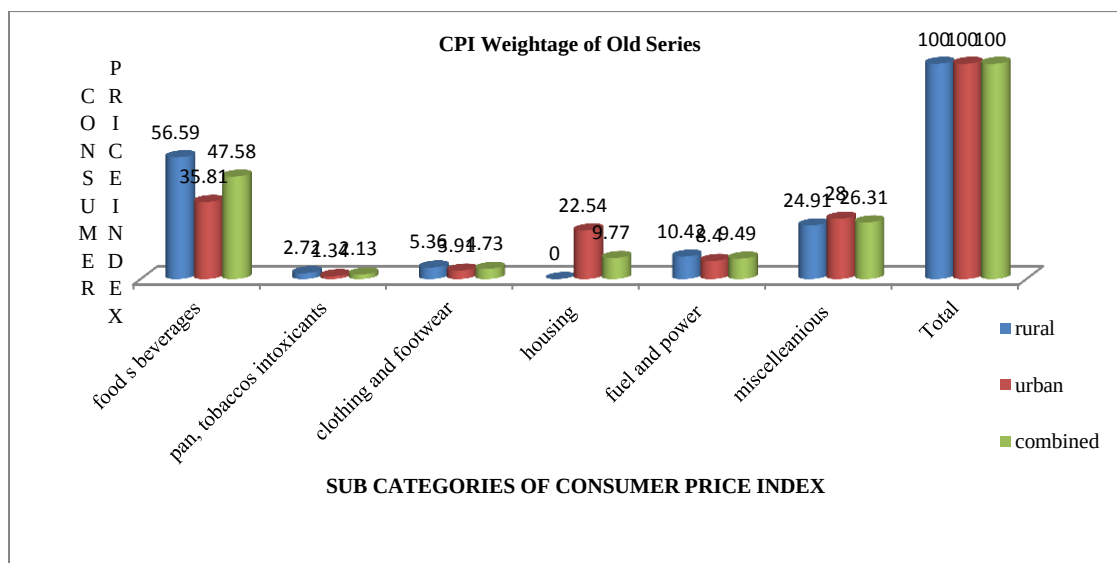
Figure 3.10: All India Weightage of CPI for Rural and Urban



Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, GOI

The figure 3.10 shows the weightage of rural area and urban area. Red color represents the rural area which has been given the weightage of (54 percent) and blue color represents the urban area, which have been given the weightage of (46 percent).

Figure 3.10.1: Consumer Price Index Weightage of Old Series



Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, the GOI.

The figure 3.10.1 shows the weightage of CPI in the old series. The consumer price index has been divided into three broad categories. According to area, population and group-wise such as rural area, urban area and combined. Then, after that all individual series have been divided into six subcategories of CPI. These categories are: Food and beverages, pan tobacco intoxicants, clothing and footwear, housing, food and light and miscellaneous.

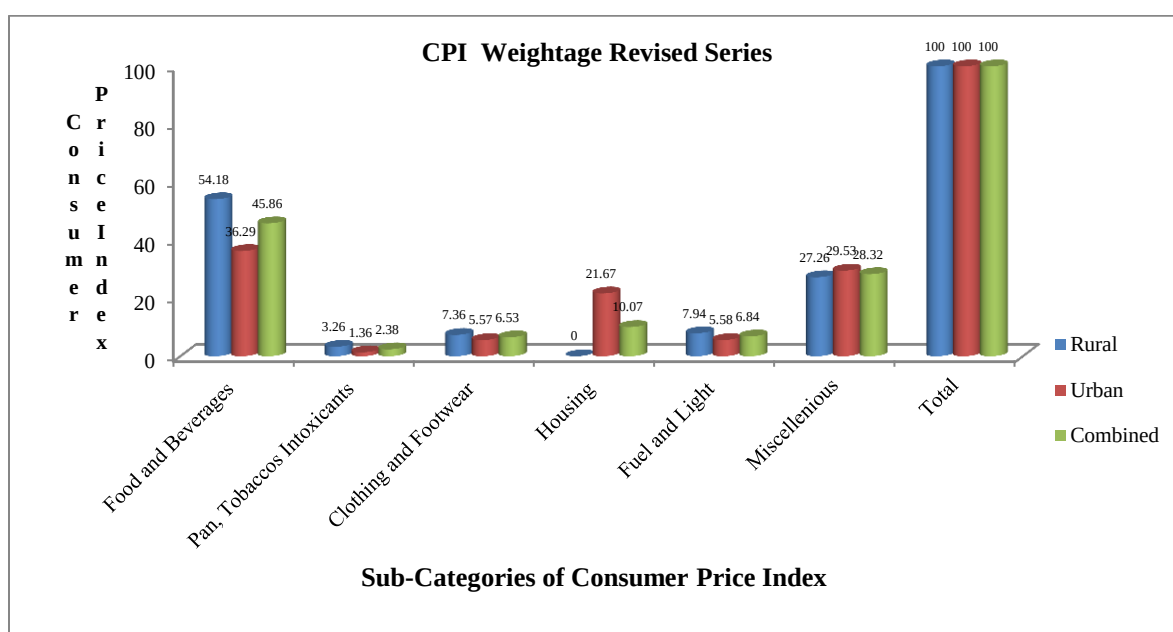
The Consumer Price Index in the rural area has been given the weightage of 100 percent. Divisions are: 56.59 percent weightage for food and beverages, 2.72 percent weighted for pan, tobacco intoxicants, and 5.36 percent weightage for clothing and footwear, 10.42 percent weightage for fuel and light, and 24.91 percent weightage for miscellaneous group. However, there is no weightage for housing in the rural area.

The Consumer Price Index in the urban area has a total weight of 100 percent. Divisions being: 35.81 percent weightage for food and beverages, 1.34 percent weighted for pan,

tobacco intoxicants, 3.97 percent weighted for clothing and footwear, 22.54 percent weightage for housing, 8.40 percent weightage for fuel and light and 28.00 percent weightage for miscellaneous group.

The Consumer Price Index of the combined zone of both rural and urban areas has the total weightage of 100 percent. Divisions are: 47.58 percent weightage for food and beverages, 2.13 percent weighted for pan, tobacco intoxicants, 4.73 percent weighted for clothing and footwear, 9.77 percent weightage for housing, 9.49 percent weightage for fuel and light, and 26.31 percent weightage for miscellaneous group.

Figure 3.10.2: Consumer Price Index Weightages for Revised Series



Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, GOI

The figure 3.10.2 shows the weightage of Consumer Price Index in revised series. The consumer price index has been divided into three broad categories. According to area, population and group-wise such as rural area, urban area and combined. Thereafter, all individual series have been divided into six subcategories of consumer price index. These categories are: Food and beverages, pan tobacco intoxicants, clothing and footwear, housing, food and light and miscellaneous.

The Consumer Price Index has been given the total weightage of 100 percent in the rural area. Divisions are: 54.18 percent for food, beverages, 3.26 percent weighted for pan, tobacco intoxicants, 7.36 percent weight for clothing and footwear, 7.94 percent weightage for fuel and light and 27.26 percent weightage for miscellaneous group. There is no weightage for housing in the rural area.

The Consumer Price Index in the urban area has a total weightage of 100 percent. Divisions are: 36.29 percent for food and beverages, 1.36 percent weight for pan, tobacco intoxicants, 5.56 percent weight for clothing and footwear, 21.67 percent for housing, 5.58 percent weightage for fuel and light and 29.53 percent weightage for miscellaneous group.

The Consumer Price Index for the combined zone of rural and urban areas has a total weightage of 100 percent. Divisions being: 45.86 percent weightage for food and beverages, 2.38 percent weighted for pan, tobacco intoxicants, 6.53 percent weighted for clothing and footwear, 10.07 percent weightage for housing, 6.84 percent weightage for fuel and light and 28.32 percent weightage for miscellaneous group.

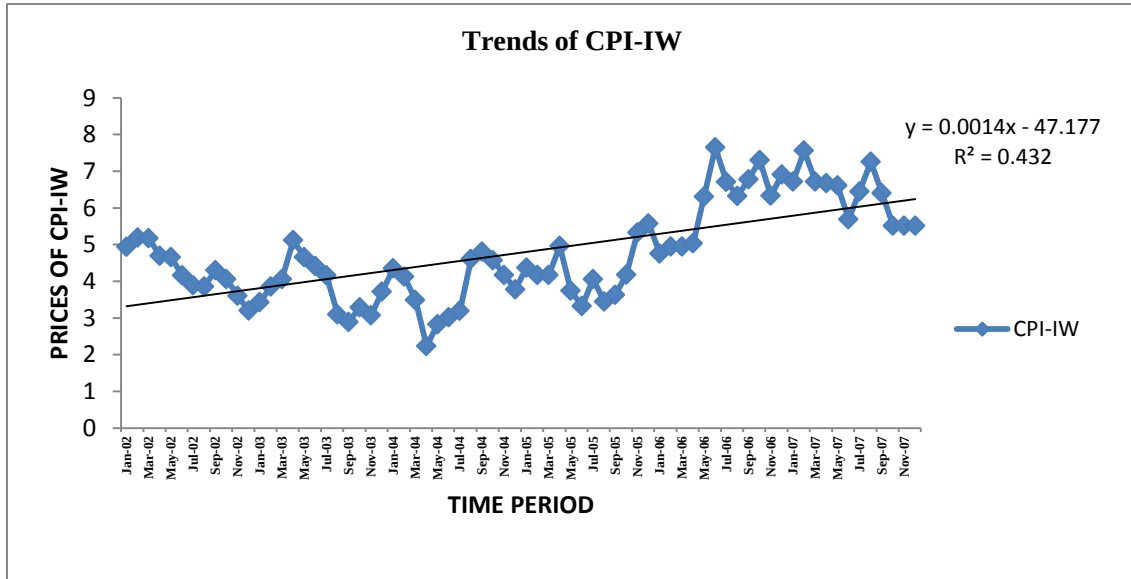
CPI is a measure of the cost of living of a person in an economy based upon the citizens' socioeconomic strata. An agricultural labor will have different requirements and weights compared to an industrial labor (http://mospi.nic.in/Mospi_New/up).

The origin of Consumer Price Index can be traced to the period after the First World War, when there was a sharp rise in prices and the cost of living. The erosion in the real wages of the workers led to demands by the workers' compensation.

3.11 Trends of Consumer Price Index in All Categories

Pre-Recession Period

Figure 3.11.1: Trends of Consumer Price Index- Industrial Worker



Sources: Labor of Statistics Bureau, Ministry of labour welfare, the Government of India

The line in chart 3.11.1 illustrates the trends of Consumer Price Index-Industrial Worker in (2002-08) pre- recession period. Y-axis represents the prices of CPI-IW and x-axis represents the time period. Blue color line shows the prices of CPI-IW and black color line shows the trend line of CPI-IW. Prices of CPI-IW starts 4.94 percent in January, 2002 and touched the trend line at 3.89 percent in July 2002. After that it continuously fluctuated and touched the trend line in Dec, 2002, with 3.2 percent till 2006. From May, at 4.95 percent, it decreased continuously. After that, it fluctuated upwards till 2006. Then in May it was 6.31 percent which remained till September, 2007 with the 6.4 percent. The trends of CPI-IW gradually increased with flatter shape in the pre-recession period. ``

Statistical Significance of the Trends of Industrial Worker (CPI)

The regression analysis is based on secondary data taken from the Labor Bureau Statistics, there are 72 observations for analysis. The study time period is from 2002 to 2007. The monthly data on CPI has been used. There are two variables in this analysis,

dependent variable and independent variable, time is independent variable and CPI-IW is a dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-IW} = f(T)$$

CPI-IW = Consumer Price Index in Industrial Worker

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-IW, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-IW} = 3.275012 + .0412554_{\text{time}} + \epsilon_t$$

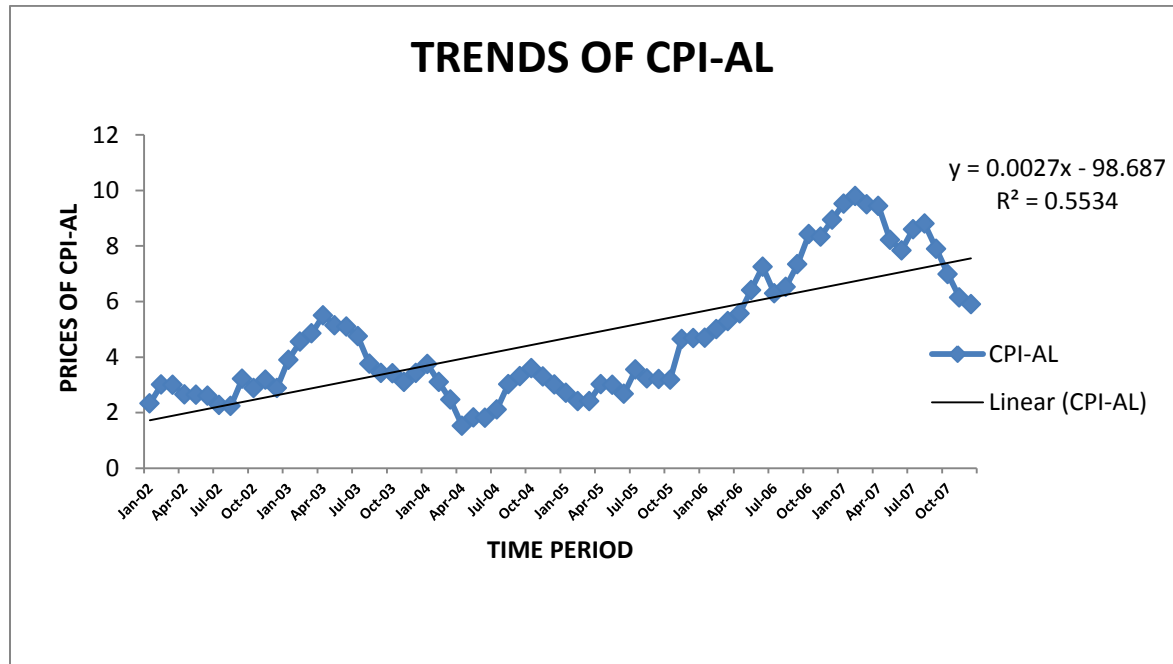
According to the statistical model, the one unit change in time will affect one unit change in the consumer price index in industrial worker of (CPI-IW). as noted in the model, the coefficient value is positive, therefore, in pre-recession period, trends of CPI-IW is positively associated with time. In other words, trends of CPI-IW decreases as the prices increase in same direction with time.

Analysis of Regression coefficient: The coefficient value is (3.275012), Standard Error (.0056526), t-stat (7.30) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-IW in Pre recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 7.30$) therefore null hypothesis is rejected at the 1% level

of significance. it concludes there are positive relationship between the trends of CPI-IW with pre-recession time.

Figure 3.11.2: Trends of Consumer Price Index-Agricultural Laborer



Sources: Labor Statistics Bureau, Ministry of labour welfare, the Government of India.

The line in chart 3.11.2 illustrates the trends of *Consumer Price Index- Agriculture Laborer* in (2002-08) pre- recession period. Y-axis represents the prices of CPI-AL and x-axis represents the time period. Blue color line shows the prices of CPI-AL and black color line shows the trend line of CPI-AL. Prices of CPI-AL starts at 2.33 percent in January, 2002 and after that it touched the trend line at 2.27 percent in August 2002, which is lowest of this series and it was highest at 9.52 percent in January, 2007. It created the cyclical fluctuations over the series or period from 2002, January to 2007, December. The trends of CPI-AL increased in the pre-recession period.

Statistical Significance of the Trends of Agriculture Laborer (CPI)

The regression analysis is based on secondary data taken from the Labor Bureau Statistics. There are 72 observations used for analysis. The study time period is from 2002 to 2007. Monthly data based on CPI has been used. There are two variables in this

analysis, dependent variable and independent variable, time is independent variable and CPI-AL is a dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-AL} = f(T)$$

CPI-AL = Consumer Price Index in Agriculture Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ui), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = CPI-AL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-AL} = 1.646483 + .0820522_{\text{time}} + \varepsilon_t$$

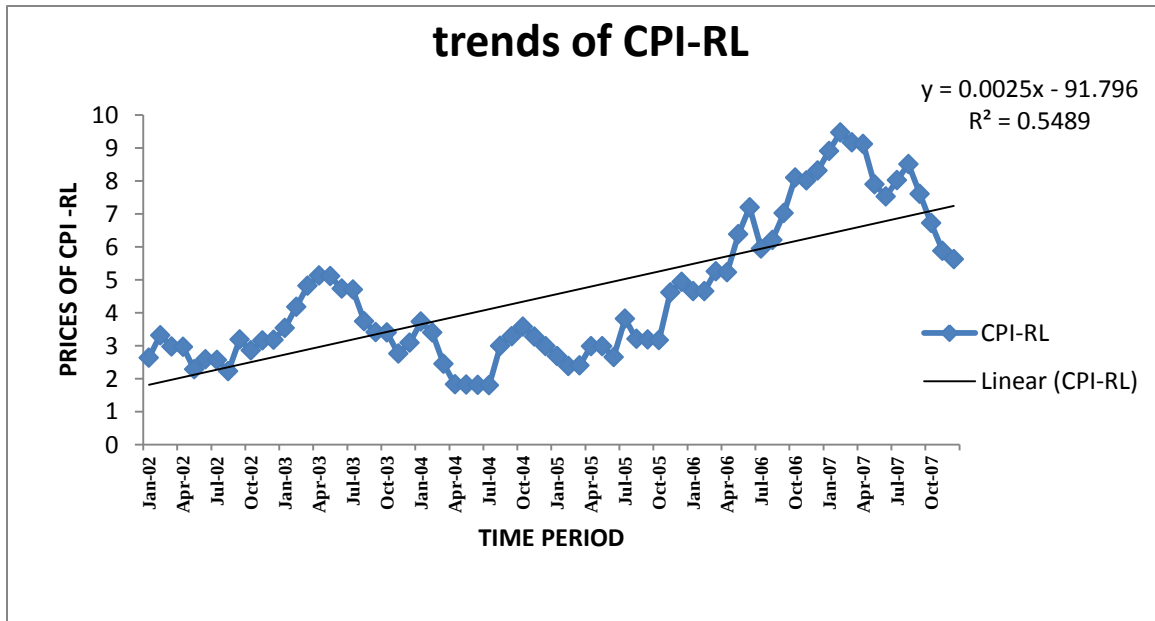
According to the statistical model, one unit change in time will affect one unit change in agricultural laborer of the consumer price index (CPI-AL). Therefore, in pre-recession period, trends of agricultural laborer in the consumer price index is positively associated with time. In other words, trends of agriculture laborer and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (1.646483), Standard Error (.0088053), t stat (9.32) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-AL in pre-recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 9.32$) therefore null hypothesis is rejected at the 1% level

of significance. it concludes there is a positive relationship between the trends of the consumer price index- agricultural laborer (CPI-AL) with pre-recession time.

Figure 3.11.3: Trends of Consumer Price Index-Rural Laborer



Source: Labor of Statistics Bureau, Ministry of labour and employment, the Government of India

The line in chart 3.11.3 illustrates the trends of **Consumer Price Index-Rural Laborer** in (2002-08) pre- recession period. Y-axis represents the prices of CPI-RL and x-axis represents the time period. Blue color line shows the prices of CPI-RL and black color line shows the trend line of CPI-RL. Prices of CPI-RL started at the value of (2.64) in January, 2002 after that it touched the trend line in May, 2002 with 2.29 percent. Further, it again crossed the trend line in September 2003 with 3.41 percent. After that it was continuously below the trend line until April, 2006. It crossed the trend line in upward way in August, 2006 with 6.21 percent. After that, it continuously increased till September, 2007 with 7.61 percent and it ended in December, 2007 with 5.63. The trends of CPI-RL increased with high rate.

Statistical Significance of Trends of Rural Labourer (CPI)

The regression analysis is based on secondary data which taken from labor bureau statistics. There are 72 observations used for analysis. The study time period is from 2002

to 2007. Monthly data on consumer price index has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and CPI-RL is dependent variable.

The model can be written as a functional form:

$$\text{CPI-RL} = f(T)$$

CPI-RL = Consumer Price Index in Rural Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-RL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-RL} = 1.73723 + .0764914_{\text{time}} + \epsilon_t$$

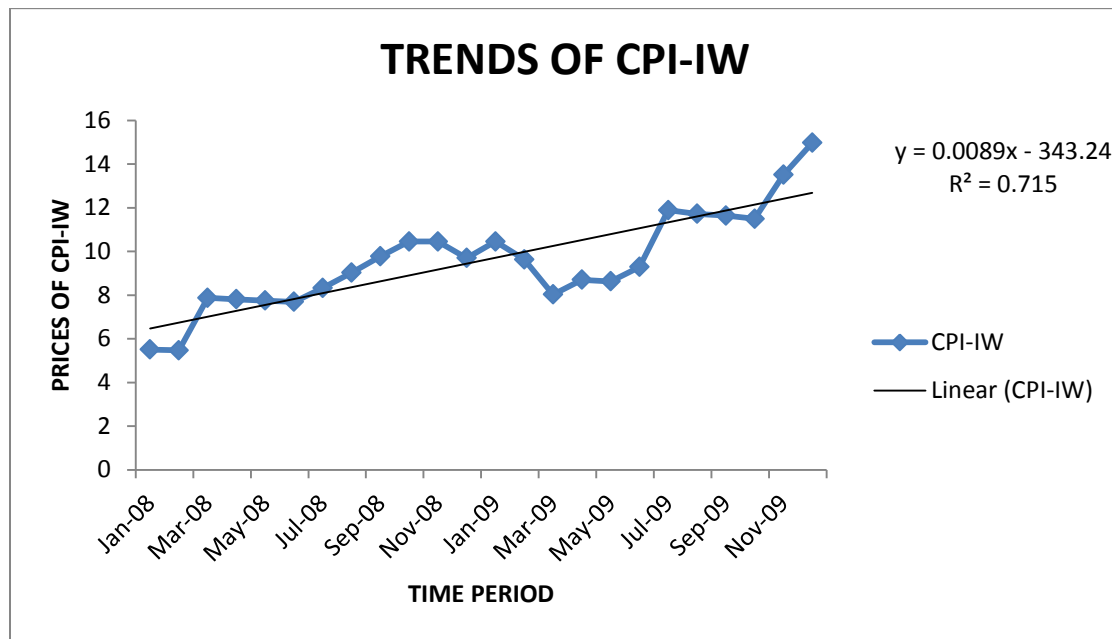
According to the statistical model, one unit change in time will affect one unit change in the consumer price index in rural laborer (CPI-RL). Therefore, in the pre-recession period, trends of manufactured products (Wholesale Price Index) are positively associated with time. In other words, trends of CPI-RL and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (1.73723), Standard Error (.0082831), t- stat (9.23) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-RL in Pre-Recession period, and $H_0 \neq 0$. In this statistical analysis the p value is less than tstat ($0.000 < 9.23$) therefore null hypothesis is rejected at the 1% level of significance. it concludes there is a positive relationship between the trends of CPI-RL with pre-recession time.

❖ Duration-recession Period

Figure 3.11.4: Trends of Consumer Price Index-Industrial Worker



Sources: Labor of Statistics Bureau, Ministry of Labor and employment, Government of India

The line in chart 3.11.4 illustrates the trends of *Consumer Price Index-Industrial Worker* in (2008-09) the recession period. Y-axis represents the prices of CPI-IW and x-axis represents the time period. Blue color line shows the prices of CPI-AL and black color line shows the trend line of CPI-IW. Prices of CPI-IW started at the lowest of 5.51 percent in January, 2008. After that, it continuously increased and touched the trend line from March, 08 with 7.89 percent to November, 2009 at 13.51 percent. It was at its highest percent of 14.97 percent in December, 2009. While the trends of CPI-IW increased but flatter shape during the recession period.

Statistical Significance of Trends of Industrial Worker (CPI

The regression analysis is based on the secondary data taken from Labor Bureau Statistics. There are 24 observations for analysis. The study time period is from 2008 to

2009. It has used the monthly data of the consumer price index. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and CPI-IW is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-IW} = f(T)$$

CPI-IW = Consumer Price Index in Industrial Worker

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots \dots \dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-IW, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

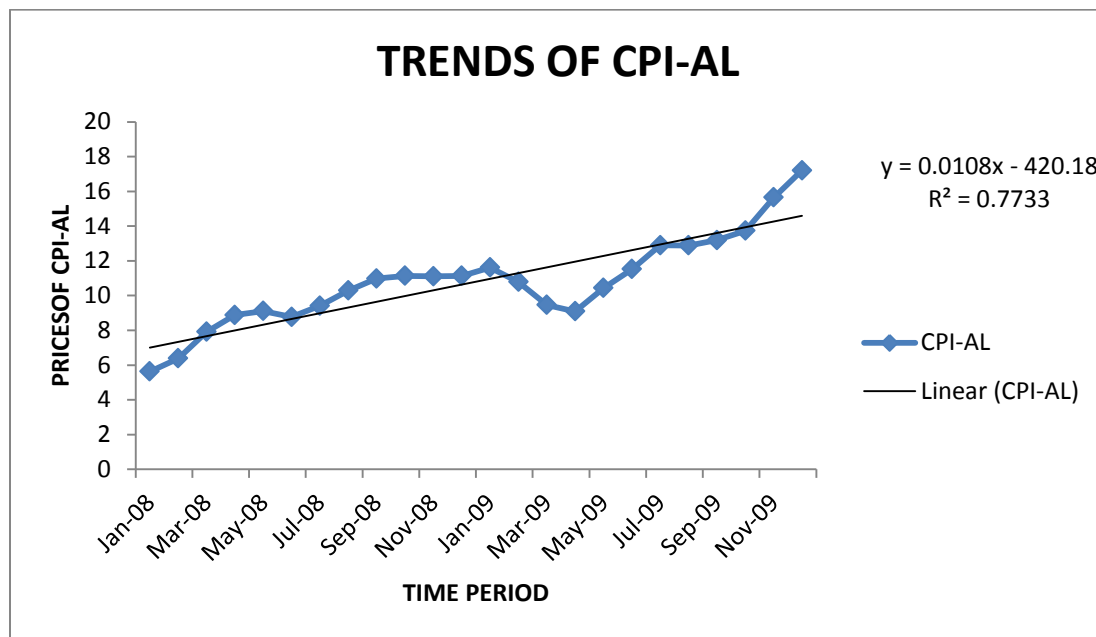
$$\text{CPI-IW} = 6.203043 + .2696565 \text{ time} + \epsilon_t$$

According to the statistical model, one unit change in time will affect of one unit change in the consumer price index in industrial worker (CPI-IW). Therefore, in duration-recession period, trends of industrial workers in the consumer price index are positively associated with time. In other words, the trends of CPI-IW and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (6.203043), Std. Err. (.0363774). t- stat (7.41) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-IW in Duration of Recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 7.41$) therefore null hypothesis is rejected at the 1% level of significance. It concludes there is a positive relationship between the trends of CPI-IW with time.

Figure 3.11.5: Trends of Consumer Price Index- Agriculture Laborer



Source: Labor of Statistics Bureau, Ministry of Labor and Employment, the Government of India.

The line in chart 3.11.5 illustrates the trends of consumer price index-agriculture laborer in (2008-09) the recession period. Y-axis represents the prices of CPI-AL and x-axis represents the time period. Blue color line shows the prices of CPI-AL and black color line shows the trend line of CPI-AL. Prices of CPI-AL starts the lowest percent of 5.63 in January, 2008. After that, the prices continuously increased and touched the trend line from March, 08 with 7.91 percent to, 2009 13.73 percent, with the highest percent of 17.21 in December, 2009. The trends of CPI-AL increased but with flatter shape during the recession period.

Statistical Significance of Trends of Agriculture Laborer (CPI)

The regression analysis is based on secondary data taken from Labor Bureau Statistics. There are 24 observations for analysis. The study time period is from 2008 to 2009 based

on monthly data of CPI. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and CPI-AL is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-AL} = f(T)$$

CPI-AL = Consumer Price Index in Agriculture Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ui), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = CPI-AL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-AL} = 6.683732 + .3294348_{\text{time}} + \varepsilon_t$$

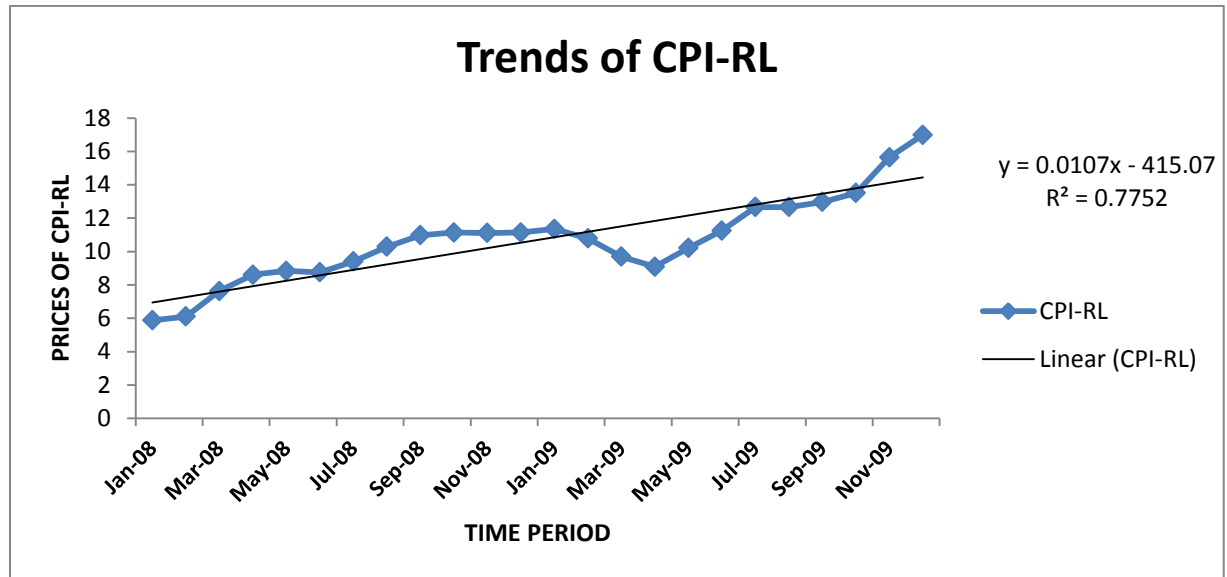
According to the statistical model, one unit change in time will affect the one unit change in the consumer price index in agriculture laborer (CPI-AL). Therefore, in duration-recession period, trends of agriculture laborer in the consumer price index are positively associated with time. In other words, trends of CPI-AL and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (6.683732), Standard Error (.0381137). t-stat (8.64) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-AL in Pre-Recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 8.64$) therefore null hypothesis is rejected at the 1% level

of significance. It concludes there is a positive relationship between the trends of CPI-AL with recession time.

Figure 3.11.6: Trends of The Consumer Price Index- Rural Laborer



Sources: Labor of Statistics Bureau, Ministry of Labor and Employment, Government of India

The line in chart 3.11.6 illustrates the trends of *Consumer Price Index-Rural Laborer* in (2008-09) the recession period. Y-axis represents the prices of CPI-RL and x-axis represents the time period. Blue color line shows the prices of CPI-RL and black color line shows the trend line of CPI-RL. Prices of CPI-RL start the value of 5.88 percent in January, 2002. Thereafter, there was a continuous increased of prices and which touched the trend line over the time period from January, 2002 to December, 2007. However, prices of CPI-RL were below the trend line from 10.79 percent in February, 2009 to 12.67 percent in July, 2009. The highest price of CPI-RL was 16.99 percent in December 2009. While the trends of CPI-RL also increased with high rate.

Statistical Significance of Trends of Rural Laborer (CPI)

The regression analysis is based on secondary data taken from labor bureau statistics. There are 24 observations for analysis. The study time period is from 2008 to 2009. The monthly data of the CPI has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and CPI-RL is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-RL} = f(T)$$

CPI-RL = Consumer Price Index in Rural Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ui), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = CPI-RL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-RL} = 6.629457 + .3254435_{\text{time}} + \varepsilon_t$$

According to the statistical model, one unit change in time will affect one unit change in the consumer price index in rural laborer (CPI-RL). Therefore, in duration-recession period, trends of the rural laborer in the consumer price index are positively associated with time. In other words, trends of CPI-RL and prices increase in the same direction with time.

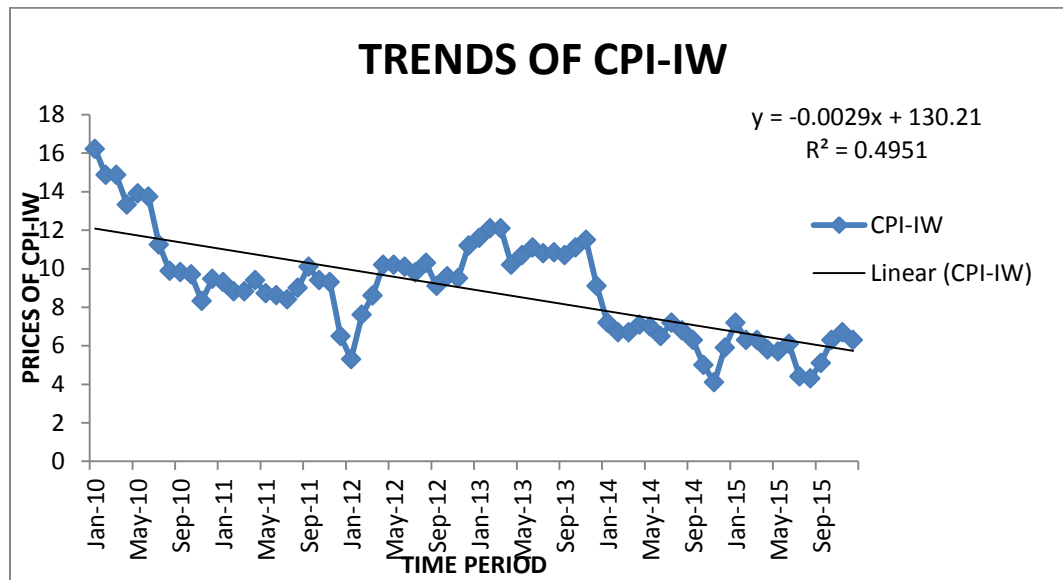
Analysis of Regression coefficient: The coefficient value is (6.629457), Standard Error (.037456), t-stat (8.69) and p value (0.000).

Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$. The null hypotheses (H_0) of this study, there are decreasing trends of CPI-RL in Duration of Recession period, and $H_0 \neq 0$. In this statistical analysis the p value is less than tstat (0.000 < 8.69) therefore null hypothesis is

rejected at the 1% level of significance. There is a positive relationship between the trends of CPI-AL with time.

❖ Post-recession Period

Figure 3.11.7: Trends of Consumer Price Index- Industrial Worker



Sources: Labor of Statistics Bureau, Ministry of Labor and Employment, Government of India

The line in chart 3.11.7 illustrates the trends of consumer price index-industrial worker in (2010 - 2015) post- recession period. Y- axis represents the prices of CPI-IW and X-axis represents the time period. Blue color line shows the prices of CPI-IW and black color line shows the trend line of CPI-IW. Prices of CPI-IW starts the highest percent of 16.22 in January 2010. It crossed the trend line with 11.25 percent in July, 2010. It further decreased till March, 2012 at 8.6 percent. After that it crossed the trend line, upwardly, from April, 2011 (10.2) percent to December, 2013 (9.1) percent. After that it once again decreased from January, 2014 with (7.2) percent to September, 2015 with (5.1) percent and then touched the trend line with (6.7) in December, 2015 in the post-recession period. In other words, it has created cyclical fluctuations over the series. While the trend of CPI-IW decreased over the period with flatter line.

Statistical Significance of Trends of Industrial Worker (CPI)

The regression analysis is based on secondary data taken from labor bureau statistics. There are 72 observations for analysis. The study time period is from 2008 to 2009. It is

based on the monthly data of the CPI. There are two variables in this analysis dependent and independent, time is independent variable and CPI-IW is a dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-IW} = f(T)$$

CPI-IW = Consumer Price Index in Industrial Worker

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-IW, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

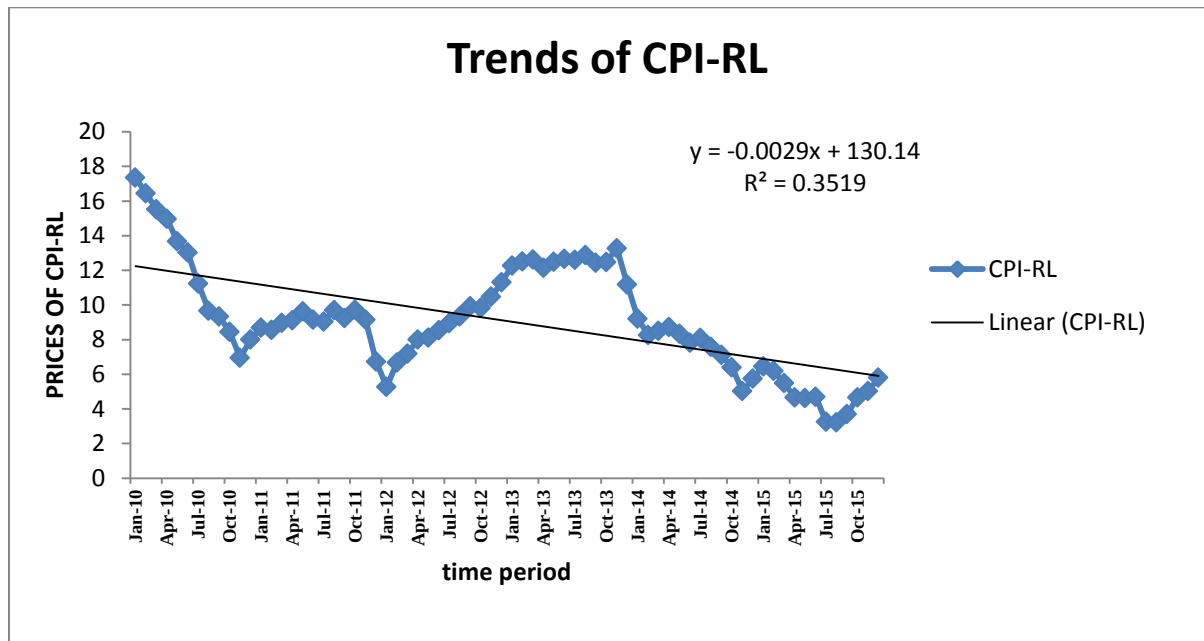
$$\text{CPI-IW} = 12.20091 + -.090166_{\text{time}} + \epsilon_t$$

According to the statistical model, the unit change in time will affect one unit change in the consumer price index in industrial worker (CPI-IW). but as noted in the model, coefficient value of time is negative. Hence, during the recession period, trends of industrial workers in the consumer price index are negatively associated with time. In other words, trends of CPI-IW and prices are increasing in the opposite direction with time.

Analysis of Regression coefficient: The coefficient value is (12.20091), Standard Error (.0110985), t-stat (-8.12) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are increasing trends of CPI-IW in Post-Recession period and $H_0 \neq 0$. While p value is more than t-stat but p value is significant at 1 % level of singificance ($0.000 > -8.12$) therefore null hypothesis is rejected at the 1% level of significance. it concludes there is a negative relationship between the trends of CPI-IW with post-recession time.

Figure 3.11.8: Trends of Consumer Price Index- Rural Laborer



Sources: Labor of Statistics Bureau, Ministry of Labor and Employment, the Government of India

The line chart 3.11.8 illustrates the trends of *Consumer Price Index-Rural Laborer* in (2010-15) post- recession period. Y-axis represents the prices of CPI-RL and X-axis represents the time period. Blue color line shows the prices of CPI-RL and black color line shows the trend line of CPI-RL. Prices of CPI-RL starts with the highest percent 17.35 in January, 2010 then it crossed the trend line in June, 2010 with 13.02 percent. After that it was below the trend line from July, 2010 with 11.24 percent until June, 2012 with 8.54 percent. Further, it again crossed trend line in upward way in September, 2012 with the 9.93 percent. Then again it crossed the trend line in March, 2014 with 8.51 percent. It was lowest in December, 2015 with 5.8 percent. While the trends of CPI-RL increased with high rate over the period.

Statistical Significance of Trends of Rural Laborer (CPI)

The regression analysis is based on secondary data taken from labor bureau statistics. There are 72 observations used for analysis. The study time period is from 2010 to 2015.

Monthly data on consumer price index has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and CPI-RL is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-RL} = f(T)$$

CPI-RL = Consumer Price Index in Rural Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-RL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

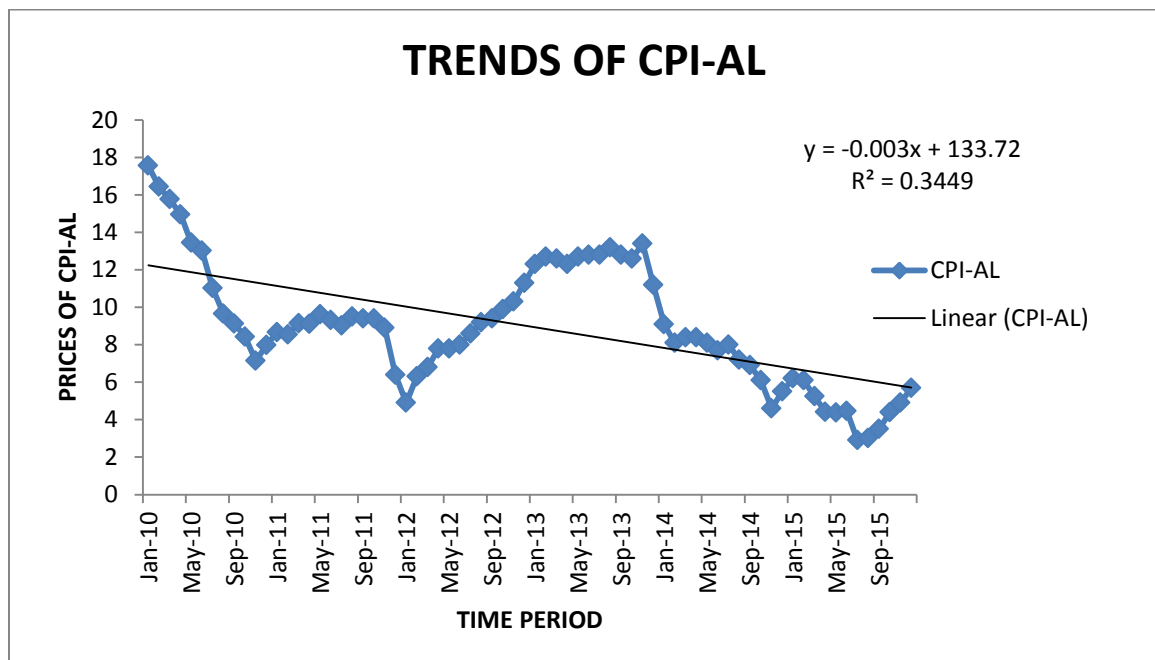
$$\text{CPI-RL} = 12.34111 + -.0891898_{\text{time}} + \epsilon_t$$

According to the statistical model, one unit change in time will affect of one unit change in the consumer price index in rural laborer (CPI-RL). Therefore, in post -recession period, trends of the rural laborer in the consumer price index is negatively associated with time. In other words, trends of CPI-RL and prices are increased opposite direction with time.

Analysis of Regression coefficient: The coefficient value is (12.34111), Standard Error (.0148973), t-stat (-5.99) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are increasing trends of CPI-RL in Post-Recession period and $H_0 \neq 0$. In this statistical analysis the p value is more than t-stat but p value is significant at 1 % level of significance ($0.000 > -5.99$). Therefore null hypothesis is rejected at the 1% level of significance and it concludes there is a negative relationship between the trends of CPI-RL with post-recession time.

Figure 3.11.9: Trends of Consumer Price Index- Agriculture Laborer



Sources: Labor of Statistics Bureau, Ministry of Labor and Employment, the Government of India

The line chart 3.11.9 illustrates the trends of *Consumer Price Index-Industrial Worker* in (2010-15) post- recession period. Y-axis represents the prices of CPI-AL and X-axis represents the time period. Blue color line shows the prices of CPI-AL and black color line shows the trend line of CPI-AL. Prices of CPI-AL starts the highest (17.59) percent in January, 2010. It crossed trend line in a decreasing pattern with (13.02) percent in June, 2010. The trend kept decreasing till July, 2012 when it registered (8.6) percent. After that, it crossed trend line in an upward pattern from September, 2012 at (9.4) percent till July, 2014 at (8) percent. After that, it once again decreased from Feb, 2015 with (6.1) percent to November, 2015 with (4.9) percent. It touched the trend line at (5.70) in December, 2015 in the post-recession period. While the trend of CPI-IW decreased over the period.

Statistical Significance of Trends of Agriculture Worker (CPI):

The regression analysis is based on secondary data taken from labor bureau statistics. There are 72 observations used for analysis. The study time period is from 2010 to 2015. Monthly data on the CPI has been used. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and CPI-AL is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-AL} = f(T)$$

CPI-AL = Consumer Price Index in Agriculture Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-AL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-AL} = 12.34012 + -.0920262 \text{ time} + \epsilon_t$$

According to the statistical model, one unit change in time will affect one unit change in the consumer price index in agriculture laborer (CPI-AL) but as noted in the model, coefficient value of time is negative. Hence, in duration-recession period, trends of agriculture laborer in the consumer price index is negatively associated with time. In

other words, trends of CPI-AL and prices are increasing in the opposite direction with time.

Analysis of Regression Coefficient: The coefficient value is (12.34012), Standard Error (.0155868), t-stat (-5.90) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of CPI-AL in Post Recession period, and $H_0 \neq 0$. While the p value is more than t-stat but p value significant at 1 % level of significance. Therefore null hypothesis is rejected at the 1% level of significance and it concludes there is a negative relationship between the trends of CPI-AL with post-recession time.

3.10 Concluding Facets

This chapter deals with only the trends of the *Wholesale Price Index* and the *Consumer Price index* with all categories in context of the Indian economy. Two hypotheses of this chapter were:

- Null hypothesis (H_0), Wholesale Price Index (WPI) has decreasing trend in the Pre - Recession period and increasing trend in the Recession and Post-Recession periods.
- **Alternative Hypothesis (H_a)**, Wholesale Price Index (WPI) has increasing trend in the Pre - Recession period and decreasing trend in the Recession & Post-Recession periods.
- **Second Null Hypothesis (H_0)**, Consumer Price Index (CPI) has increasing trend in all categories such as CPI-IW, CPI-AL, CPI-RL in Pre-Recession, duration of Recession and Post-Recession period.
- **Second Alternative Hypothesis (H_a)**, Consumer Price Index (CPI) has decreasing trend in all categories such as CPI-IW, CPI-AL and CPI-RL in Pre-Recession, during Recession and Post-Recession period.

The study's analysis showed that the *Wholesale Price Index in Pre-Recession* (2002 to 2007) period shows decreasing trend in all categories which include commodities, primary articles, fuel and power and manufactured products. On the contrary, both the *Recession period* (2008 to 2009) and in the *Post-Recession* (2010 to 2015) period WPI

shows an increasing trend. In addition, it is statistically significant by the simple regression model. Consumer Price Index of the three sub-categories namely; Consumer Price Index- Industrial Worker (CPI-IW), Consumer Price Index–Rural Laborer (CPI-RL) and Consumer Price Index Agricultural Laborer (CPI-AL) was found to be almost increasing in Pre-Recession, Recession and Post-Recession period. Only the consumer price index industrial workers (CPI-IW) has found decreasing trend in pre- recession period.

CHAPTER-4

IMPACT OF RECESSION ON

MACRO VARIABLES

IMPACT OF RECESSION ON MACRO VARIABLES

4.0 Overview

This chapter introduces yet another key factor of our study, i.e., the trends of unemployment as well as the impact of recession on Macro variables. The significance of this chapter underlines the upheavals that were faced by the Indian economy, particularly in reference to unemployment and inflation, in the wake of the Global Financial Crisis. Macroeconomic variables play a crucial role in fluctuations of economy. Fluctuations in the major variables like export, lending rate and inflation rate can creates huge problems in the economy. Hence, it is imperative to reckon how the Global Recession of 2008 in the USA affected these variables in the Indian scenario. Thus, this chapter shows the impact of financial crisis on macroeconomic variables such as export, lending rate and CPI-IW by the Vector Error Correction Model (VECM). The data has been taken for the time period from 2002-M1 to 2015-M12 in Context of Indian economy. Furthermore, this time has divided into three sub-periods, such as pre-recession, during recession and post-recession period. In addition, comparative analysis among the measurement approaches of unemployment rate such as the Usual Status, Current Weekly Status and Current Daily Status from the 61st, 66th and the 68th NSSO Rounds of the Quinquennial employment-unemployment have been drawn for empirical profiling.

4.1 Introduction

The global economic slowdown has affected the overall growth of India's economy. The impacts are spatially as well as sectorally differentiated. The influence of the global crisis has been transmitted to the Indian economy through three distinct channels, viz., the financial sector, export and exchange rate (Sahu, 2013, p).

It is essential to establish the reasons for choosing the macroeconomic variables mentioned above, hence, let's consider the integral choice of exports. *“Export plays an essential role in the international trade, whereby the goods produced in one country are*

shipped to another country for future sale or trade and this sale of such goods adds to the producing nation's gross output".

Exporting is not just an activity of large multinational conglomerates to obtain scale and location economies but it is an activity for small firms as well. Approximately all huge multinational companies today started their enlargement overseas through expansion in exports. Exporting can be a very challenging activity for many firms. More than mere shipping of goods, it is the competitive way for a brand to reach the international business ambit. Export as an investment needs minimum resources though optimum flexibility. Moreover, exports yield substantial financial, marketing, technological and other benefits to the firm. Since exporting is usually the first means of foreign entry used by many companies, exporting early usually gives companies a *first-mover advantage* (Yigang, Shaomin and David, 1999). However, exporting requires experiential knowledge that includes the foreign market knowledge (such as clients, market needs, and competitors) and institutional knowledge (such as government, institutional framework, rules, norms, and values) and adeptness in operational knowledge (Eriksson, et al. 2000). Export is predominant for the growth and development of the economy as it brings valuable foreign exchange that assists in the growth of the economy (Goyal, 2012). India, since the implementation of new economic policy in 1991, has been experiencing a high rate of economic growth along with a high rate of export growth. Though the growth slowed down to some extent during the period of the Asian currency crisis of 1997, it once again picked up from the beginning of the 21st century (Sultan, 2012).

According to International Monetary Fund *"Lending Rate is the other depository corporation rate that usually meets the short-term and medium-term financing needs of the private sector. This rate is normally differentiated according to creditworthiness of borrowers and objectives of financing".*

Reserve Bank of India is the central bank of India. It manages and controls the supply of money. Thus, the RBI and is accountable for economic growth and controlling inflation. If Reserve Bank of India makes money supply easy, then it will become very conversant for commercial banks to lend loan to public. Lending loan to public in excess will cause

increase in the supply of money in the hands of people⁸. The interest rate is charged by banks to their largest, secure, and most creditworthy customers on short-term loans. This rate is used as a guide for computing interest rates for other borrowers⁹. There are some studies supported to Consumer Price Index, such as according to Mohanty, Subbarao, Patnaik, Shah and Veronese among others discuss that Wholesale Price Index does not cover price of services. They also argued that although Wholesale Price Index is considered as measure headline inflation, it does not reflect the consumer price situation in the economy. Therefore, we considered consumer price index.

Inflation is a condition in which there is continuous and unchecked increase in the general price level of essential commodities. Inflation reduces consumption as the purchasing power of money depletes. Therefore, inflation is a situation of price rise. The reason for price increase can be due to two main factors identified as the increase in demand and decrease in supply. The Consumers buy from the retailers and not the wholesalers, so the CPI gives the accurate picture of the cost of living. In India, Consumer Price Index shows the inflation rate at retail level. There are 260 commodities enlisted in CPI. There were four Consumer Price Indices covering different socio-economic groups in the economy, namely as Consumer Price Index for Industrial Workers (CPI-IW); Consumer Price Index for Agricultural Labourers (CPI-AL); Consumer Price Index for Rural Labourers (CPI -RL) and Consumer Price Index for Urban Non-Manual Employees (CPI-UNME). However, currently, the CPI-UNME has closed. CPI is now using a new series on the base 2010=100 for all-India and States/UTs separately for rural, urban and combined. The Consumer Price Index at Industrial Workers (CPI-IW) is the measurement of general price level in India. This includes selected services and is measured on the basis of retail prices. CPI-IW is used to determine the dearness allowance of employees in both the public and private sectors. It is also an accurate indicator of general inflation¹⁰.

⁸www.quora.com/What-is-the-difference-between

⁹<http://www.businessdictionary.com/definition/prime-lending-rate.html>

¹⁰pp.1, website: <http://indiabudget.nic.in>.

4.2 Objectives and Hypothesis

1. To examines the impact of recession on export, Lending rate and inflation rate.
2. To examines comparative analysis among the various NSSO unemployment rounds.
1. H_0 There is significant impact of recession on macro-variable in pre and post-recession period and no significant impact in the recession period.
2. H_0 There is no significant impact of recession on macro unemployment

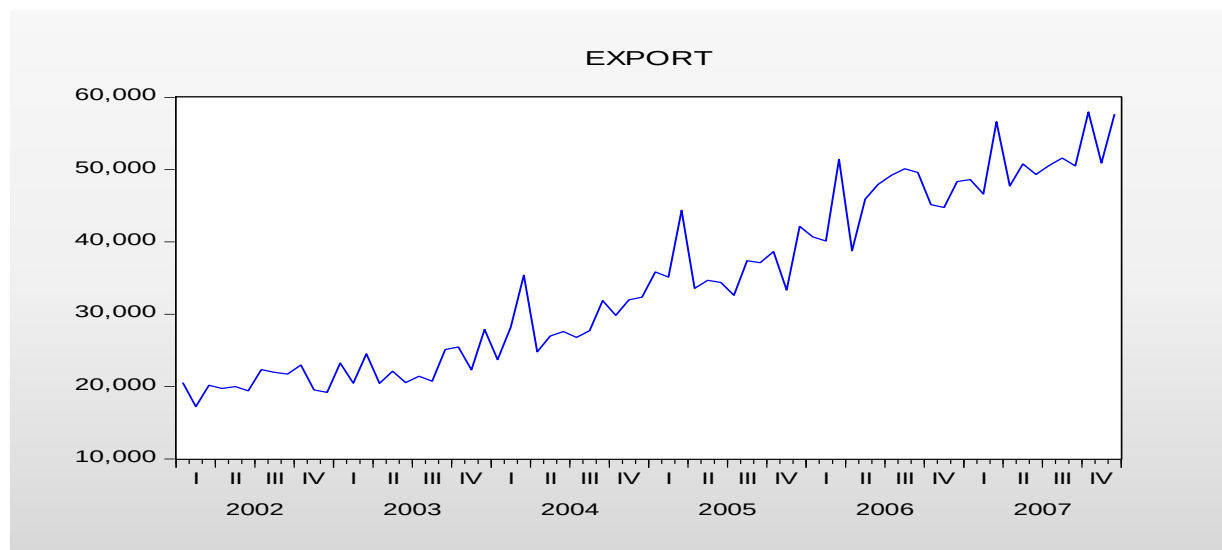
4.3 Data Source and Methodology

The present study is time series analysis and is fundamentally based on secondary data. The data has been taken from 2002 to 2015 in the context of the Indian economy. Additionally, this period has been divided into three sub-categories: Pre-Recession, Duration of Recession and Post-Recession period. We have used monthly data and collected data from various sources such as the Reserve Bank of India, Economic Political Weekly Time series Dataset and the National Sample Survey Office.

4.4: Pre-Recession Period from (2002 to 2007)

4.4.1 Pattern and Trends of Macro-Variables

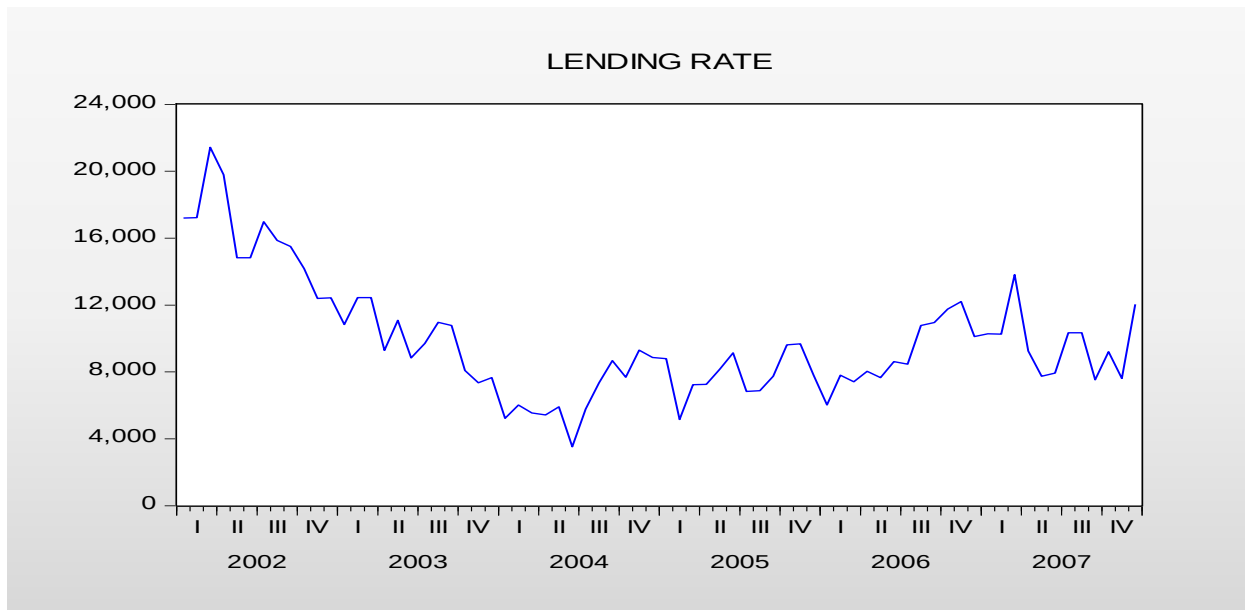
Figure 4.4.1: Trends of Export



Data Source: Reserve Bank of India & EPW Time Series

The figure 4.4.1 indicates the trends of export from 2002 to 2007 (pre recession period) in the reference of the Indian economy. The y axis occurs the quatity of export and the x axis occurs the time period. The blue line occurs the trends of export. It started with the increased rate in January 2002. Then, decreased in March 2002. It was continiously flatuating with cumulative rate in the pre-recession period. It was very high at the end of 2007.

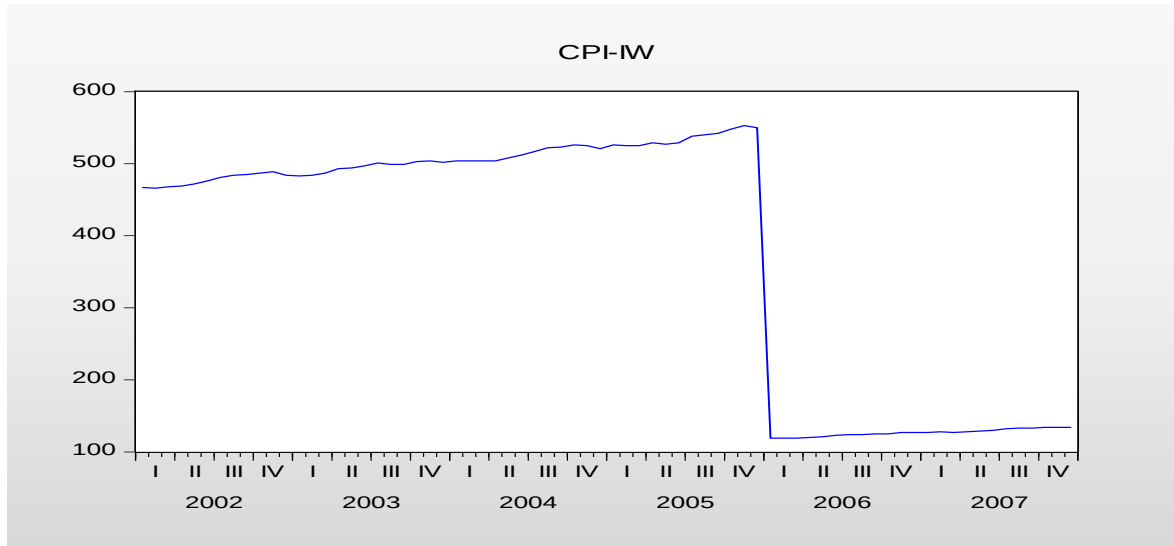
Figure 4.4.2: Trends of Lending rate



Data source: Reserve Bank of India & EPW Time Series

The figure 4.4.2 indicates the trends of lending rate from 2002 to 2007 (pre recession period) in the context of the Indian economy. The y axis occurs the quantity and amount of lending rate and the x axis occurs the time period. The blue line indicates the trends of lending rate. It started with the decline rate in the first quarter of 2002. After which, it quickly increased in the second quarter of 2002. Then came the unexpected decrease in the third quarter of 2002. After that it decresed continuously, with steep decline in the mid of the second and the third quarters of 2004. Then, it increased continiously at a slow rate from the fourth quarter of 2004 to the fourth quarter of 2007.

Figure 4.4.3: Trends of General Inflation Rate (CPI-IW)



Data source: Reserve Bank of India & EPW Time Series

The figure 4.4.3 occurs the trends of general inflation rate from 2002 to 2007 (pre recession period) in reference of the Indian economy. The y axis occurs the quantity and the amount of general inflation rate and the x axis occurs the time period. The blue line indicates the trends of general inflation rate (CPI-IW). There was a gradual increase from the first quarter of 2002 to the fourth quarter of 2005. Then came the unexpected decrease (structural break) with very low rate at the start of 2006. Though, an escalation at very slow rate started from the first quarter to the fourth quarter of 2007.

4.4.2: Augmented Dickey Fuller Test

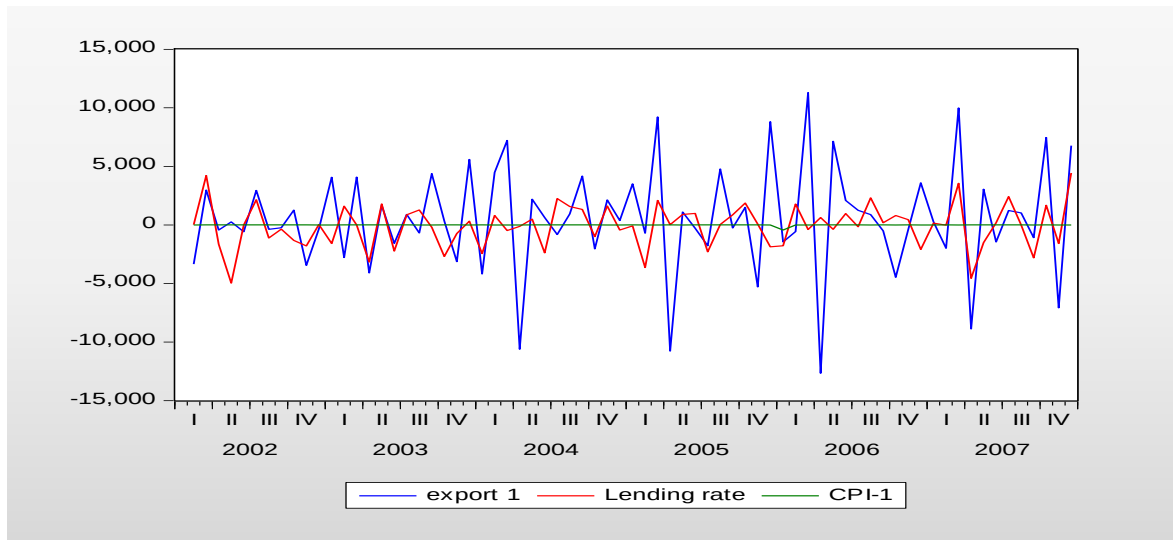
We have applied the Augmented Dickey Fuller test to avoid unauthentic regression. Testing or the unit root hypothesis has become a standard feature of applied econometric research, with the Dickey-Fuller (1979) test commonly employed. Due to the invalidity of the DF statistic in the presence of serial correlation, the test is typically applied in its augmented form. To examine the significance of the resulting Augmented Dickey-Fuller (ADF) statistic, the response surface analysis of MacKinnon (MK) (1991) can be used to calculate critical values for any sample size.

**Table 4.4.1: Augmented Dickey Fuller Test for Differences First Order Data,
(2002M1 to 2007M12)**

Variables	ADF Value DF-T Statistics	Critical value of Mackinon. In levels of significance	
		1%	5%
General Inflation rate	-8.250146 *	-3.527045	-2.903566
Export	-10.56071 *	-3.528515	-2.904198
Lending rate	-7.325386 *	-3.530030	-2.904848

Table 4.4.1 indicates the Augmented-Dickey Fuller test outcome and it depicts that variables are non-stationary at the level, but we have converted them into first differentiate on order. At the present, all variables are stationary at level one. Lending rate, Export and inflation (CPI-IW), are integrated at same order. All variables are stationary at 1 percent (*) level of significance.

Figure 4.4.4: Johanson Test for Cointegration



In Pre-Recession Period, the figure 4.4.4 shows that all variables are cointegrated with the lending rate, export and inflation rate. The lag selection criteria model has suggested that we should choose lag 2 because in this case, there are three criteria are significant such as LR, FPE and AIC.

The earlier outcomes and tests verify that we can use vector error correction (VEC) Model for assessment. According to the outcome of Johnson cointegration test, three directions are confirmed for variables of the model. The directions of variables are export lending rate and inflation (CPI-IW). Therefore, we are using Vector Error Correction Model (VECM).

We have attempted to develop the new VECM model. Common form of VECM model is as tracks:

$$\Delta y_t = a_0 + \alpha_1 + \alpha_2 ec_{t-1} + \alpha_3 \Delta y_{t-1} + \alpha_4 \Delta X_{t-1} + \epsilon_t$$

ec_{t-1} = Measures the speed of adjustment of economic growth to its equilibrium level

ΔY = Endogenous variable, ΔX = Exogenous variable, ϵ_t = Error term or residual

$$\Delta y_t = a_{cons} + \alpha_{LR} + \alpha_{EXP} ec_{t-1} + \alpha_{INF} \Delta Y_{t-1} + \alpha_{Dum} \Delta X_{t-1} + \epsilon_t$$

Where LR = Lending rate, EXP = Export, INF = Inflation rate (CPI-IW) and DUM= dummy variable. In order to establish the joint effects of variables under Vector Error Correction Model which all variables have been taken as endogenous (ΔY) and exogenous (ΔX), to establish the long-term and short-term association between them (Andrei and Andrei, 2015, P. 573). Zero dummy = No impact of structural breakdowns on other variables and one dummy = Impact of structural Breakdowns on other variables.

We have introduced the Dummy Variable because even after having a stationary data in the series of inflation (CPI-IW) was found to have structural breakdowns(**break date**). Therefore, this study used Dummy variables for captured effect of structural breakdowns on the dependent variables.

Table 4.4.2: An Analysis of Vector Error Correction Model Estimation

Vector Error Correction model of three variables such as Export, Lending rate and CPI-IW

Vector Error Correction Eq.	Coefficient	Std. Error	t-Statistic	Prob.
Lending rate	-1.929678*	0.257572	-7.491790	0.0000
Export	-2.115526*	0.345272	-6.127133	0.0000
Inflation (CPI-IW)	0.004411	0.019704	0.223873	0.8236

First Model Lending rate: In this model, which has the dependent variable, lending rate (the speed of adjustment towards equilibrium error correction term), it is adjusting very fast at 192% towards long-run equilibrium. In other words, there is a long-run causality running from the export and consumer price index for industrial worker to lending rate and there is no short-run causality running from the export and CPI-IW to lending rate. Implication being that, this model has been affected by permanent shocks (supply shock). The overall model is a good fit because R^2 is high and F statistics or P-value is significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
Lending rate	0.696353	0.649236	14.77906	0.000000	1.832213

Overall, this model is a good fit because there is no statistical error. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

Second Model Export: In this model, the dependent variable is export, the speed of adjustment towards equilibrium error correction term; it is adjusting very fast at 2.11% towards the long-run equilibrium. In another way, there is long-run causality running from the lending rate and inflation (CPI-IW) to export and only short-run causality

running from inflation (CPI-IW) to export. There is no impact of shocks (CPI-IW) on export. Meaning that, export has affected by supply shocks as well as demand shocks. The overall model is a good fit because R^2 85 % and F statistics is 39 % and P-value is 0.000 (*) significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob(F-statistic)	Durbin-Watson stat
Export	0.858784	0.836871	39.19098	0.000000	1.960527

In this model is good fit because there is no statistical error. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

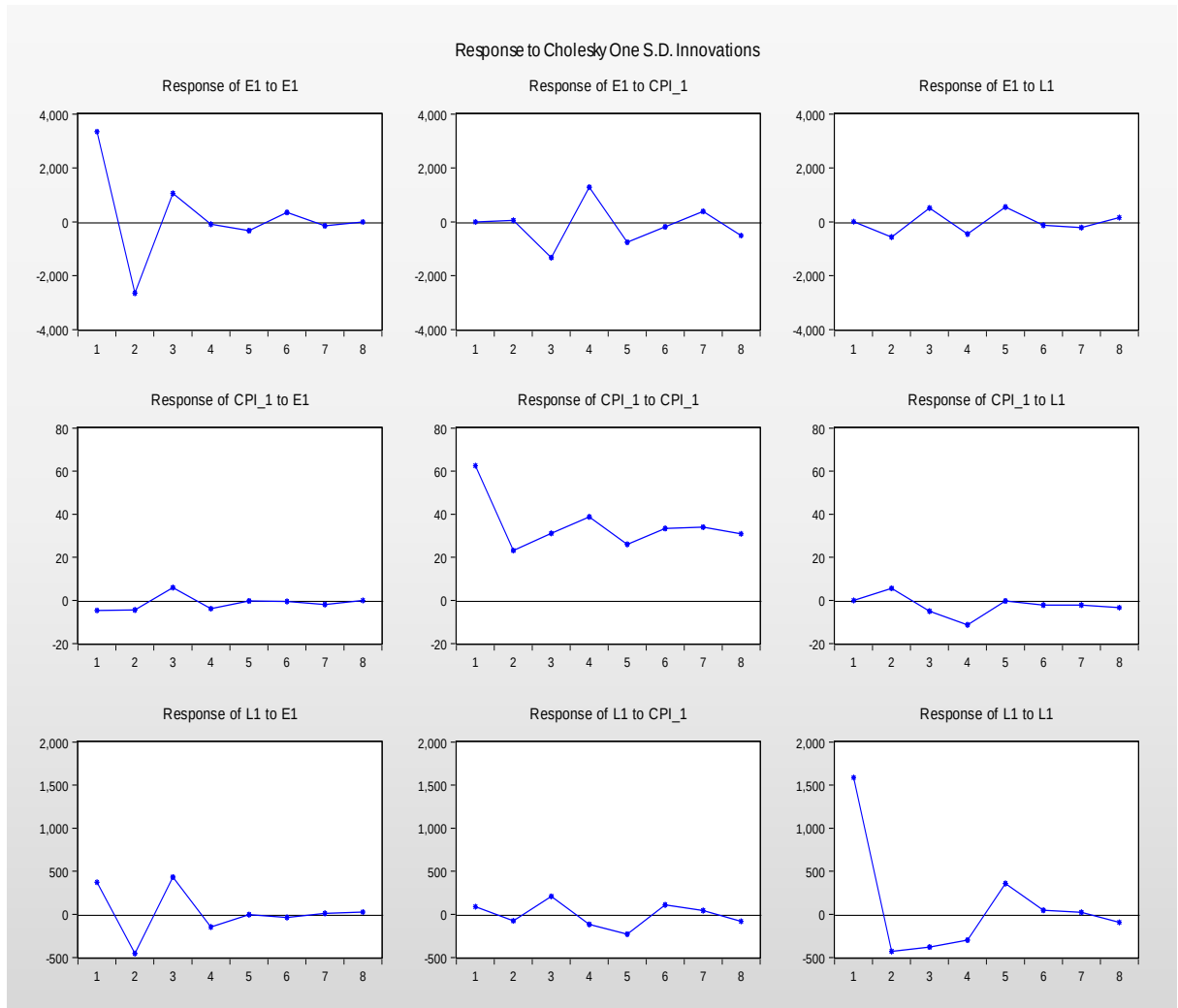
Third Model is CPI-IW: In this model, which has the dependent variable, CPI-IW, there is no long run and short run causality running from the lending rate and export to CPI-IW. It is only affected by own past values and own past shocks. The overall model is not a good fit because R^2 is 41 % low and F statistics is 4.58 % or P-value is 0.000 (*) significant, so it is acceptable.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
CPI-IW	0.415587	0.324903	4.582771	0.000138	2.181259

In this model, there is statistical error because we found the problem of serial correlation. Therefore, there is deduction of serial correlation through the lag difference order. Now, there is no serial correlation and heteroscedasticity. Another problem is that the residuals are not normally distributed and it is not desirable but acceptable because many economists and the statistician are supporting it.

4.4.3: Impulse Response Function

Figure 4.4.5: Impulse Response Function



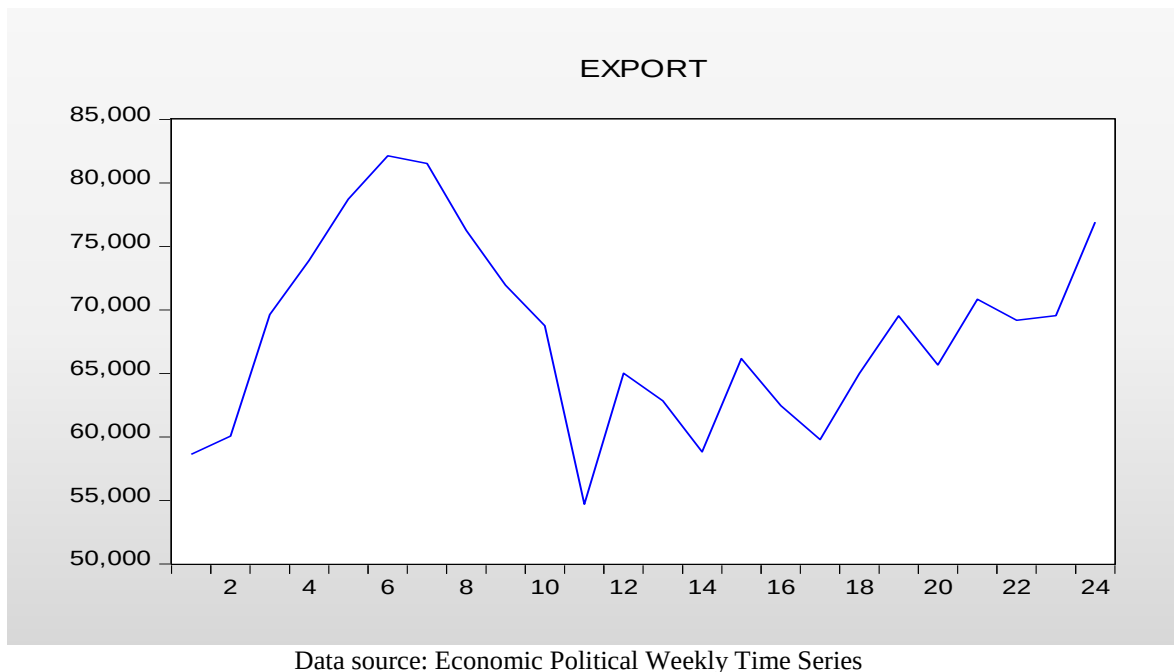
Impulse Response Functions: It determines the responsiveness of the dependent variables in Vector Error Correction Model system when a shock is put to the error term such as U_1 , U_2 and U_3 , as in the equations given above. A unit shock in U_1 will bring a change in the lending rate. It had influenced the export and inflation (CPI-IW) during the next eight months. However, before calculating the impulse response function the ordering of variables is essential. There are many methods but We have chosen the Cholesky dof adjusted, response to Cholesky one standard deviation innovation, shock or residual (error term) + 2 standard error. In the next eight months, all variables in this entire function had been affected. Hence, all the three variables had a significant

influence on each other. Nevertheless, the past values of variables more influenced. The past values of variables (lagged variables) have affected them more because they were presenting more fluctuation. Overall, this study finds that in the pre-recession period, export and lending rate had been affected more in comparison to the inflation rate (CPI-IW)

4.5. Case: 2 During the Recession Period (2008-09)

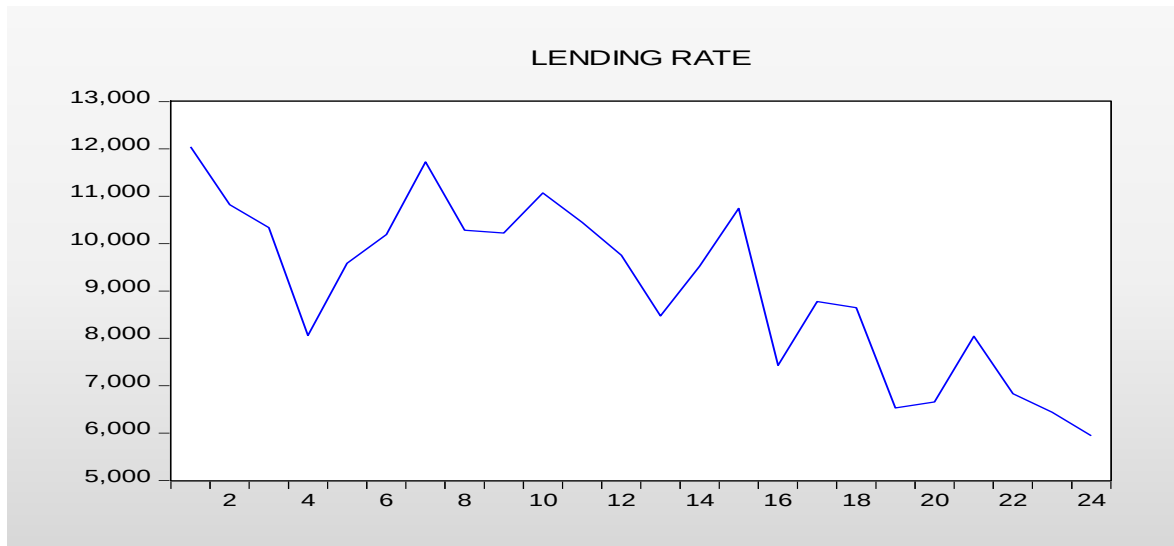
Trend of Macroeconomic Variables

Figure 4.5.1: Trends of Export



The figure 4.5.1 demonstrates the trends of export from 2008 to 2009 (during recession period) in reference of the Indian economy. The Y axis denotes the quantity of export and X axis denotes the time period. The blue line denotes the trends of export. It started decreasing in January 2008, then in February- 2008 it increased considerably, reaching the peak point in June -2008. But a steep decline is seen in the Figure in November, 2008. After that, it fluctuated and an upward trend is observed at a slow pace till December, 2009. In this series we found the structural breakdowns.

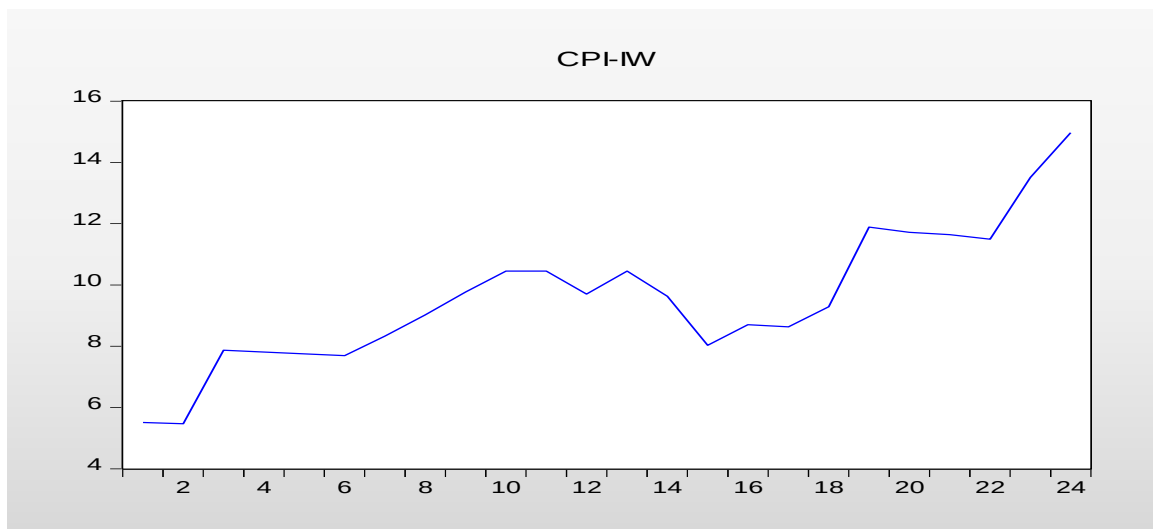
Figure 4.5.2: Trends of Lending Rate



Data source: Economic Political Weekly Time Series

This figure 4.5.2 demonstrates the trends of lending rate from 2008 to 2009 (during recession period) in reference of the Indian economy. The y axis denotes the quantity of lending rate and the Xaxis represents the time period. The blue line denotes the trends of lending rate. It starts with high and peak point of this series in January, 2008. After that, decreases in April- 2008 and then it fluctuates continuously and decreases to the hit the lowest in December- 2009. Structural breaks were also seen in this series.

Figure 4.5.3: Trends of General Inflation Rate (CPI-IW)



Data Source: Handbook, Reserve Bank of India

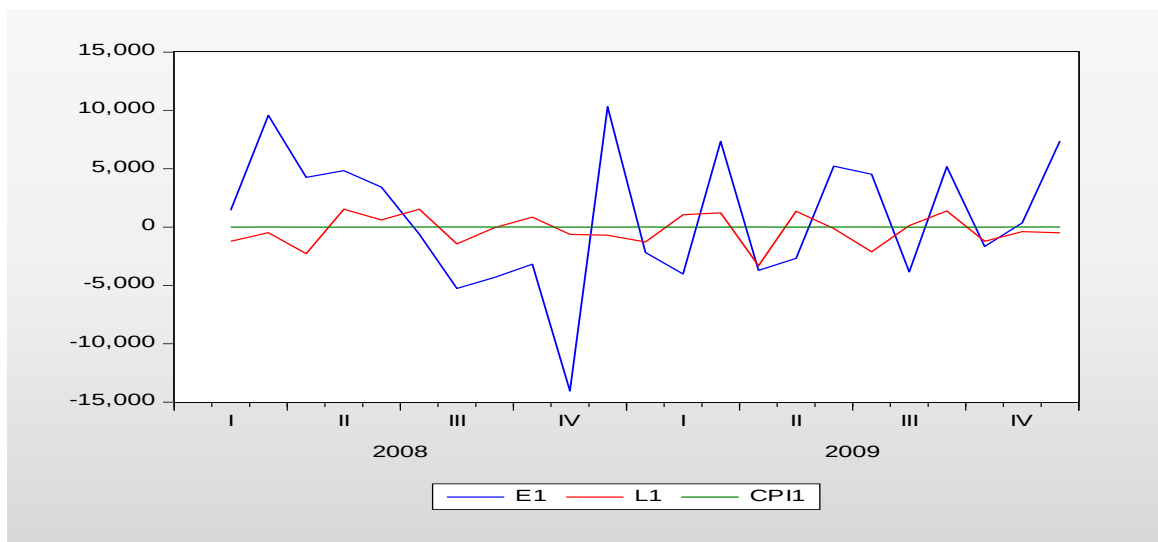
The figure 4.5.3 demonstrates the trends of general inflation (CPI-IW) from 2008 to 2009 (during recession period) in reference of the Indian economy. The **y axis** denotes the price level of general (inflation rate) and X axis denotes the time period. The blue line denotes the trends of general inflation rate. It starts with the decreasing rate in January, 2008. Then it continuously increases to reach the peak point in December, 2009.

Table 4.5.1: ADF Test for Differences First Order Data, (2008-M,1 to 2009-M,12)

Variables	ADF Value DF-T Statistics	Critical value of Mackinnon in levels of significance	
		1%	5%
Inflation (CPI)	-4.239513 **	-3.769597	-3.004861
Export	-4.826144 *	-3.769597	-3.004861
Lending rate	-5.242422 *	-3.788030	-3.012363

Table 4.5.1 described the Augmented-Dickey Fuller test result and it tells us that data are non-stationary at the level, but we have converted them into first differentiate on order. Now all variables are stationary at the level one. Lending rate, export and CPI-IW are integrated at the same order. All variables are stationary at 1% level of significance.

Figure 4.5.4: Johanson Test for Cointegration



The figure 4.5.4 indicates that only one variable (lending rate) is cointegrated in this period. Because trace statistics value is more than the critical value (TS>CV), it tells us that variables are cointegrated. If TS<CV, it tells us that variables are not cointegrated with each other. Thereby meaning that, there is no long-run association among these variables. And the lag selection criteria model has suggested that we should choose lag 2 because in this case there are three criteria is significant such as: LR, FPE and AIC.

We have attempted to develop the new VECM model. General form of Vector Error Correction Model is tracks;

$$\Delta y_t = \alpha_0 + \alpha_1 + \alpha_2 ec_{t-1} + \alpha_3 \Delta Y_{t-1} + \alpha_4 \Delta X_{t-1} + \alpha_5 \Delta X_{t-1} + \alpha_6 \Delta X_{t-1} + \epsilon_t$$

ec_{t-1} = Measures the speed of adjustment of economic growth to its equilibrium level,
 ΔY = Endogenous variable, ΔX = Exogenous variable and ϵ_t = Error term or residual term

$$\Delta y_t = \alpha_{cons} + \alpha_{LR} + \alpha_{EXP} ec_{t-1} + \alpha_{INF} \Delta Y_{t-1} + \alpha_{DLR} \Delta X_{t-1} + \alpha_{DEX} \Delta X_{t-1} + \alpha_{DINF} \Delta X_{t-1} + \epsilon_t$$

Where LR = Lending rate, EXP = Export, INF = Inflation rate (CPI-IW) and DINF= dummy variable for inflation, DEX = Dummy variable for export, DLR = dummy variable for lending rate. Zero dummy = No Impact of Structural breakdowns and one dummy = Impact of Structural Breakdowns.

During recession period, we have introduced three dummies because we found structural breakdowns in every series by the breakpoint unit root test (which is result provided in appendix). Therefore, we have used dummy variables to capture the effects of structural breakdowns on the other variables.

Table 4.5.2: An Analysis of Vector Error Correction Model Estimation

Vector Error Correction Eq.	Coefficient	Std. Error	t-Statistic	Prob.
Export	0.154309	0.141262	1.092357	0.3031
Lending rate	-2.755490 *	0.322179	-8.552663	0.0000
CPI-IW	-0.463927	0.303311	-1.529543	0.1544

First model: Export: In this model, the dependent variable is export, there is no short-run and long-run causality running from lending rate and CPI-IW to Export. Moreover, there is no impact of structural breakdown on export.

Model	R-squared	Adjusted R-squared	F-statistic	Prob(F-statistic)	Durbin-Watson stat
Export	0.680474	0.325444	1.916668	0.170992	2.061011

In this model, there is no statistical error. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

The Second Model is Lending Rate: In this model, which has the dependent variable, lending rate, the speed of adjustment towards equilibrium, it is adjusting very fast at 275% towards the long-run equilibrium. In other words, there is a long-run causality running from export and CPI-IW to lending rate and short-run running causality from CPI-IW to Lending rate. Moreover, all shocks on CPI-IW, export and lending rate in the duration of the recession are presenting a significant impact on the lending rate. It has been affected by the permanent and temporary shocks.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
Lending Rate	0.976734	0.950883	37.78286	0.000004	2.513949

There is no statistical error in this model. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

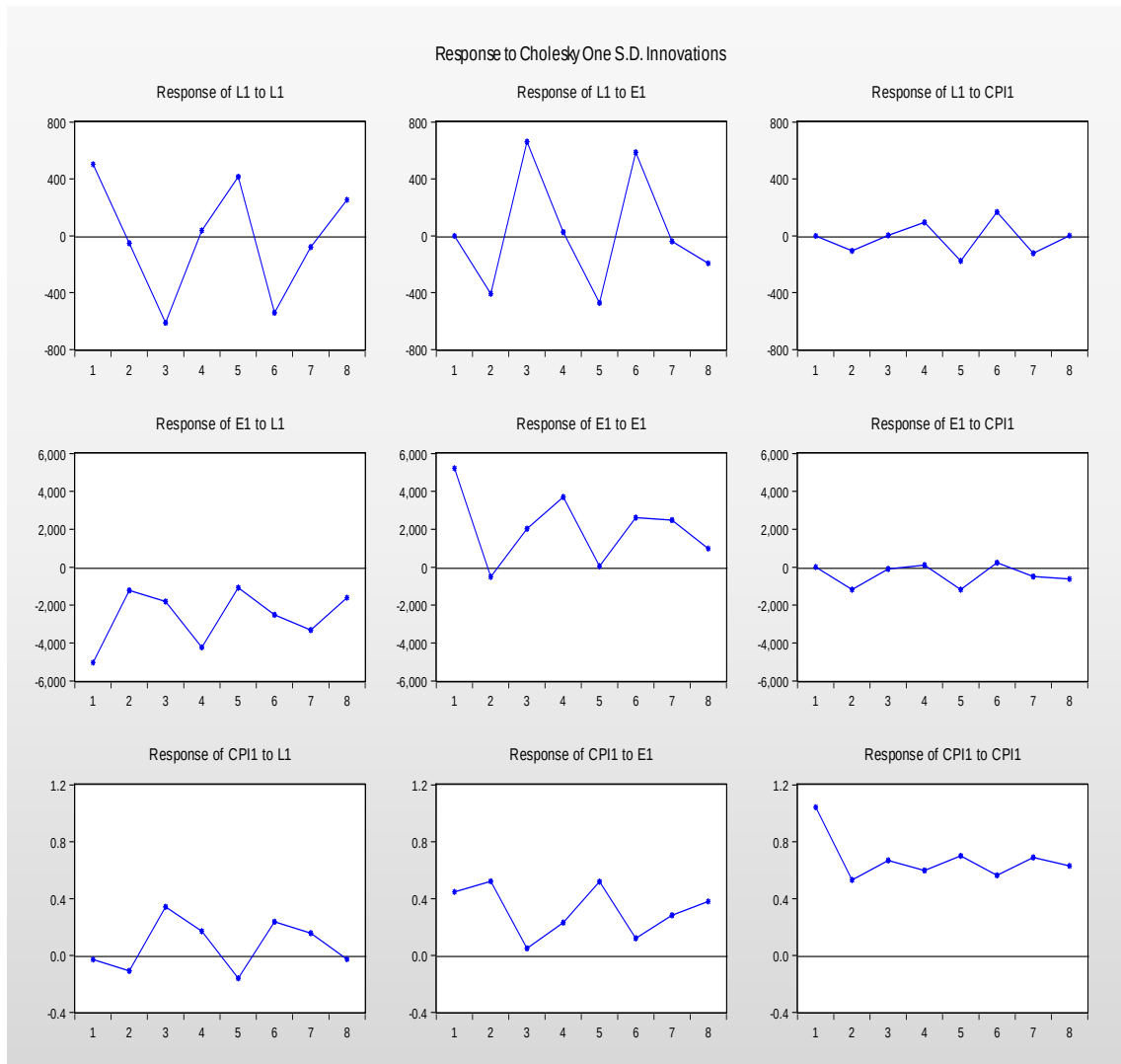
Third Model CPI-IW: In this model, which has dependent variable, CPI-IW there is no short- run and long- run causality running from export and lending rate to CPI-IW.

Model	R-squared	Adjusted R-squared	F-statistic	Prob(F-statistic)	Durbin-Watson stat
CPI-IW	0.553670	0.229066	1.705678	0.202463	2.079533

In this model, there has been the problem of multicollinearity. It has been removed but now there is no statistical error. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

4.5.5: Impulse Response Function

Figure 4.5.5: Impulse Response Function



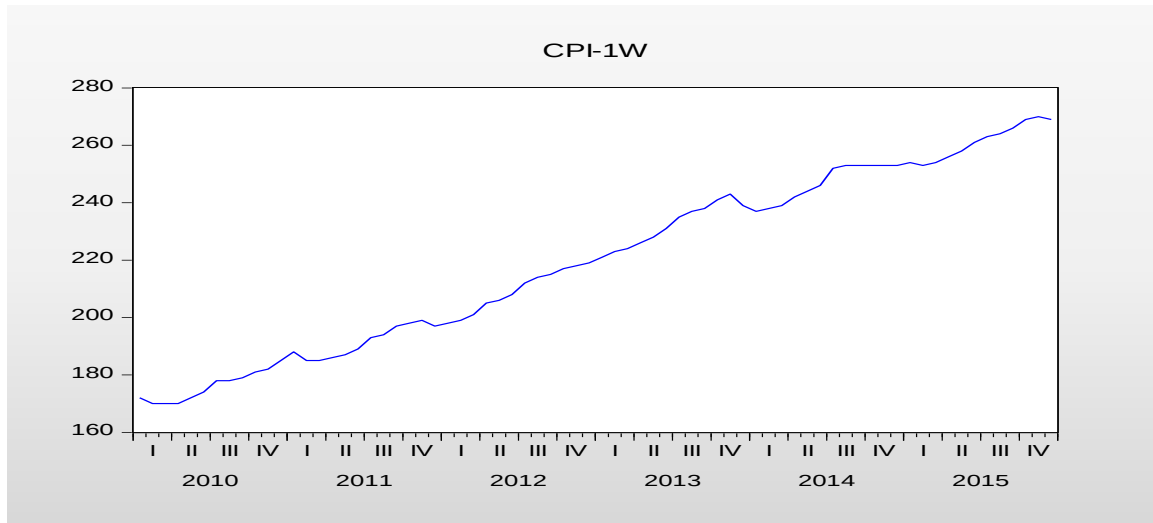
Impulse Response Functions: It identifies the responsiveness of the dependent variables in Vector Error Correction Model system, when a shock is put on error terms such as U_1 , U_2 , and U_3 , in equations given above. A unit shock in U_1 will bring a change in the lending rate. It has changed the export and inflation (CPI-IW) in next eight months. Nevertheless, before calculating the impulse response function, the ordering of the variables is essential. Many methods are given for ordering but we have chosen *Cholesky dof* adjusted, Response to Cholesky one standard deviation innovation, shock or residual (error term) + 2 standard error.

This diagram has presented the impact of the lending rate on (own lagged value) lending rate in the next eight months. It started at the high peak point and then indicated sudden decrease in the third month. After that, it increased in the fifth month, decreased in the sixth month and then increased in the eighth month. It was fluctuating due to the recession. The impact of lending rate on export started from the origin negatively and then decreased in the second month. It reached the peak point in the third month. Thereafter, came a phase of continuous highs and lows with the high rate becoming negative in the last month. In the end, there was a gradual impact of lending rate on the inflation rate for the entire period of eight months. Evidently, we can see the impact of the second error term of export on the other independent variables such as the lending rate and the inflation rate. The impact of export on the lending rate started negatively and did not touch the origin line. The affect was always negative. We can say that it has created liquidity situation in the next eight months. The impact of export on export started with high peak point and it decreased in the second month and touched the origin line. It was fluctuating continuously in the positive way and reached near the origin in the eighth month. In other words, in the last impact of export on the inflation rate, it scaled gradually up and down and touched the origin line always in the negative. Lastly, we see the impact of the third error term of inflation rate on the independent variables such as the lending rate and export. Finally, the impact of inflation rate on the lending rate started to touch the origin line negatively. It scaled up and down for the whole month. The impact of inflation rate on export started with the increasing rate and it was continuously fluctuating in the positive way. However, it did not touch the origin line. The impact of inflation rate on the inflation was gradually fluctuating with the increasing rate.

Case: 3 Post-Recession Period (2010 to 2015)

4.6. Trend of Macroeconomic Variables

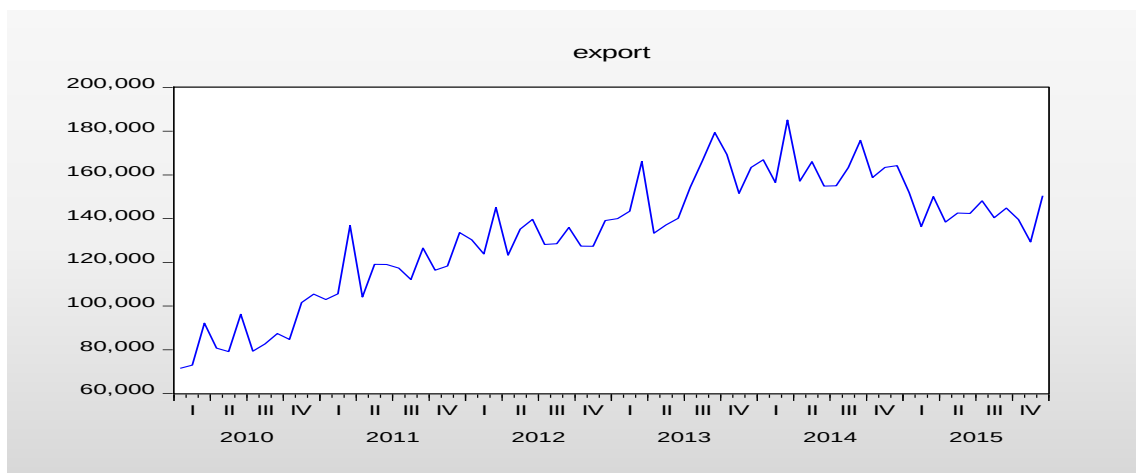
Figure 4.6.1: Trends of General Inflation Rate



Data source: Handbook, RBI

This figure 4.6.1 shows the trends of general inflation (CPI-IW) from 2010 to 2015 (post recession period) in the context of Indian economy. The y axis represents the price level of general inflation rate and the X axis represents the time period. The blue line represents the trends of general inflation rate. It started with the low rate and it increased continuously with minor fluctuations. Moreover, it reached the peak point in Decemeber, 2015.

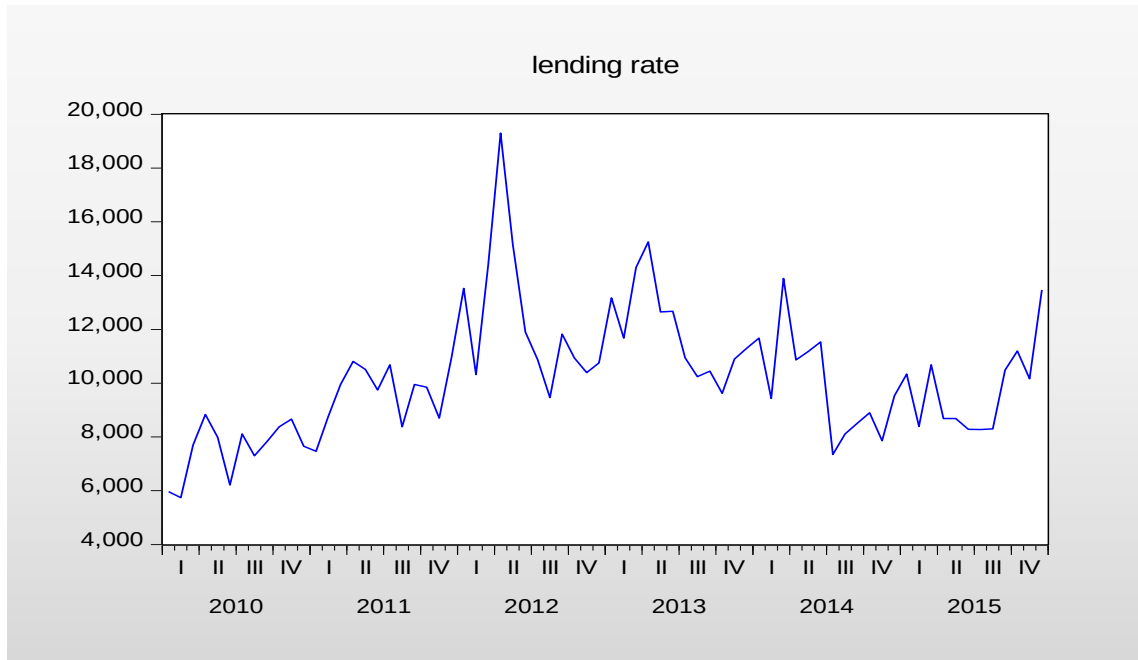
Figure 4.6.2: Trends of Export



Data source: EPW Time series

The figure 4.6.2 demonstrates the trends of export from 2010 to 2015 (the post recession period) in reference of the Indian economy. The y axis denotes quantity of export and the x axis denotes the time period. The blue line denotes the trends of export. It started with the low rate, after that it was fluctuating continuously and increased from the first quarter of 2014. Thereafter, it kept declining till December, 2015.

Figure 4.6.3: Trends of Lending Rate



Data source: Economic Political Weekly Time series

The figure 4.6.3 demonstrates the trends of lending rate from 2010 to 2015 (the post recession period) in reference of the Indian economy. The y axis denotes quantity and the amount of lending rate and the x axis denotes the time period. The blue line denotes the trends of lending rate. It started with the declining rate in January, 2010. Then, continuously increased with fluctuations. Finally, it reached the peak point in the second quarter of 2012. It was continuously fluctuating from the third quarter of 2012 to the fourth quarter of 2015.

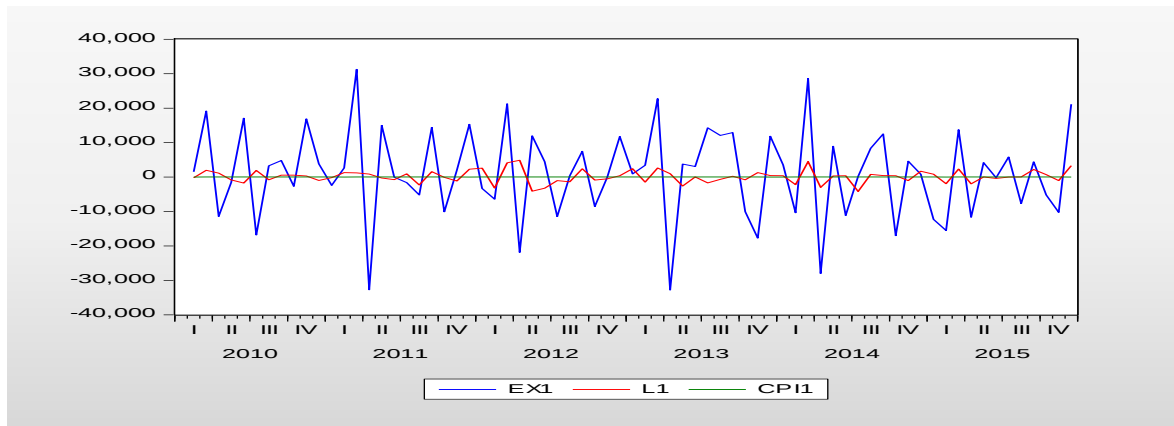
Dickey Fuller Test for Stationary

Table 4.6.1: ADF Test for Differences First Order Data, (2010-M,1 to 2015-M,12)

Variables	ADF Value DF-T Statistics	Critical value of Mackinon in levels of significance	
		1%	5%
CPI-IW	-6.569218 *	-3.527045	-2.903566
Export	-9.729711 *	-3.528515	-2.904198
Lending rate	-10.56238 *	-3.527045	-2.903566

Table 4.6.1 describes the Augmented-Dickey Fuller test result and it tells us that data are non-stationary at the level but we have converted them into first differentiate. Now, all the variables are stationary at the level one. The lending rate, export and CPI-IW have been integrated at the first order.

Figure 4.6.4: Johanson Test for Cointegration



The figure 4.6.4 indicates that all the three variables are cointegrated in this period. In other words, all variables are correlated to each other in the long-run and it influences significantly. The lag selection criteria model has suggested that we should choose lag two because in this case there are three criteria is significant. This means that there are three criteria: LR, FPE and AIC.

We have attempted to develop the new VECM model. General form of VECM model is charts:

$$\Delta y_t = \alpha_0 + \alpha_1 + \alpha_2 ec_{t-1} + \alpha_3 \Delta Y_{t-1} + \epsilon_t$$

ec_{t-1} = Measures the speed of adjustment of economic growth to its equilibrium level,
 ΔY = Endogenous variable, ΔX = Exogenous variable and ϵ_t = Error term

$$\Delta y_t = \alpha_{cons} + \alpha_{LR} + \alpha_{EXP} ec_{t-1} + \alpha_{INF} \Delta Y_{t-1} + \epsilon_t$$

Where LR = Lending rate, EXP = Export, INF = Inflation rate (CPI-IW)

Table 4.6.2: An Analysis of the Vector Error Correction Model Estimation

Vector Error Correction Eq.	Coefficient	Std. Error	T-Statistic	Prob.
Lending rate	-1.143724 *	0.271392	-4.214290	0.0001
Export	-1.220665 *	0.298319	-4.091819	0.0000
General inflation rate (CPI-IW)	-0.564972 **	0.188031	-3.004671	0.0039

First Model Lending Rate: In this model, the dependent variable is lending rate, the speed of adjustment is towards equilibrium error correction term. It is adjusting very fast at 114% towards the long-run equilibrium. In other words, there is long-run causality running from CPI-IW and export to the lending rate. Only short-run causality running from the CPI-IW to lending rate is presenting influence significantly in the short-run. In simple way, it was affected by permanent shocks and temporary shocks. The overall model is a good fit because R^2 is high and F statistics or P-value is significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
Lending rate	0.647222	0.599387	13.53048	0.000000	2.076253

In this model, there is no statistical error and it is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed and it is a good fit.

Second Model Export: In this model, which has the dependent variable, export, the speed of adjustment towards equilibrium error correction term is adjusting very fast at 122% towards the long-run equilibrium. In other words, there is long-run causality running from the lending rate and CPI-IW to export and only short-run causality running from the CPI-IW to export. This is showing significant influence in the short-run. This means that the export has also been affected by the permanent shocks and temporary shocks in the post-recession period. The overall model is a good fit because R^2 is high and F statistics or P-value are significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
Export	0.796403	0.768796	28.84844	0.000000	2.036434

In this model, there is no statistical error. It is desirable because there is no ^{serial} correlation and heteroscedasticity and residuals are normally distributed and it is a good fit.

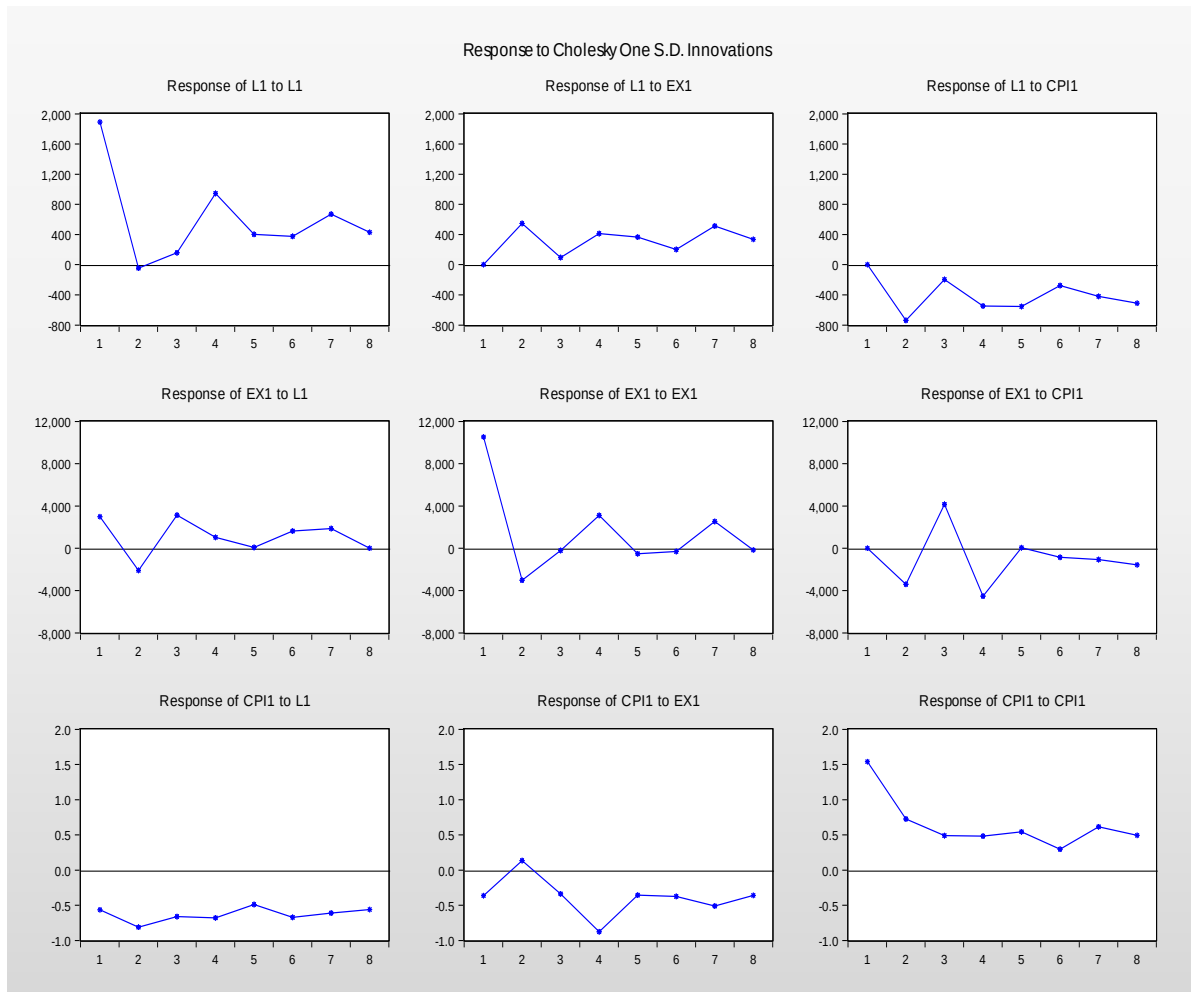
Third Model is CPI-IW: In this model which has the dependent variable, CPI-IW, the speed of adjustment towards equilibrium error correction term is adjusting very poorly at 056% towards the long-run equilibrium. In other words, there is long-run causality running from Export and lending rate to CPI-IW and short-run causality running from export and lending rate to CPI-IW. It jointly influences significantly. It has also been affected by permanent and temporary shocks. The overall model is average because R^2 is low and F statistics or P values are significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (t-statistic)	Durbin-Watson stat
CPI-IW	0.431571	0.354496	5.599363	0.000028	1.775667

In this model the problem of serial correlation is found which has been deducted from the model. Now there is no statistical error in this model. So, it is desirable because there is no serial correlation and no heteroscedasticity and residuals are normally distributed.

4.6.5: Impulse Response Function

Figure 4.6.5: Impulse Response Function



Impulse Response Functions: It identifies the responsiveness of the dependent variables, in this Vector Error Correction Model system, when a shock has put to the error terms such as U_1 , U_2 , and U_3 , as in equations given above. A unit shock in U_1 had brought a change in the lending rate. It has changed export and inflation (CPI-IW) in next eight months. However, before calculating the impulse response function the ordering of variable is important. There are many methods for that. We have chosen the Cholesky dof adjusted. The Response to Cholesky is one standard deviation, innovation, shock or residual (error term) + 2 standard error. In the next eight months, all variables in this

entire function have been affected. We can see the impact of all dependent variables on the independent variables in the next eight months.

The Impact of the Lending Rate on Lending Rate: Started with the high peak point and touched the origin line. After that, it was fluctuating and then decreased in the last month. The impact of the lending rate on export started touching the origin line and increased in the second month. Then, it was fluctuating continuously between the decreasing and the constant rate. Impact of general inflation rate on general inflation rate started touching the origin line negatively and continuously fluctuated in the last month.

The Second Error Term is Export: The impact of export on lending rate started with the peak point and after that, it was continuously fluctuating the whole time. It touched the origin line in the last month. The impact of export on export started with the high peak point and it decreased in the second month. After that, it was continuously fluctuating and touched the origin line in the last month. The impact of export on general inflation rate started from touching the origin line. It was negative in the second month. After that, it continuously scaled up and down. In between the sixth and the eight-month, it was negative with origin line.

Third Error Term is Inflation Rate: The impact of general inflation rate on lending rate. It started negatively and while fluctuating remained negative till the end. The impact of general inflation rate on export: started negatively and touched the origin line in the second month. Moreover, it was again fluctuating with negative rate. It was negative in last month. The impact of general inflation rate on general inflation rate started with the high peak point and it kept decreasing till the last month. It generated the rectangular hyperbola curve.

4. 7 In addition to Measurement of Unemployment from Various NSSO Round

4.7.1 Unemployment Meaning, Definition and Measurement

The concept of unemployment plays a central role in the debates on economic and social policy. The difficulty of finding a definition of unemployment that captures all relevant aspect of this phenomenon should be interpreted as reflecting the great diversity of

workers without a job searching for work. This is reflected in recent labour market theoretical approaches- efficiency wages and segments labour market that devote much attention to the heterogeneous behaviour of the non-employed when they move between jobs (Centeno, et al. 2010).

Unemployment is a major problem for both the developed and developing economy. It is the most important indicator of the health of any economy. Unemployment is a situation when employable people who wish to avail of work opportunities do not get any work. Unemployment is at the core of social, political and economic problems in any country. In this context, (Diamond, 2013, P.1) study is most relevant and it states that, *“whenever unemployment stays high for an extended period, it is common to see analysis, statements, and rebuttals about extent to which the high unemployment is structural, not cyclical”*.

It is also important to consider the unemployment scenario in India and understand why the unemployment in the country is so volatile. India is a developing country where most people are employed in agriculture for their livelihood pattern. According to Mahesh Vyas (M.D. & CEO), *“a large proportion of the labour force does not have a regular job. People are mostly employed as daily wageworkers, agricultural labourers, small farmers and self-employed traders. These move in and out of jobs rapidly. ‘It is the high proportion of these workers in India that makes unemployment volatile”*.

There are two types of unemployment found in the Indian economy which are the Structural Unemployment and the Disguised Unemployment. Indian economy is beset with the problems of poverty, hunger, malnutrition that has drastically affected the developmental work of the Nation. It is pertinent to investigate the main reason of unemployment in India. When people do not work and do not have a sustainable income, their spending potential remains negligible. Spending on essentials and services also becomes unaffordable. Hence, the reduction in purchasing power creates low demand. Due to low demand and low production, the companies reduce their production cost. Many companies start downsizing and lay off employees. This creates even more unemployment and worsens the situation. With no means for economic sustenance, the employable youth often get frustrated and resort to illegal pursuits to make ends meet.

Thus, unemployment is directly linked to the increasing crime graph. As cited by many economists the main reason of unemployment in India is the Structural Framework. In the wake of the Global Recession many people lost their jobs in India also. According to the International Labour Organisation's Director General Guy Ryder, *"more than 61 million jobs have been lost since the start of the Global crisis in 2008 and our projections show that unemployment will continue to rise until the end of the decade. This means that the jobs crisis is far from over, so there is no place for complacency."*

According to the ILO, about a million of people were fired in the world due to recession. The *Global Economic Crisis* bears a profound impact on people's well-being, reaching far beyond the loss of jobs and income, and affecting citizens' satisfaction with their lives and their faith in the governments. According to the OECD report (2013 a, b) *"basically, unemployment is also a cause of recession. As output and demand falls, the firms cut the nominal wage rate on hiring new workers. This leads to a rise in unemployment, as there are reduced job vacancies. Therefore, some firms directly create unemployment by not hiring the labour. The rise of unemployment worsens the recession"*. A recent report of BBC suggests that recession has had a deep impact on jobs. According to the Chartered Institute of Personnel and Development (CIPD), the Recession caused the loss of 1.3 million jobs. This is higher than the official rise in development because many of those redundant were unable to find new jobs.

The Financial Crisis of 2007–2008, also known as the Global Financial Crisis is considered by many economists to have been the worst financial crisis since the Great Depression of the 1930s (Temin, 2010). It began in 2007 with a crisis in the subprime mortgage market in the US and developed into a full-blown international banking crisis with the collapse of the Investment Bank Lehman Brothers on September 15, 2008 (Mark, 2012). The financial crisis happened because banks were able to create too much money too quickly and used it to push up house prices and speculate on financial markets. Lending large sums of money into the property market pushed up the price of houses along with the level of personal debt. Interest had to be paid on all the loans that banks make and with the debt rising quicker than incomes, eventually some people become unable to keep up with repayments. At this point, they stopped repaying their

loans, and banks found themselves in danger of going bankrupt (<http://positivemoney.org/issues/recessions-crisis/>). U.S. is a biggest economy of the world; it is central body to exporter importer and food supplier. According to a report released by the Union Government in Aug 09, 1.71 Lakh had lost their jobs in various sectors of India. The textile industry was worst hit.

According to ILO some definitions and concept related to Unemployment.

Definition of Economic Activity: According to the International Labour Organisation (ILO), an economic activity is defined in terms of the production of goods and services as set forth by the United Nations system of national accounts (SNA). In broad way the SNA covers the production of goods and services for sale or barter in the market and the production of goods for personal consumption. All domestic or personal services provided by unpaid household members are excluded.

4.7.2 Economically Active Population: The ILO defines that the economically active population comprises all persons of either sex who furnish the supply of labour for the production of economic goods and services, as defined by the SNA, during a specified time reference period. The following set of priority rules is adopted to ensure that each person is classified into one of the three categories: employed, unemployed and economically inactive population. The first two categories make up the economically active population, which gives a measure of the number of persons furnishing the supply of labour at a given time period (Liu, E. & Wu, J., 1999). The International Labour Organisation has divided the total population of three categories, such as employed, unemployed and not in labour force. Further, all these categories have been divided into sub categories. The categories are discussed below:

4.7.2.1 The Employment Categories: According to priority rules, the first step is to identify those who are above the specified minimum age and during the specified short reference period were either at work or having formal job attachment. This group belongs to the “employed” category.

4.7.2.2 The Unemployed Category: The second step is to identify among the remaining persons those who were seeking and available for work. They belong to the “unemployed” category.

4.7.2.3 Economic Inactive Population: Those without work but they are not seeking nor are available for work, as well as those persons below the minimum age specified belong to the residual category of economically inactive population.

4.7.2.3 One Hour Criterion: The ILO recommends that, for operational purposes, the notion of some work should be interpreted as work for at least one hour during the reference period. This means that engagement in an economic activity for as short as one hour is sufficient for a person to be classified as “employed”. The main reason for the use of one hour criterion is to make the definition of employment as extensive as possible in order to cover all types of employment that exist in the economy (op. Cit,1999.).

4.7.3 According to Committees and NSSO, some Definitions and Measurements of Unemployment in India

4.7.3.1 Approaches to Measurement of Unemployment:

In early fifties, there were only two approaches to the measurement of unemployment. The first approach deals with the problems of open unemployment or idleness for want to work and the second approach is concerned with surplus labour (Raj, 1976).

Raj Krishna suggested three other criteria in addition to the production criterion time, willingness and income. According to *time criteria* a person is classified as unemployed or under employed, if he is gainfully occupied for a number of less than some normal or optional hours defined as full employment hour”(Krishna,1973). According to *willingness criterion*, a person is considered as unemployed only when he is willing to work to do more work. Dandekar and Rath (Dandekar & Rath, 1971) originally suggested the *income approach*. Sen said, “They relate to two difference categories of thought and to identify the one with the other is to weaken both the concept” (Sen, 1975). After that Sen suggested two more approaches to unemployment, first is income and second is recognition. According to income approach, a person is considered as employed if his

income is conditional on work it is immaterial whether his income is high or low. The *Recognition approach* treats a person as unemployed only when he considers himself as unemployed. He argues that “*unemployment is a state of being without fruitful work and the perception of the fruitfulness of work is to large extent, a result of social conditioning*” (Op. Cit, 1975).

4.7.4 The National Sample Survey Organisation

The National Sample Survey collected data on unemployment during many rounds though there were variations from round to rounds; the basic approach was the labour force approach with a short reference period (Visaria, P. and PP.43-144). “The employment and unemployment’ surveys were carried out in rural areas by NSSO adopting three approaches such as Usual status (US), current weekly status (CWS) and current daily status(CDS)” (NSSO, 1999, Pp.31-55).

In India, the main sources of data on employment- unemployment are the various surveys being conducted by the National Sample Survey Organisation, the Population Census, and Employment Market Information Programme of DGET that is provides information on the organised sector employment and Employment Exchange Statistics. All the data sources available and surveys conducted by the NSSO are the main data source on employment and unemployment in the country. Starting with the 27th round of survey and based on concept, definitions and procedures as recommended by the Dantwala Committee (1970). NSSO has been conducting a gap of five years (quinquennial) surveys on employment and unemployment in the country (Report, E.U.S., 2009-10).

In the employment and unemployment surveys of NSSO, information regarding the activity status of a person is collected in three different approaches viz. usual status approach, current weekly status approach and current daily approach. In the usual status approach, the broad activity status of a person viz. employed unemployment and not in labour force is decided by major time criterion. In current weekly status and current daily status approach, the broad activity status of a person is decided by priority- cum major time criterion where work activity gets priority over unemployment that in turn gets priority over ‘not in labour force activities (68th round NSSO, Pp. 6).

The National Sample Survey Organisation that provides estimates of the rate of unemployment in India bases its analysis on the *quinquennial* surveys. It has collected the data on employment and unemployment using three broad approaches. These are: The Usual Status Unemployment, Current Weekly Status Unemployment and Current Daily Status Unemployment.

4.7.4.1 The Usual Status of Unemployment: It is further categorised into two subcategories, first is usual principal status and second is usual principal and subsidiary status. Usual Status relates to the activity status of person during the reference period of last 365 days preceding the date of survey. The activity status on which, a person spent relatively longer time (major time criterion) is considered the usual principal status (UPS). To decide the usual principal activity status of a person a two stage classification is used to determine the broad activity status, viz. employed, unemployed and not in labour force within which, the detailed activity status is determined depending on the relatively longer time period spent in the activities. Apart from this the usual principal activity status, a person could have pursued some economic activity for a smaller period, not less than 30 days. The status in which such economic activity is pursued is the subsidiary economic activity status of that person. If these two are taken together, the measure of usual principal and subsidiary status (UPSS) i.e. usual status is obtained.

4.7.4.2 Current Weekly Status (CWS): A person's activity status is obtained for a reference period of 7 days preceding the date of survey. According to this, a person is considered as a worker if he/ she has performed any economic activity at least for one hour or any day of the reference week, and is obtained on the basis of daily activities performed on each day of the reference period.

4.7.4.3 Current Daily Status (CDS): A person is determined by his/her activity status on each day of the reference using a priority-cum- major time criterion (day to day labour time disposition). A person is considered working (employed) for the full day if he/she has worked for 4 hours or more during day.

The National Sample Survey Organisation has collected the data of unemployment in every five years and unemployment has released it twice in the year in India. The NSSO

has divided the entire population into three categories of the employed, unemployed and not for labour. Furthermore, these categories are divided into sub categories.

The Labour Force: *“Labour force indicates the supply of labour in the country and is an important input for production of goods and services in the country. The reliable estimates of labour force are important for policy and planning purposes. The labour force participation rate derived shows the proportion of a countries working –age population that engages actively in the labour market, either by working or searching for work”* (EUS., Report, 2015). The breakdown of labour force has been in various categories such as sex, sector, social group, and age group wise. It gives a better profile of the economically population within the country to formulate policies and plans for various target population.

4.7.5 Concept and Measurement of Labour Force

Labour Force Participation Rate- labour force participation rate is defined as the number of persons in the labour force per 1000 persons.

$$\text{LFPR} = \frac{\text{No. of Employed Persons} + \text{No. of Unemployed persons} \times 1000}{\text{Total Population}}$$

Working Population Ratio- worker population ratio is defined as the number of persons employed per 1000 persons.

$$\text{WPR} = \frac{\text{No. of Employed/Persons} \times 1000}{\text{Total Population}}$$

Proportion Unemployed: -proportion unemployed is defined as the number of persons unemployed per 1000 persons.

$$\text{PU} = \frac{\text{No. of Unemployed persons} \times 1000}{\text{Total Population ages 15+}}$$

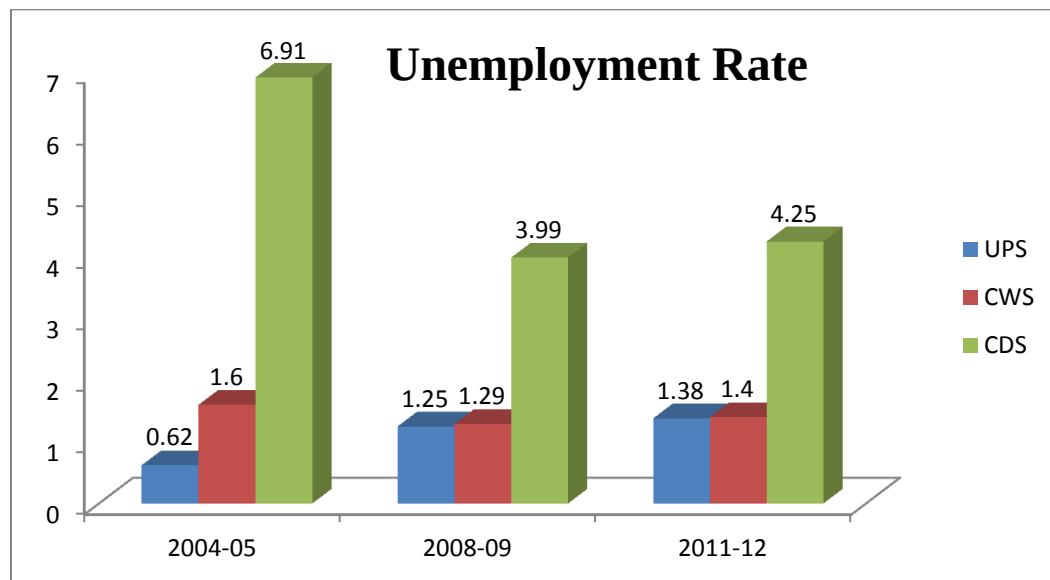
Unemployment Rate: - unemployment rate is defined as the number of persons unemployed per 1000 persons in the labour force (employed and unemployed)

$$\text{UR} = \frac{\text{No. of Unemployed persons} \times 1000}{\text{Labour force}}$$

In India there are various sources of collection of unemployment data but the National Sample Survey Organisation (NSSO) has more comprehensive strategy to collect the data of the employed and unemployed person.

4.7. The Graphic Presentation of the Percentage of Unemployed Persons in Indian Economy from Various NSS Rounds

Figure 4.7.1: Percentage of Unemployment Rate from Various NSS Round



Data Source: Unit Level Data at National Level from various NSS Rounds

The figure 4.7.1 shows the percentage change of the 5th year on 5th year rate of unemployment in namely the three quinquennial National Sample Survey (NSS) of the 61st, 64th and 68th rounds. The bar chart shows the percentage of unemployed persons in various NSS rounds.

The *Red colour* bar diagram denotes the percentage of unemployed persons in the Usual Principal Status. The *blue* bar diagram belongs to the percentage of unemployed persons in the Current Weekly Status. The *green* bar diagram depicts the Current Daily Status.

Tabulated results depict the following:

- I. In the *Pre-Recession Period* (61st NSS Round), basis of Usual Principle Status & unemployed person is at 0.62 percent. 1.60 percent persons are unemployed

in the Current Weekly Status. Moreover, 6.91percent people are unemployed in the Current Daily Status basis.

- II. During the *Recession Period* (66th NSS Round), the basis of Usual Principle Status & the unemployed person is at 1.25 percent. 1.29 percent persons are unemployed in Current Weekly Status. Moreover, 3.99 percent of the people are unemployed in Current Daily Status basis.
- III. In the *Post-Recession Period* (68th NSS Round), basis of Usual Principle Status &unemployed person is at 1.38 percent and 1.40 percent persons are unemployed in Current Weekly Status. 4.25 percent of the people are unemployed in Current Daily Status basis.

This clearly describes that in the pre- recession National Sample Survey Organisation round, the Current Weekly Status and Current Daily Status is at the highest but the Usual Principle Status is lowest than in the other National Sample Survey Organisation rounds. Further, the National Sample Survey Organisation round data also reveals that during the recession the Usual Principle Status increased but the Current Weekly Status and Current Daily Status reduced. In the post-recession phase, as per the National Sample Survey Organisation round, the Usual Principle Status, Current Weekly Status and Current Daily Status all increased in comparison to the National Sample Survey Organisation round on (P & Verma, 2019). Thus the analysis establishes that there is significant reduction of people's employment during the recession phase and the global crisis has had an impact in the Indian economy as well.

4.8 Concluding Facets

Chapter 4 summation clearly indicates that in the Pre-Recession period all variables such as export lending rate and (CPI-IW) general inflation are non-stationary at level but after the first differentiate all the variables are stationary at level one by the Augmented-Dickey Fuller test. Moreover, structural breaks were found in the CPI-IW series so we had to generate one dummy variable as an exogenous variable for removing the breaks in CPI-IW series. After that we have applied the Johnson cointegration for cointegration among the variables and all variables are cointegration, meaning that all variables are among the long run relationship and it is significant. These two tests were confirmed by

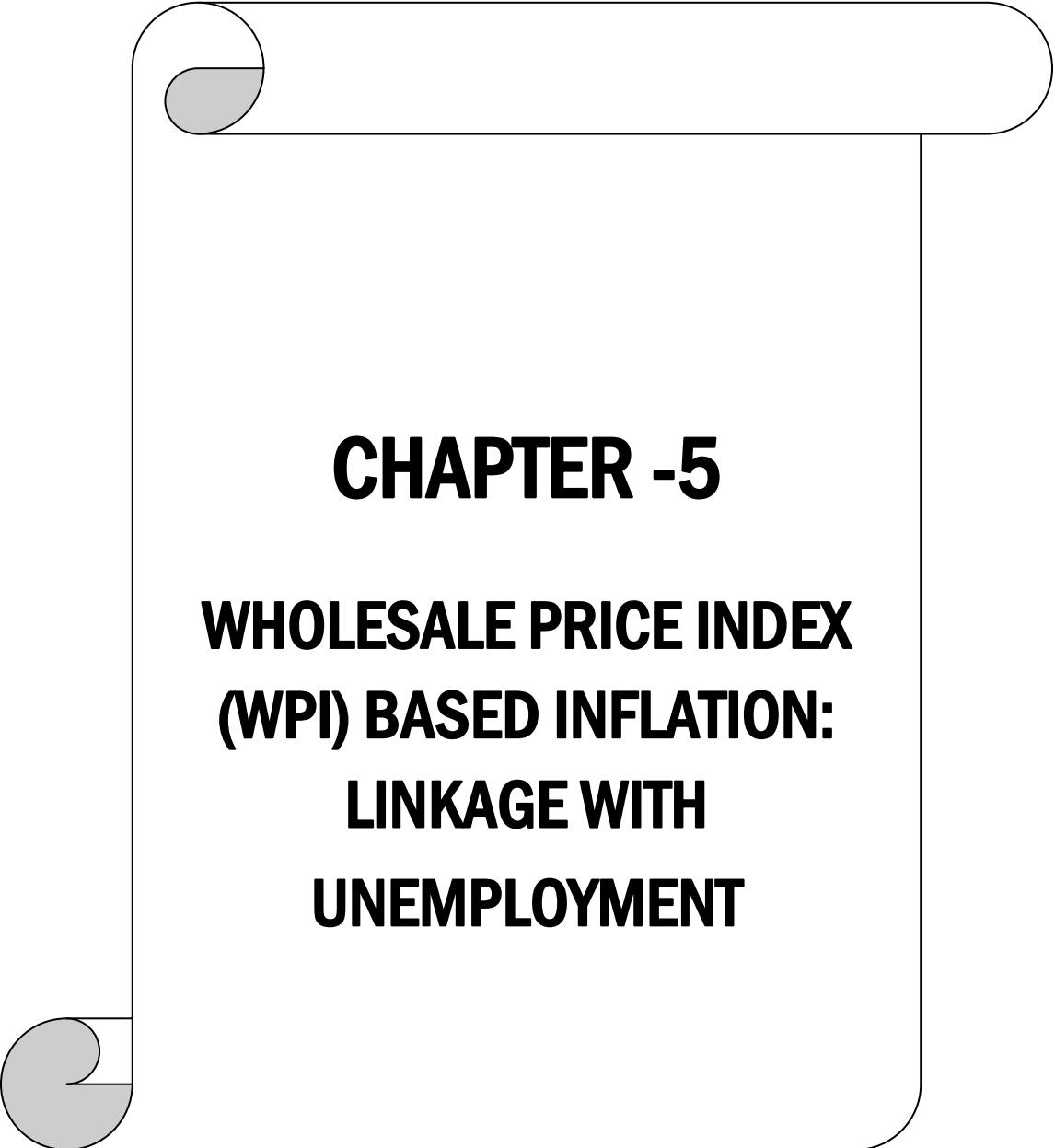
applying the VECM model. Further, the lag selection criterion has suggested that we should choose two lags. In the lending rate, there is long-run causality running from export CPI-IW to Lending rate and there is no any short-run causality running from export CPI-IW to Lending rate. In the export, there is long-run causality running from lending rate and CPI-IW, and short-run causality running from CPI-IW to export and no impact of structural breaks on export and lending rate. In the (CPI-IW) inflation rate there is no short-run or long-run causality running from lending rate and export to (CPI-IW) inflation rate.

During the Duration of Recession Period: All variables such as export lending rate and (CPI-IW) general inflation are non-stationary at level but after first differentiate all the variables are stationary by the Augmented-Dickey Fuller test. Moreover, structural breaks were found in all data series so we generated three dummies variables as exogenous variables for removing the breaks in our data series. After that we have applied the Johnson cointegration for cointegration among the variables and all variables are the long-run association. These two tests were confirmed by applying the VECM model. Further the lag selection criterion has suggested that we should choose two lags. In the export and CPI-IW there are no short run or long run causality and only lending rate is a long-run causality running from export and CPI-IW to lending rate and short-run causality running from export and the lending rate, moreover the shocks of export lending rate and CPI-IW has a significant impact on the lending rate. In other words, it is affected significantly in the Recession period.

In Post-Recession Period: All variables such as export, lending rate and (CPI-IW) general inflation are non-stationary at a level but we have converted them into first differentiate where all the variables are stationary by the Augmented-Dickey Fuller test. After that we have applied the Johnson cointegration test for cointegration among the variables and all variables are cointegration, meaning that all variables are long-run association. These two tests were confirmed by applying the VECM model. Further, the lag selection criterion has suggested that we should choose two lags. In the lending rate, there is long-run causality running from export CPI-IW to Lending rate, and there is also short-run causality running from CPI-IW to the lending rate. In the export there is long-

run causality running from lending rate and CPI-IW, and short-run causality running from CPI-IW to export. In the CPI-IW there is long-run causality running from lending rate and export to CPI-IW and short-run causality running from lending rate and export to Inflation (CPI-IW).

In short, In the Pre-Recession Period, the lending rate was affected due to supply shocks (permanent effect). The export has been affected due to both supply shocks and demand shocks (permanent & temporary effect) and there was no any impact on the inflation rate. During the Recession Period there was no impact on export and inflation rate. Although the lending rate was affected by supply shocks and demand shocks as well as structural breaks were found in export, lending rate, and inflation rate. In the Post-Recession Period, during this period all variables such as export, lending rate, and inflation rate were affected by supply shocks and demand shocks and it is significant and proved (P & Verma, 2018). In addition, to sum up, in this present study we have analysed the comparative descriptive analysis among the quinquennial unemployment rates taking into account the recession period. We found that there is significant impact of global financial on recession and post-recession period in Indian economy.



CHAPTER -5

WHOLESALE PRICE INDEX (WPI) BASED INFLATION: LINKAGE WITH UNEMPLOYMENT

CHAPTER-5

WHOLESALE PRICE INDEX BASED INFLATION: LINKAGE WITH UNEMPLOYMENT

5.0 Overview

This Chapter discusses the relationship between Inflation and Unemployment which are connected through the Phillips Curve theory, specifically during the Financial Crisis, 2008. The analysis done in this chapter also reckons the time period from 2002 to 2015 to understand the relationship between unemployment and inflation in the Indian context. For deducing our empirical facts, we have divided the specified time period in two sub categories which are the Pre-Recession and Post-Recession period.

5.1 Introduction

The relationship between inflation and unemployment are very debatable and frequently used in macroeconomics. Inflation indicates continuous increase in the general price level in the economy. Less inflation is good for economy because it helps in the growth and development of economy. However, high inflation is destructive for economy's development. In Indian economy, two types of price index are mostly used for measurement of inflation, these are: the *Wholesale Price Index* and *Consumer Price Index*. Indian economy started as lowdown in 2007-08 (April-March) after accomplishment of a GDP growth of 9.8 per cent in the last quarter of 2006-07. In fact, Indian economy propagated at an annual average rate of 8.8 percent during the five years ending 2007-08. In the first half of the financial year 2008-09, the growth rate had fallen to 7.8 percent. The pre-crisis slowdown of the economy can be accredited to the tightening of monetary policy right from September 2004 in response to the fear that the inflation was increasing. The monetary contraction became harder in 2006-07 and later in early 2008-09 a huge upsurge in world commodity prices pushed India's inflation similarly high. Inflation measured in terms of wholesale price index (WPI) sickly-looking at 12.9 percent in early August 2008 and endured high for some time. From mid-September till the end of October 2008 the economy was in the control of a serious liquidity crisis and credit crunch as detailed earlier. The Reserve Bank of India (RBI)

acted violently from mid-October to ease the situation by a series of rate cutting and liquidity injecting measures till April 2009 (Joseph, 2009).

Unemployment refers to those people who are available for work at the current wage rate but they do not find the work. Issue of unemployment is a big problem in Indian economy and it creates many social, economic and political problems. There are three measurements for gauging the unemployment in Indian economy. These are: Usual Principle Status, Current Weekly Status and Current Daily Status. Industry is a large employment intensive sector. Once the industrial sector is adversely affected, it has a cascading effect on employment scenario. The services sector is affected because hotel and tourism have significant dependency on high-value foreign tourists. Real estate, construction and transport are also adversely affected. Apart from GDP, the bigger concern is the employment implications¹¹. A survey conducted by the Ministry of Labour and Employment states that in the last quarter of 2008, five Lakh workers lost jobs. The survey was based on a fairly large sample size across sectors such as Textiles, Automobiles, Gems & Jewellery, Metals, Mining, Construction, Transport and BPO/ IT sectors. Employment in these sectors went down from 16.2 million during September 2008 to 15.7 million during *December 2008*¹². We can see this relationship by the Phillips Curve theory. It is the most pertinent tool for policy makers and helps them to gauge the expansion and contraction of money in the economy according to the shape of the Phillips curve. As a result of the severe and the prolonged Global Recession that unfolded in the wake of the 2007–2008 financial crises, special attention was paid to the issue of the shape of the curve. The Global Financial Crisis of 2007-08 has cast its long shadow on the economic prosperities of various countries, resulting in what has often been called the Great Recession. According to *Glen Stevens 2008*, the Governor of the Reserve Bank of Australia, no one could predict the Global Financial Crisis and its impact thereafter, (*Verick and Islam, 2010*). The World Bank estimated that the Great Recession of 2008-09 resulted in an increase in poverty of 64 million people (*World Bank, 2010*). The United States of America is the biggest economy in the world as well as exporter, importer and

¹¹Singh, N.K., 2008, “A matter of trust”, The Hindustan Times, October 20, 2008

¹²GoI, (2009), “Report on Effect of Economic Slowdown on Employment in India”, *Ministry of Labour and Employment*, p. 10.

food supplier of the world. Therefore, any calamity in USA was bound to impact the other economies in the world. Due to Globalisation, even the Indian economy could not be isolated from the present Financial Crisis in the developed economies (*Prasad and Reddy, 2009*). With India's increasing dependence on bilateral trade with other countries and its financial relationship with the advanced economies, the economic shocks across the world also jolted the National economy. The adverse impacts on the Indian economy were reduced export earning, fall in industrial growth, difficulty in generation of foreign exchange reserves, stock market and many others indicators (*Mathew, 2012*).

The Phillips Curve is one of the best knowingly discussed and most often used macroeconomic correlations. The Phillips curve captures the correlations between inflation and unemployment as well as between inflation and the output gap (*Szentmihályi and Világi, 2015*). The policy makers widely used the Phillips curve for policy implication. New Keynesian framework, *Kuttner and Robinson (2010)* found that there has been a flattening of the Phillips curve in the Globalization period in the US. While *Razin and Binyamini (2007)*, *Borio and Filardo (2007)* cite Globalisation as the reason for it, *Roberts (2006)*, among others, argues in favour of firmer anchoring of Inflation expectations. Therefore, many economist, academicians, and researchers still debate the connection between inflation and unemployment. However, this relationship actually exists in the economy. It is important to reckon how they affect each other and is there any relationship between these two variables. To check this relationship we need to examine the Phillips Curve theory (*Maximova, 2016, p. 1*).

Regarding the above issues, the purpose of this present study is to see the impact of Global Financial Crisis on inflation and unemployment in the Indian context. At that time (slowdown period), many were people fired from their jobs and this created more unemployment, while the Inflation was low. Moreover, it had negative impact on the economies for a long time. This study examines if the Phillips curve theory existed in the Pre-Recession (2002-08), Post-Recession (2009-15) and during the period from 2002-2015 in the Indian economy. Further, the study would also analyse the extent of changes in the Phillips curve shape in the Pre, Post-Recession. Whether, the shape is vertical, horizontal, flatter, downward, from pre, and post-recession. Moreover, the study also

examines if there is any affect of structural change such as the economic reform in 1991 and Global Financial crisis in the Phillips Curve relationship or not. For this purpose, the study draws reference from the data taken during the phase of 1991 to 2015.

5.1.1 Theory of Phillips Curve

The enunciation and origin of this theory came from the famous economist Alban William Housego Phillips (**A. W. Phillips**). He was the first economist who discovered and presented with convincing evidence the connection between the rate of inflation and the rate of unemployment in the UK economy. His empirical paper was published in the Economics Journal titled “*The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957.*” Phillips theory was based on 100 years of data. He found an inverse relationship between the rate of inflation and rate of unemployment.

When the rate of inflation increases, then the rate of unemployment decrease and vice versa. Phillips curve slope is downward. After that, many economists found a stable relationship between the rate of inflation and the rate of unemployment and used it for policymaking. Economists like *Lipsay (1960)*, *Phelps (1967)*, *Leijonhufvud (1968)*, *Samuelson & Solow (1970)* and *Gordon (1971)* supported the Phillips Curve theory. But Phillips curve failed to explain the economic crises of the 1970s. Thus, some economists cited the delimits of the Phillips Curve theory, in particular, *Phelps (1967)*, *Friedman (1968)*, *Lucas (1976)* and *Okun (1975)* argued against the hypothesis.

There were many debates among the researchers and economists on the Phillips curve shape in the economy. Some economists re-examined this relationship and many economists supported it while on the other side, few economists criticized by Phillips curve. There are three ideologies on the Phillips curve which are: the *Classical (Keynesian)*, *Monetarist* and the *Neo-Classical*.

5.1.2 According to the Keynesian Approach: Some of the traditional Keynesians followers like Lipsay, Samuelson, and Solow tried to give theoretical justification for the described connection. Their belief was based on the concept of Static expectations.

According to them, there is some alternative between inflation and unemployment, i.e., the Phillips curve is interpreted as a certain law, a certain dogma. For example, if aggregate demand will increase, respectively the same will trend in the demand for a factor of production. They have assumed the static expectation or no change in people's expectation.

5.1.3 According to the Monetarists Approach: Monetarist economists such as Almond Phelps and Milton Friedman criticized Keynesian visions through the adaptive expectations. According to them, people's expectations are not fixed, because it is changeable and people are not money illusion. Their opinions are changeable according to their adaptive expectations based on past experience. In the long run, actual inflation and expected inflation is equal, therefore, there is no inverse relationship between the rate of inflation and rate of unemployment.

5.1.4 According to the Neo-Classical Approach: Which was supervised by Lucas, the Neo-classical approach used the term of rational expectations for criticizing the monetarist economists. They believed that inflation is based on present and future and information is available to the consumers. Hence, there is no short run or long run relationship that exists between the rate of inflation and the rate of unemployment.

Hence, it is evident that there are three different tangents to address and interpret the Phillips curve theory. The Phillips curve theory propounds an inverse relationship between the rate of Inflation and the rate of Unemployment in the economy. Phillips found a stable and inverse relationship between inflation and unemployment, though he did not talk about the short term or long term phases. According to Milton Friedman, two studies have described the possibility of Phillips curve; first is the short run and the second is the long run relationship between the rate of inflation and rate of unemployment.

5.1.5 Short Run Period: Phillips curve theory described that there is an inverse relationship between the rate of inflation and rate of unemployment. If the money wage rate is increasing then the rate of unemployment decreases whereas if the money wage

rate is decreasing, then the rate of unemployment increases. This is the downward and negative slope.

5.1.6 Expectations and the Long Run Phillips Curve: The phenomenon of stagflation and the break down in the Phillips curve led the economists to lay more emphasis on the role of expectations in the relationship between unemployment and inflation. Economists opined that the workers and consumers tend to adapt and alter their expectations for future inflation rates based on the present rates of inflation and unemployment. Hence, the inverse relationship between inflation and unemployment could only hold over the short run.

When the central bank increases inflation with the intent to contain and reduce unemployment, there may be an initial shift along the short run Phillips curve. However, as workers and consumers' expectations about inflation adapt to the new environment, in the long run the Phillips curve itself can shift outward. This is more prevalent around the Natural Rate of Unemployment or NAIRU (Non Accelerating Inflation Rate of Unemployment). Thus, it becomes evident that in the long run as expectations are tempered to adapt to the possibilities of changes in the inflation rates, then the Phillips curve resembles the vertical line at the NAIRU.

During stagflation, as soon as the workers and consumers become aware of the fact that there is likely to be a revision or expansion of monetary policy, there is a growing tendency to expect higher inflation rates. This rationale can cause an outward shift in the short run Phillips curve even before the expansionary monetary policy has been implemented. In such a situation, any policy would become ineffectual in lowering the unemployment. And, in effect, the short run Phillips curve also becomes a vertical line. In the Long run period there is a direct relationship between the rate of inflation and rate of unemployment. If money wage rate increases then the wage rate of unemployment also increases. Due to the adaptive expectations, the Actual Rate of Inflation and Potential Rate of Inflation is equal in the long run, therefore Phillips curve slope is vertical in the long run.

5.2 Objective and Hypothesis of the Study

The key intent of the study is to check whether the original Phillips curve relationship exists or not in the Pre-Recession (2002-2008), Post-Recession (2009-2015) and over the period from 2002 to 2015 in the context of the Indian economy.

Hypothesis

H_0 = There is direct relationship between the rate of inflation and the rate of unemployment in the Pre and Post-Recession period, as well as whole study period in the context of the Indian economy.

H_a = There is inverse relationship between the rate of inflation and rate of unemployment in pre and Post-Recession period, as well as in the whole study period in context of India.

5.3 Period of Time and Data Source

This chapter is essentially based on secondary time series data. The data has been taken from the time period between 2002 to 2015, furthermore, this time period has been divided into two categories which are the Pre (2002-08) and the Post-recession (2009-15). We have taken the data of inflation rate and unemployment rate from reliable authentic database such as the World Bank database. To fulfill our objective we employed, first, the Augmented Dickey-Fuller test for unit root. After that, we used the double log model for removing variance or change of data in percentage form. Polynomial Linear Regression is used for showing the relationship between variables or in other words for curve fitting. Thereafter, the Simple Linear Regression has been used to examine the cause and effect of the relationship.

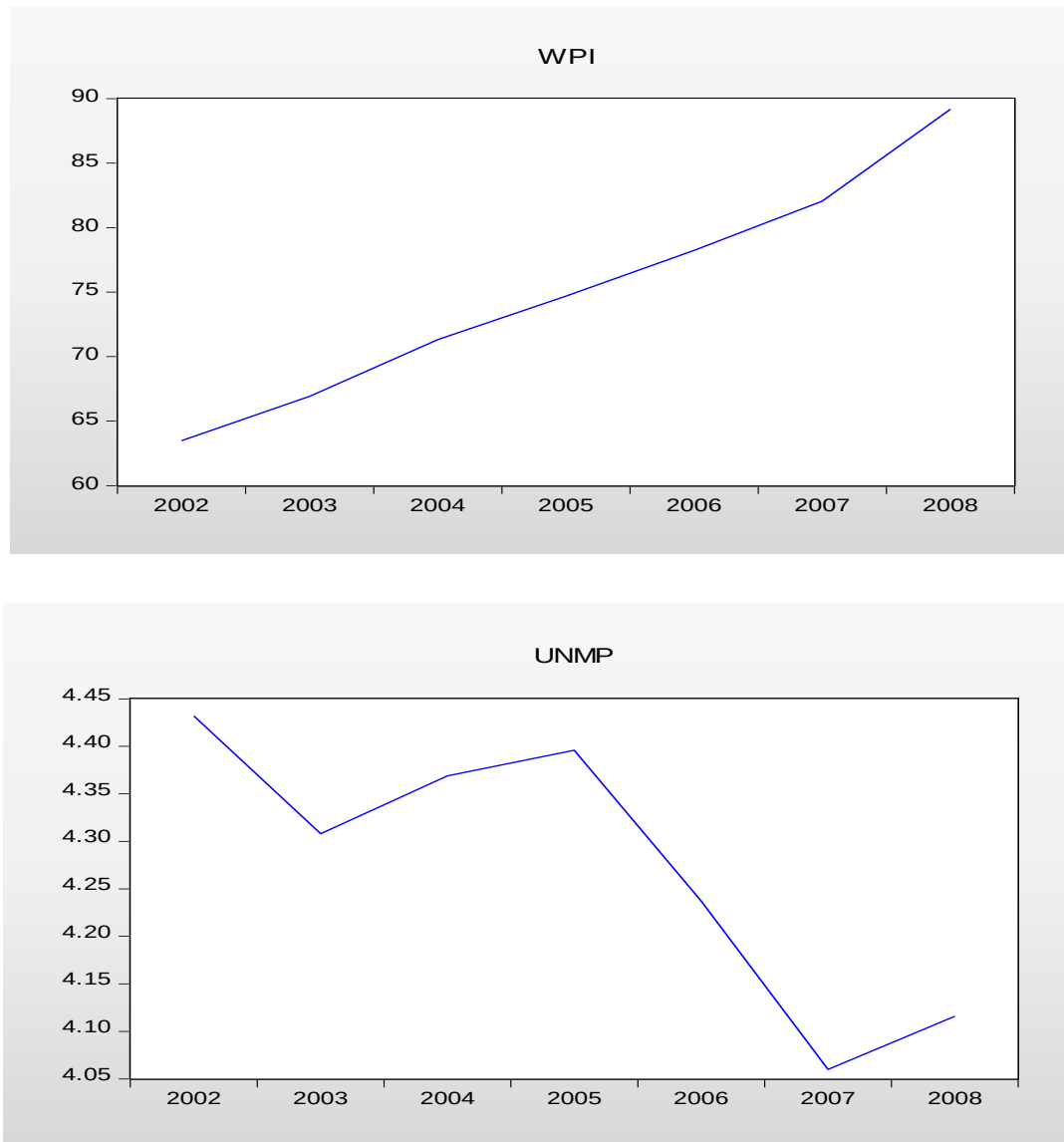
5.4 Methodology and Estimation Process

This study is based on the secondary and time series database. Before applying any test or model on data, it is important to check our variables nature and determine whether they are stationary or non-stationary. This study's data is non-stationary. Therefore, we have applied the Augmented Dickey Fuller test for stationarity. We have found that our

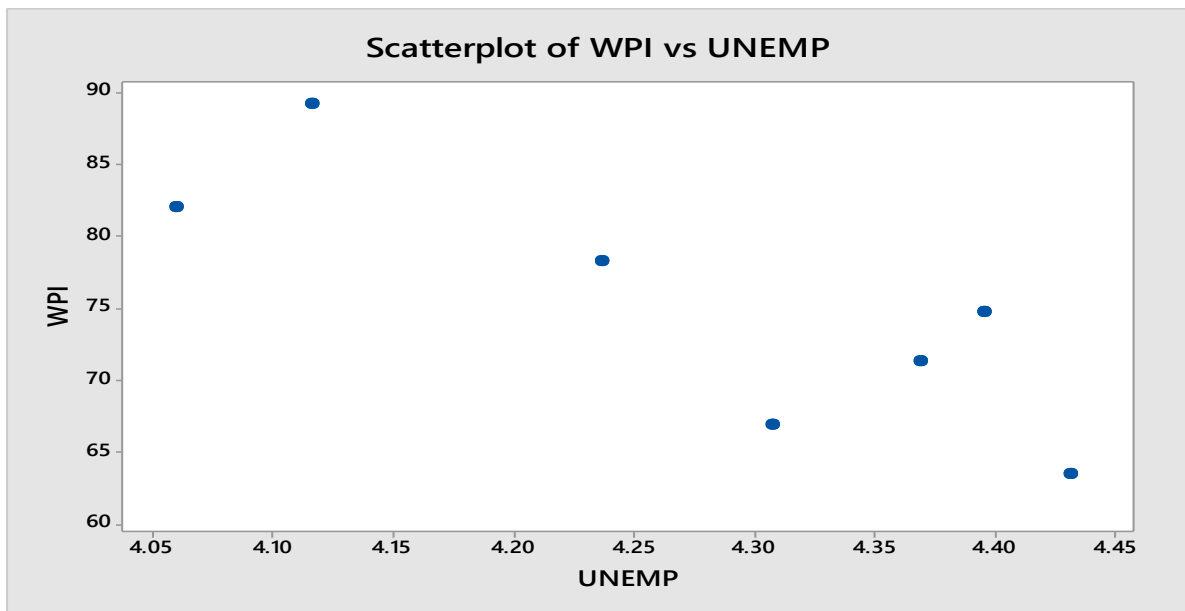
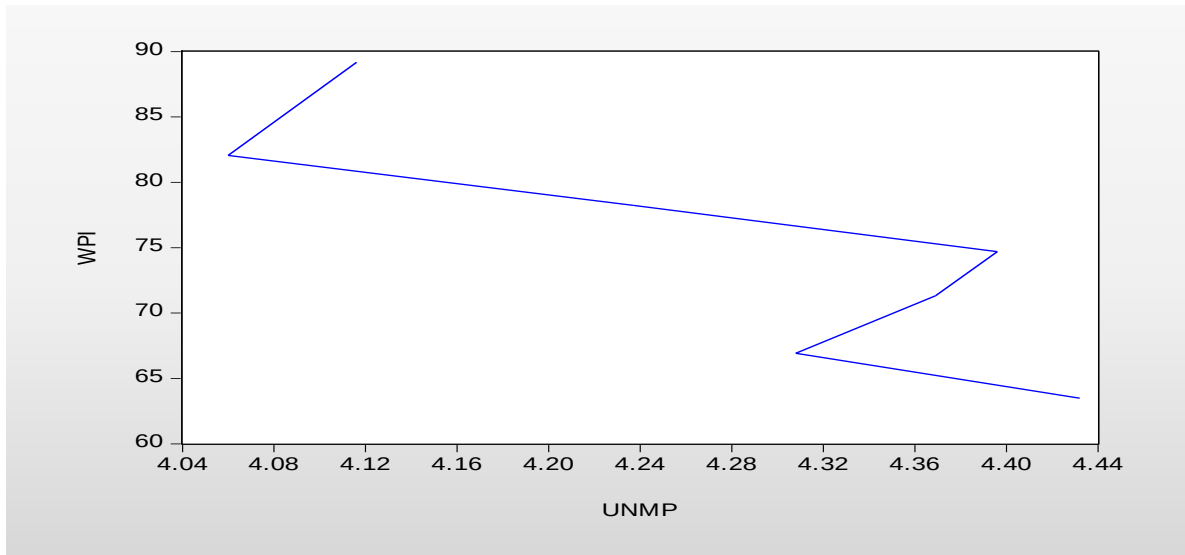
variables are non-stationary in nature. So, we transformed the data from non-stationary to linear by the linear log model $(\log_{10})^{13}$. We have taken both sides log in the dependent and independent variable.

5.5 Pre-Recession Period (2002 -2008)

Figure 5.5.1: Trends of Rate of Inflation and Rate of Unemployment



¹³If you use natural log values for your independent variables (X) and keep your dependent variable (Y) in its original scale, the econometric specification is called a *linear-log model* (basically the mirror image of the log-linear model). These models are typically used when the impact of your independent variable on your dependent variable decreases as the value of your independent variable increases.



Data Source: World Bank

The above graphs show the trends in inflation and unemployment during the pre-recession period. The pre-recession period is showing an increased trend of inflation and decreased trend of unemployment, furthermore, its combination shows a downward slope. Y-axis represents the inflation rate (WPI) and the Y-axis represents the unemployment rate. In addition, scatter Plot also plotted.

5.5.1 Unit root Test for Stationary: Augmented Dickey Fuller

Named after the American statisticians David Dickey and Wayne Fuller, who developed the test in 1979, the Dickey-Fuller test is used to determine whether a unit root (a feature that can cause issues in statistical inference) is present in an Autoregressive Model. The formula is appropriate for trending time series like asset prices. It is the simplest approach to test for a unit root, but most economic and financial times series have a more complicated and dynamic structure than what can be captured by a simple autoregressive model, which is where the augmented Dickey-Fuller test comes into play¹⁴.

Earlier testing whether any cointegration exists between inflation and unemployment the standard augmented dickey fuller test is applied to check for the order of cointegration of variables in table 5.5.1 below.

Table 5.5.1: ADF Test for Difference First Order Data, (2002 to 2008)

Variables	ADF value DF-T Statistics	Critical value of Mackinnon in levels of significance		Result of Test	Stationary or not Stationary
		1%	5%		
Inflation	-0.490701	-5.604618	-3.694851	H ₀ is accepted	Not stationary
Unemployment	-1.823522	-5.604618	-3.694851	H ₀ is accepted	Not stationary

Table 5.5.1 describes that the data are not stationary at a level; therefore, we have to first convert the data into the first, second and third differentiate of order. However, it was not stationary in any order of differentiate. Variables are non-integrated in any order and also non-stationary.

Curve Fitting with Log Functions in Polynomial Linear Regression model

Simple Regression Functions:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon_t$$

The log transformation permits linear models to fit curves that are otherwise possible only with Nonlinear Regression

$$\text{A log form: } L_N Y = \beta_0 + \beta_1 L_N X_1 + \varepsilon_t$$

¹⁴ www.thoughtco.com

Furthermore, to apply the Simple Linear Regression model for seeing the cause and effect relationship between rate of Inflation and rate of Unemployment.

Curve Fitting by the Polynomial Regression Model

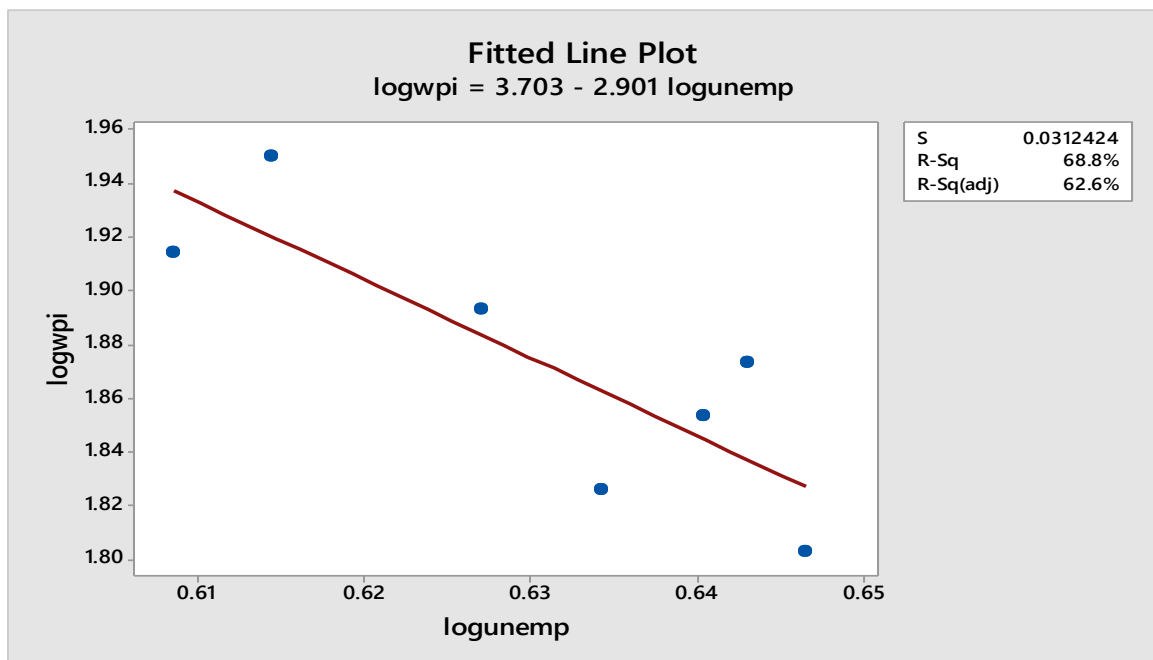
The most common approach to fit curves to the data using Linear Regression is to include Polynomial terms, such as squared or cubed¹⁵.

A polynomial term—A Quadratic (squared) or Cubic (cubed) term turns a Linear Regression Model into a curve. However, because it is X that is squared or cubed, not the Beta coefficient, it still qualifies as a linear model. This makes it a nice, straightforward way to model curves without having to model complicated non-linear models¹⁶. Linear Polynomial is any polynomial defined by an equation of the form

$$P(x) = ax + b$$

Where a and b are real numbers. A linear polynomial is the same thing as a degree 1 polynomial.

Figure: 5.5.2 Curve Fitting by the Polynomial Regression Model



¹⁵blog.minitab.com/.../curve-fi

¹⁶<https://www.theanalysisfactor>

Figure 5.5.2 shows the inverse relationship between rate of inflation and rate of unemployment in the Pre-Recession period. This Polynomial Regression Line is best fit because the standard error is 0.0312424; R-squared value is 68.8 % and Adjusted R square value is 62.6 % which tell us that the model is good and desirable.

Table-5.5.2 Interpretation of ANOVA

Source	SS	DF	MS
Model	.00088116	1	.00088116
Residual	.000399027	5	.000079805
Total	.001280187	6	.000213365

The ANOVA (analysis of variance) table splits the sum of squares into its components.

Total Sum of Square = Residual (error term) Sum of Square + Regression (unemployment) Sum of Square.

Table-5.5.3 Analysis of Regression Coefficient

Log Unemployment	Coef.	Std. Err.	t-stat	P >(t)	Upper	Lower
Log WPI	-.237226	.0713922	-3.32	0.021	-.4207455	-.0537064
Constant	1.074998	.133775	8.04	0.000	.7311187	1.418878

Sources: Authors Estimation from the Secondary Data.

The model can be written in the following functional form:

$$UNEP = f(INF)$$

UNEP = Rate of Unemployment

INF = Rate of Inflation

F = functional relationship

Increasing the model into a Linear Mathematical Relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An Econometric model, by including the stochastic term (ui), is demonstrated below:

$$Y = \alpha + \beta_1 X_1 + \varepsilon_t$$

Y = Rate of Unemployment, α = intercept of y (Constant Coefficient),

β = Slope for X_i (coefficient of X_i) and X_i = independent variable.

but we have taken log with both sides which is called the log Linear Regression Model, so our model becomes:

$$\text{A log form as: } L_N Y = \beta_0 + \beta_1 L_N X_1 + \varepsilon_t$$

Here the output puts on the equation

$$L_N \text{unemployment rate} = 1.074998 + L_{N,INF} \cdot -0.237226 + \varepsilon_t$$

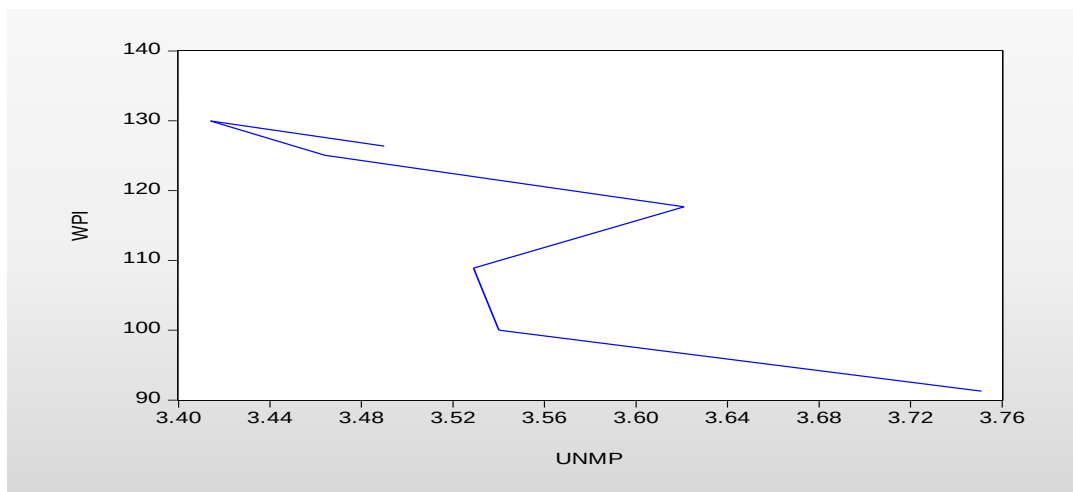
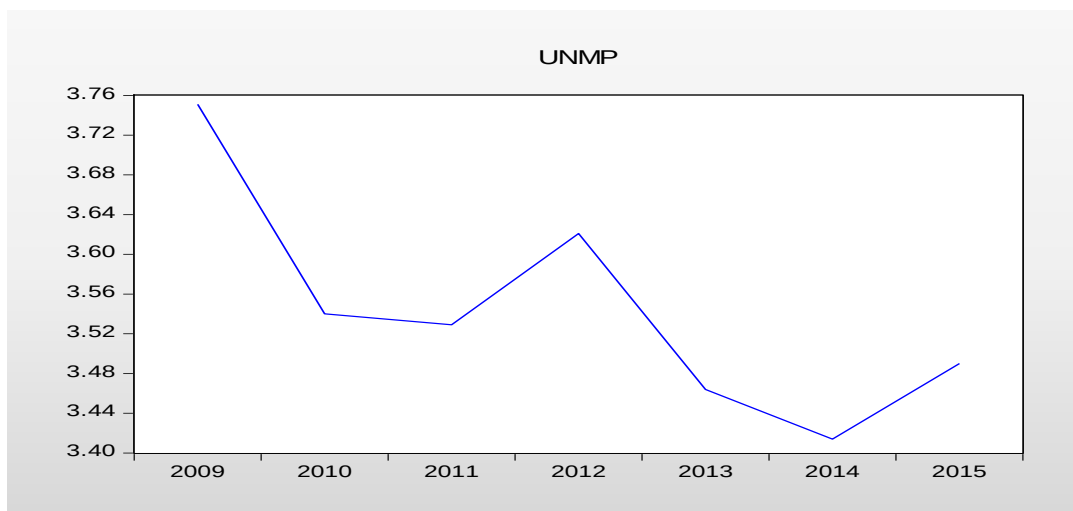
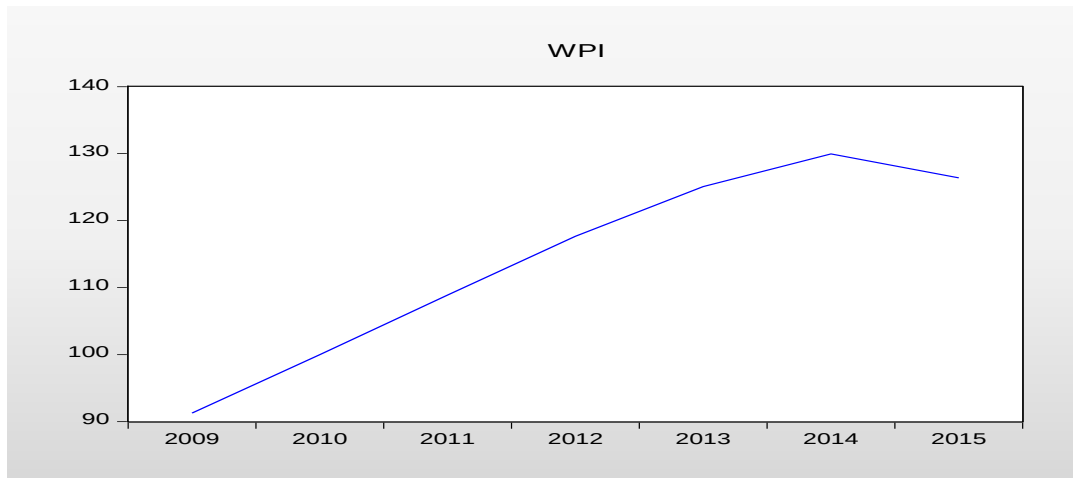
According to the statistical model, one percent change in inflation rate will affect one percent change in unemployment but as noted in the model, coefficient value of inflation is negative. Hence, there is inverse relationship between the rate of inflation and rate of unemployment in Pre-Recession period.

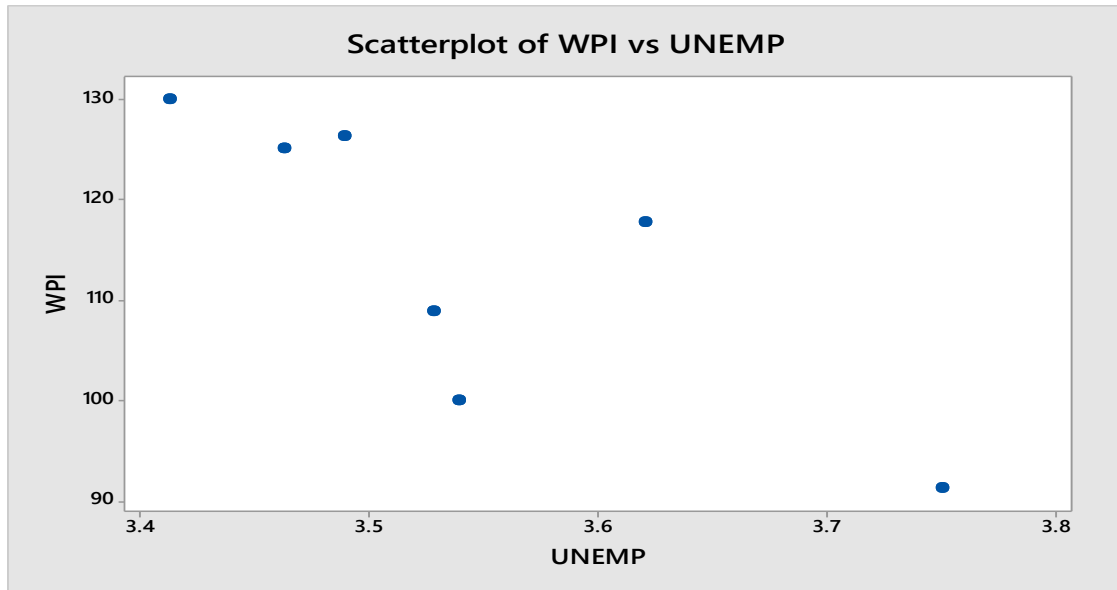
Analysis of Regression coefficient- The coefficient value is (1.074998), Standard. Error. (.0713922). t-stat (-3.32) and p value (0.021). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There is positive relationship between the rate of inflation and rate of unemployment in the Pre-recession period and $H_0 \neq 0$. While the p value is more than t-stat ($0.021 > -3.32$) but p value significant at 5 % level of significant. Hence, the null hypothesis is rejected at the 5% level of significance and it concludes an inverse relationship between the rate of inflation and rate of unemployment with the pre-recession time.

5.6 Post-Recession Period (2009- 2015)

Figure 5.6.1: Trends of Rate of Inflation and Rate of Unemployment





Data Source: World Bank

The above figures show the trend of inflation and unemployment during the Pre-Recession period. The pre-recession period shows an increased trend of inflation and decreased trend of unemployment. Further, its combination shows a downward shape. Wherever, Y-axis describes the inflation rate (WPI) and X-axis describes the unemployment rate. In addition, the scatter plot also plotted.

Table 5.6.1: ADF Test for Difference First Order Data, (2009 to 2015)

Variables	ADF value DF-T Statistics	Critical value of Mackinnon in levels of Significance		Result of test	Stationary or not stationary
		1%	5%		
Inflation	8.641810	-5.604618	-3.694851	H₀ is accepted	Not stationary
Unemployment	-2.582061	-5.604618	-3.694851	H₀ is accepted	Not stationary

Table 5.6.1 describes that the data is not stationary at level; therefore, we have to first convert it into the first, second and third differentiate of order. However, it was not stationary in any order of differentiate. Variables are non-integrated and non-stationary.

Figure 5.6.2 Curve Fitting by The Polynomial Regression Model

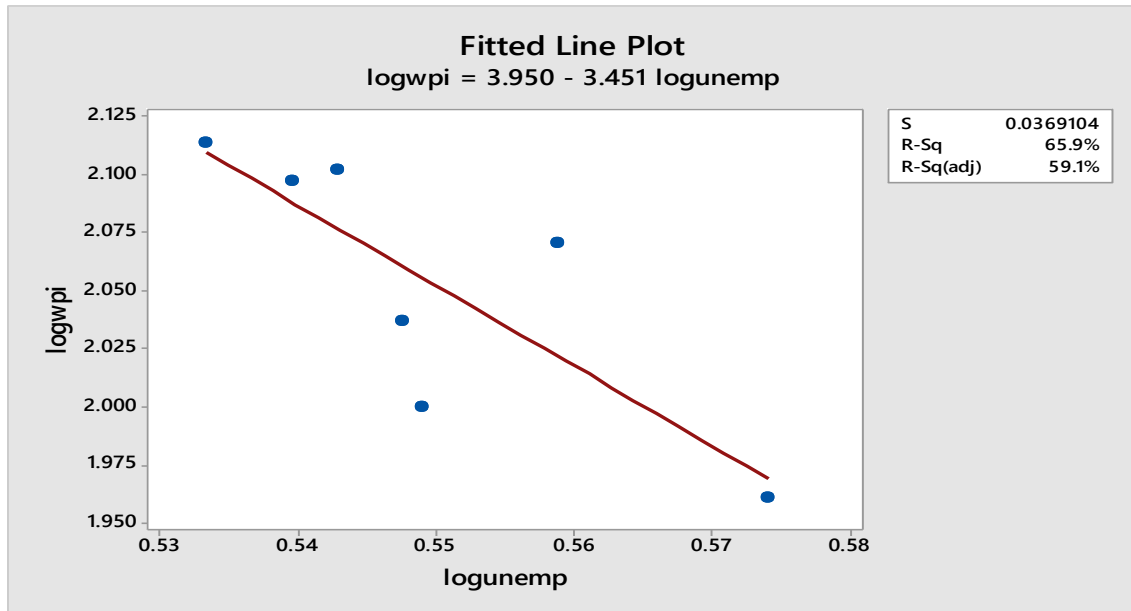


Figure 5.6.2: this figure shows the inverse relationship between rate of inflation and rate of unemployment in post-recession period. This polynomial regression line is best fit because Standard Error is 0.0369104; R-squared value is at 65.9 % and Adjusted R Square Value is 59.1 % which tell us that model is good and desirable.

5.6.1 Analysis of Regression Result

Table 5.6.2 Interpretation of ANOVA

Source	SS	DF	MS
Model	.000727725	1	.000727725
Residual	.000376852	5	.00007537
Total	.001104577	6	.000184096

The ANOVA (analysis of variance) table splits the Sum of Squares into its components.

Total sum of square = Residual (error term) sum of square + regression (unemployment) sum of square.

Table 5.6.3 Analysis of Regression Coefficient

Log Unemployment	Coef.	Std. Err.	t-stat	P >(t)	Upper	Lower
Log WPI	-.1909133	.0614403	-3.11	0.027	-.3488505	-.032976
Constant	.9415353	.1262639	7.46	0.001	.6169637	1.266107

Sources: Authors Estimation from the Secondary Data.

The model can be written in the functional form as follows:

$$UNEP = f(INF)$$

UNEP = Rate of Unemployment

INF = Rate of Inflation

f = functional relationship

Increasing the model into a Linear Mathematical Relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An econometric model, by including the stochastic term (ui), thus our model becomes:

$$Y = \alpha + \beta_1 X_1 + \varepsilon_t$$

Y = Rate of inflation, α = intercept of y (constant coefficient),

β = slope for X_i (coefficient of X_i) and X_i = independent variable.

but we have taken log with both side: which is called log log linear regression model so our model becomes:

$$\text{A log form as;} \quad L_N Y = \beta_0 + \beta_1 L_N X_1 + \varepsilon_t$$

Here the output puts on the equation

$$L_N \text{unemployment rate} = \beta_0.9415353 + L_N x_{i INF} -.1909133 + \varepsilon_t$$

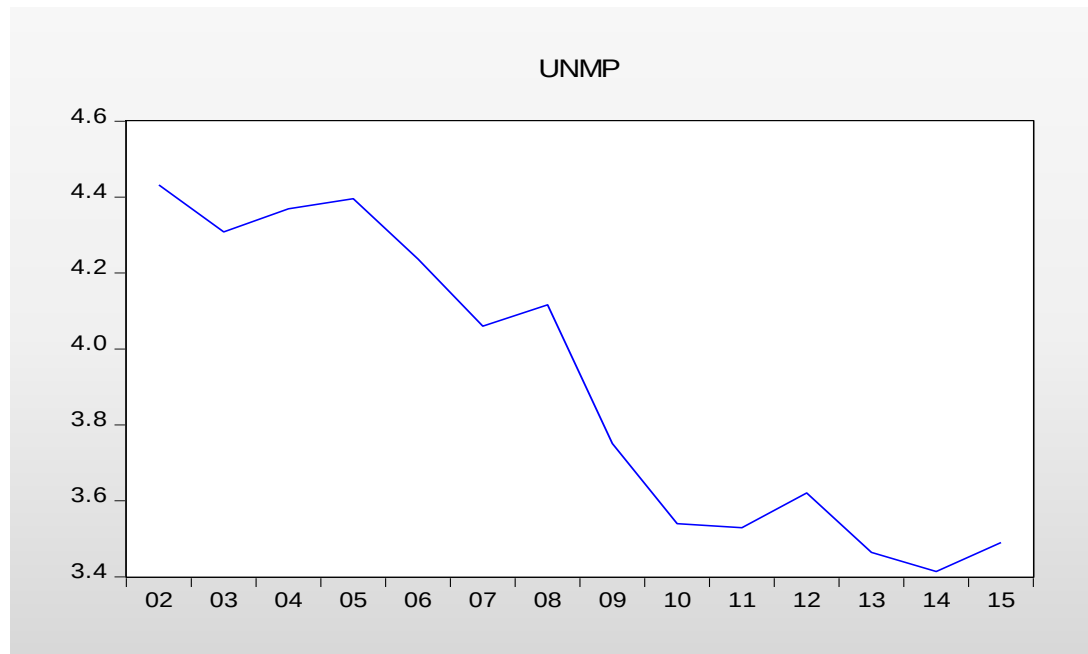
According to the statistical model, one percent change in inflation rate will affect one percent change in unemployment but as noted in the model, coefficient value of inflation is negative. Hence, there is inverse relationship between rate of inflation and rate of unemployment in the Post-Recession period.

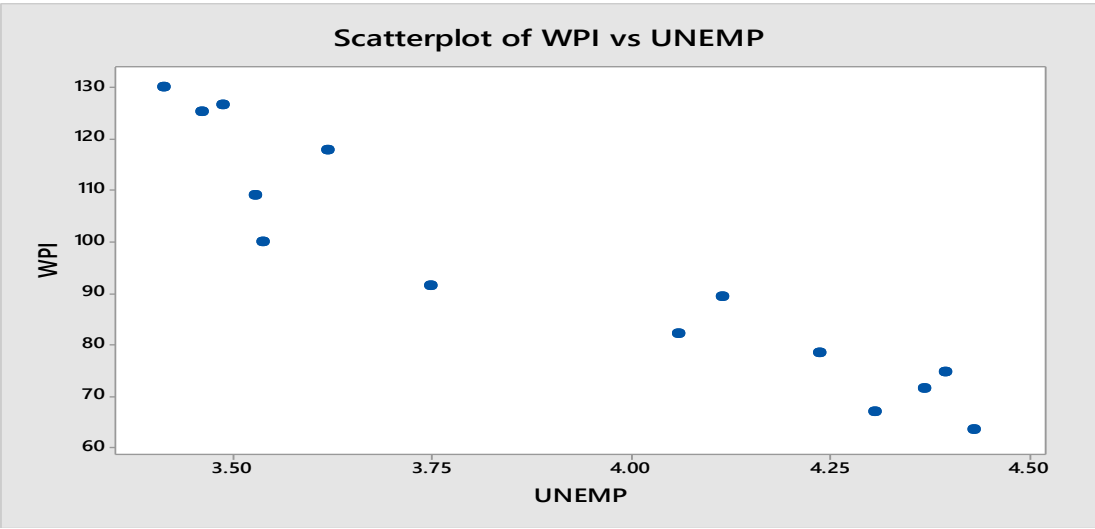
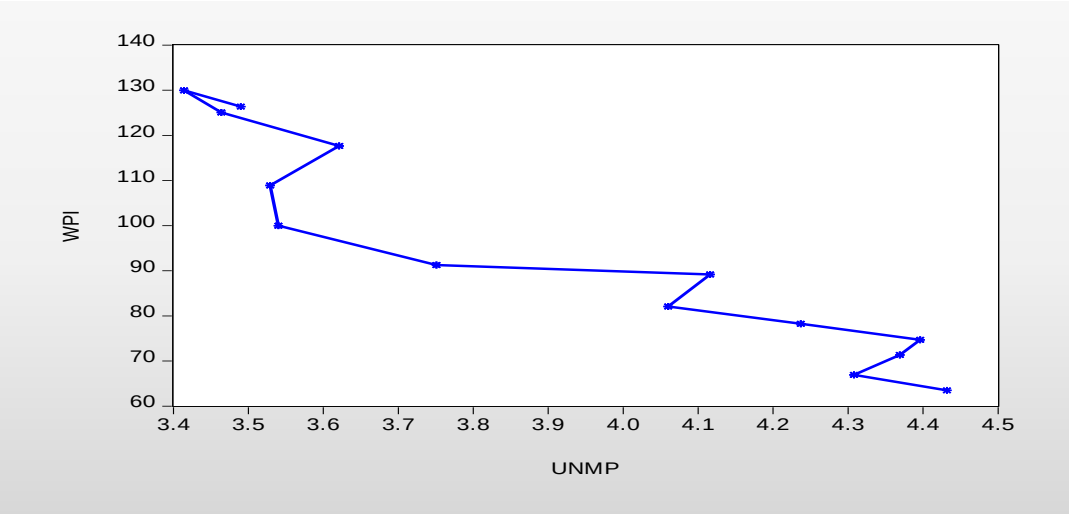
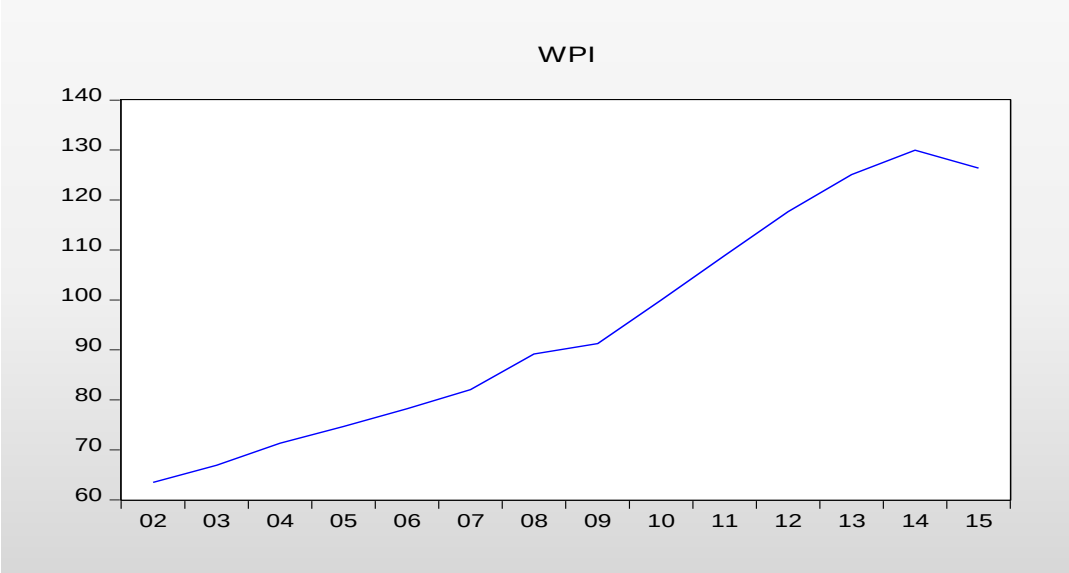
Analysis of Regression Coefficient: The coefficient value is (.9415353), Standard Error (.0614403). t-stat (-3.11) and p value (0.027). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There is no inverse relationship between rate of inflation and rate of unemployment in the Post-Recession period and $H_0 \neq 0$. While the p value is more than t-stat ($0.027 > -3.11$) but p value significant at 5 % level of significance. Therefore null hypothesis is rejected at the 5% level of significance and it concludes an inverse relationship between the rate of inflation and rate of unemployment with post-recession period.

5.7.1 Over period of study 2002 to 2015

Figure 5.7.1: Trends of Rate of Inflation and Rate of Unemployment (2002 to 2015)





Data source: World Bank

The above graphs show the trends in inflation and unemployment from 2002 to 2015 over period. This period shows an increased trend of inflation and decreased trend of unemployment. Its combination shows a downward slope. Here, the Y-axis describes the inflation rate (WPI) and the y-axis represents unemployment rate. In addition, the scatter plot also plotted.

5.7.1 Dickey Fuller Test for Stationary

Table 5.7.1: ADF Test for Difference First Order Data, (2002 to 2015)

Variables	ADF value DF-T Statistics	Critical value of Mackinoon in levels of significance 1% , 5%		Result of Test	Stationary or not stationary
Inflation	-1.395328	-4.121990	-3.144920	H ₀ is accepted	Not stationary
Unemployment	-3.221894	-4.121990	-3.144920	H ₀ is accepted	Not stationary

Table 5.7.1 describes that the data is not stationary at level; therefore, we have to first convert it into the first, second and third differentiate of order. However, it was not stationary in any order of differentiate. Variables are non-integrated and non-stationary.

Figure 5.7.2: Curve Fitting by the Polynomial Regression Model

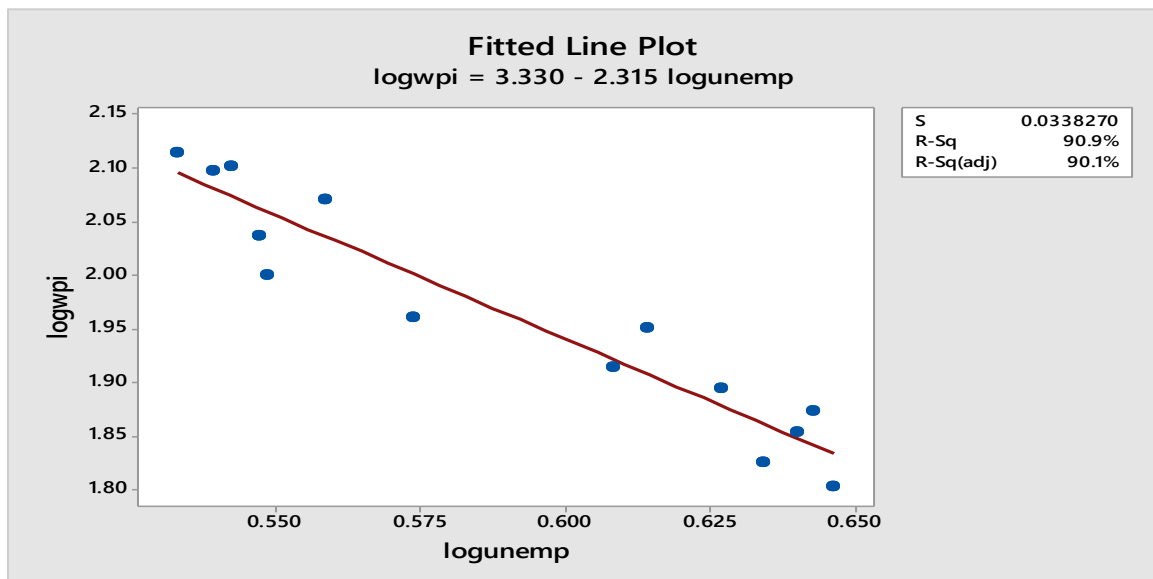


Figure 5.7.2 shows the inverse relationship between rate of inflation and rate of unemployment in this whole study time period for 14 years. Y axis is the rate of inflation (wholesale price index) and X axis is the rate of unemployment. This polynomial regression line is best fit because standard error is 0.0338270; R-squared value, 90.9 % and Adjusted R square value 90.1 % which tell us that the model is good and desirable.

5.7.2 Analysis of Regression Result

Table-5.7.2 Interpretation of ANOVA

Source	SS	DF	MS
Model	.023188761	1	.023188761
Residual	.002328112	12	.000194009
Total	.025516874	13	.001962836

The ANOVA (analysis of variance) table splits the sum of squares into its components.

Total sum of square = residual (error term) sum of square + regression (unemployment) sum of square.

Table 5.7.3 Analysis of Regression Coefficient

Log Unemployment	Coef.	Std. Err.	t-stat	P >(t)	Upper	Lower
Log WPI	-.3925299	.0359042	-10.93	0.000	-.4707584	-.3143014
Constant	1.360823	.0706065	19.27	0.000	1.206984	1.514661

Sources: Authors' Estimation from the Secondary Data.

The model can be written as a functional form as follows:

$$UNEP = f(INF)$$

$$UNEP = \text{Rate of Unemployment}$$

$$INF = \text{Rate of Inflation}$$

f = functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An econometric model, by including the stochastic term (ui), is demonstrated below:

$$Y = \alpha + \beta_1 X_1 + \varepsilon_t$$

Y = Rate of unemployment , α = intercept of y (constant coefficient),

β = slope for X_i (coefficient of X_i) and X_i = (INF) independent variable.

but we have taken log with both side which is called the log linear regression model so our model becomes:

$$\text{A log form as: } L_N Y = \beta_0 + \beta_1 L_N X_1 + \varepsilon_t$$

Here the output puts on the equation

$$L_N \text{unemployment rate} = \beta_0 1.360823 + L_N x_i INF -.3925299 + \varepsilon_t$$

According to the statistical model, one percent change in inflation rate will affect one percent change in unemployment but as noted in the model, coefficient value of inflation is negative. Hence, there is inverse relationship between the rate of inflation and rate of unemployment in this whole study period, for 14 years.

Analysis of Regression Coefficient: The coefficient value is (1.360823), Standard Error (.0359042). t stat (-10.93) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

there is no inverse relationship between rate of inflation and rate of unemployment in this whole study period and $H_0 \neq 0$. While p value is more than t-stat ($0.000 > -10.93$) but p value is significant at 1 percent level, which indicate negative relationship between inflation and unemployment. Therefore null hypothesis is rejected at the 1% level of significance and it concludes an inverse relationship between the rate of inflation and rate of unemployment in pre, post and over the time period of this study.

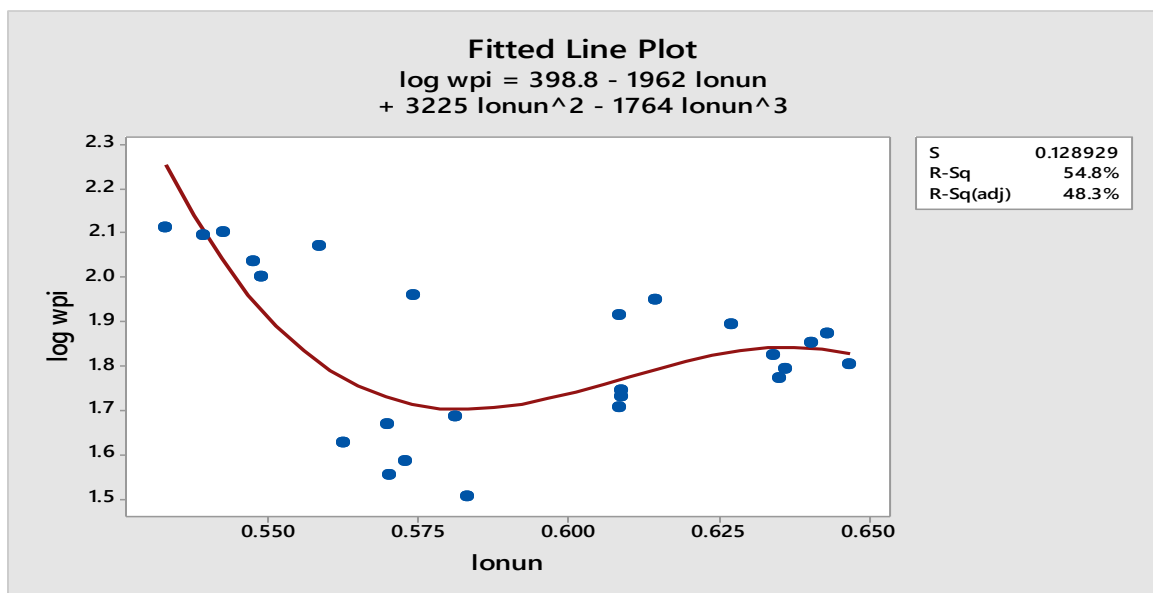
In addition, we have estimated the Phillips curve shape from 1991 to 2015. As well as to check the validity of shape, short run and long run existence in Indian economy by the ARDL model.

Before applying any model we have to first check the data's nature for the spurious or nonsense relationship. Since we found structural breaks, therefore, both tests such as Dickey Fuller and Phillips Perron test are used in this study. After that, the unit root checking by Augmented Dickey Fuller test and Phillips perron test found that one variable data series is stationary at level and second variable data is stationary at level one. According to the data's nature we have applied the Auto Regressive Distributive Lag (ARDL) Model.

We draw the Phillips curve using log-log model (algorithm) model to remove the variance of series so, we have taken the $\log^{10}$ after that plotted the Phillips curve shape by the polynomial regression.

5.8 Extended time period 1991 to 2015

Figure 5.8.1: Phillips Curve Shape using Polynomial Regression Model



This figure 5.8.1 shows the inverse relationship between rate of inflation and rate of unemployment for some time after that it shows the direct relationship between rate of inflation and rate of unemployment in the Indian context from 1991 to 2015, although we have found unidirectional (one-way) relationship in these variables and not bi-directional (two-way) relationship.

Table 5.8.1: The Summary of Descriptive Analysis

Variable	Inflation	Unemployment	Dummy UNEP.	Dummy INF.
Mean	73.95298	3.921160	0.320000	0.360000
Median	66.92171	3.832000	0.000000	0.000000
Maximum	129.9643	4.432000	1.000000	1.000000
Minimum	31.89419	3.414000	0.000000	0.000000
Std. Dev.	30.04892	0.332437	0.476095	0.489898
Skewness	0.513636	0.078996	0.771744	0.583333
Kurtosis	2.104017	1.613511	1.595588	1.340278
Jarque-Bera	1.935495	2.028451	4.536172	4.287280
Prob.	0.379938	0.362683	0.103510	0.117227

Data source: World Bank

Table 5.8.1 clearly demonstrates the disposition of the data series. Converging over the value of Skewness, the regress and variables have positively skewed, implying long right tail about the mean and the regressors closer to normal distribution though positive. Now if we stress over the value of kurtosis, except the independent variable all the dependent variables have an almost non normal distribution with kurtosis below to 3. The Jarque-Bera test indicates residuals are normally distributed.

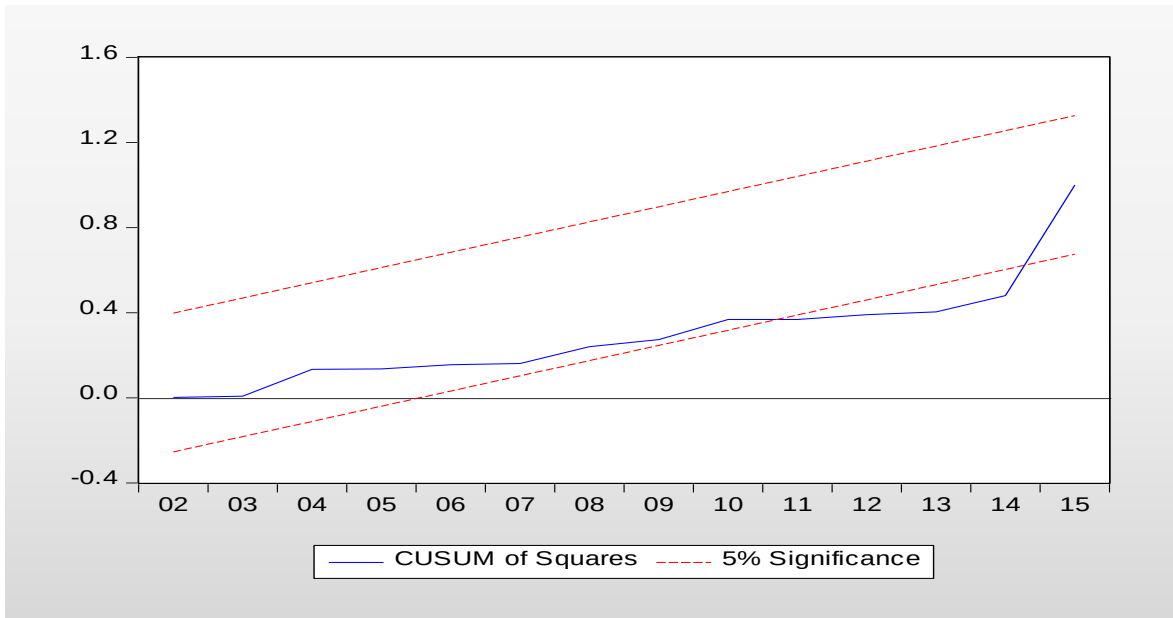
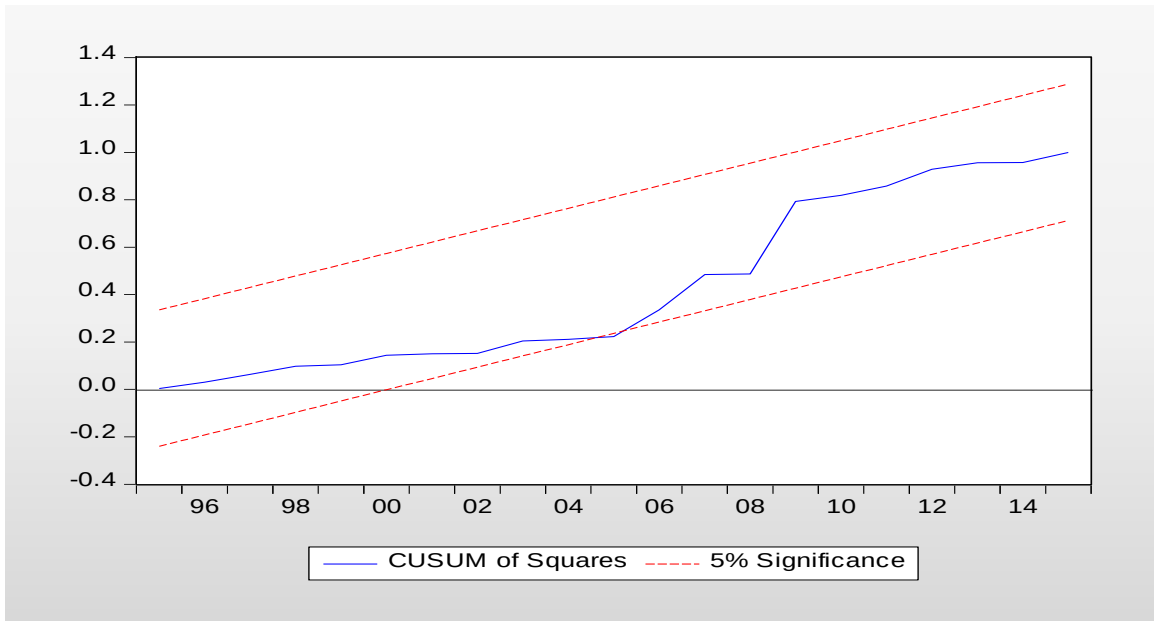
Outliers

Outliers indicates that when an event has affected the trend of a particular series or a movement in particular series is distorted or when there is a visible difference between the past and future movements in a particular series that change is considered a structural break.

5.8.1 Preliminary Test

The figure 5.8.2 is verified form of sign of some structural breakdowns in the chosen period presented through CUSUM-Square test.

Figure 5.8.2: CUSUM-Square test



5.8.2: Testing for Structural Breaks

We applied recently developed Kim and Perron (2009) single structural break unit root test to isolate single unknown structural shocks that are streaming into series.

Table 5.8.2 Kim and Perron (2009) Structural Break Unit root Test

Variable	Break Period	t-stat. level	Prob.	Decision
Unemployment	2008	-6.256629	0.000*	Stationary
Inflation	2007	-3.402898	0.4394	Non-Stationary

* shows the significance at 1 % level of significance

Table 5.8.2 presented the Kim Perron test results founds that two structural breaks date. We have worked on both break dates.

5.8.3: Checking Stationary of Data, through the Augmented Dickey Fuller Test and Phillip Perron Test

Table 5.8.3: ADF Test for Differences First Order Data (1991 to 2015)

Variables	ADF Value DF-T Statistics	Critical value of Mackinnoon in levels of significance 1% 5%		Result of Test	Stationary or no Stationary
LnInflation (WPI)	-2.135607	-3.737853	-2.991878	H0 is accepted	Non-Stationary
Ln Unemployment	-3.947424	-3.752946	-2.998064	H0 is rejected	Stationary

Table 5.8.3 describes the Augmented-Dickey Fuller Test result and it tells us that the series of inflation is non-stationary at the level, although the series of Unemployment is at a stationary at level. So in this dataset one variable is at stationary level and one series is at stationary level one. All variables are mix stationary so we have applied Auto Regressive Distributed Lag (ARDL) model. We have also used Phillips perron test for stationarity.

Table 5.8.4: Phillips Perron Test for Differences First Order Data (1991 to 2015)

Variables	Phillips Perron Value DF-T Statistics	Critical value of Mackinnon in levels of significance		Result of Test	Stationary or no Stationary
		1%	5%		
LnInflation (WPI)	-1.888000	-3.737853	-2.991878	H0 is accepted	Non- Stationary
Ln Unemployment	-3.947424	-3.752946	-2.998064	H0 is rejected	Stationary

Table 5.8.4 describes the Phillips Perron test result and it tells us that the series of inflation is non-stationary at the level, although the series of Unemployment is at a stationary at level. So in this dataset one variable is at stationary level and one series is at stationary level one. All variables are mix stationary. Both tests confirmed that we should apply Auto Regressive Distributed Lag (ARDL) model.

5.8.4: Lag Length Criteria

The maximum dependent and dynamic regress or lag limit according to AIC, SC and HQ criteria for annually data is chosen one. The table 5.8.5 represents optimal lag criteria.

Table 5.8.5: Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	55.24159	NA	2.15e-05	-5.070627	-4.971149	-5.049038
1	125.5970	120.6092*	3.89e-08*	-11.39019*	-11.09175*	-11.32542*
2	129.5188	5.976184	3.98e-08	-11.38275	-10.88536	-11.27480
3	130.5551	1.381717	5.46e-08	-11.10049	-10.40414	-10.94936
4	135.5028	5.654460	5.33e-08	-11.19074	-10.29544	-10.99644

The figure 5.8.5 shows the lag length criteria and this lag selection criteria model has suggested that we should choose lag one because in this case there are three main criteria is significant such as AIC, SC and HQ.

Table 5.8.6: Short ARDL Determination (1,0) Model Dependent Variable**Short Run ARDL Model**

Dependent Variable Δ Unemployment , ARDL(1, 0, 0, 1) Model based on AIC Criteria				
Regressor or independent variable	Coefficient	Standard Error	t-Ratio	p-value
Lag 1 Unemployemnt	0.805311	0.095234	8.456135	0.0000*
Inflation	0.069475	0.033939	2.047066	0.0540***
Dummy inflation	-0.029432	0.006139	-4.794258	0.0001*
Dummy unemployment	-0.010471	0.012823	-0.816553	0.4238

The table 5.8.6 shows the clear association between the rate of unemployment and rate of inflation in short run. Although the lagged unemployment and own lagged value of inflation has a positive impact on rate of inflation, it means direct relationship between them in the short run. while The taking account of (dummy inflation) shock of Global Financial crisis has negative impact on the rate of inflation, this means that in the negative association between rate of inflation and rate of unemployment in the short run, Phillips curve theory exists.

We can write the above result in equation form:

$$unemployment = \alpha_0 + \beta_1 \Delta_{t-1} + \beta_2 \Delta + \beta_3 \Delta + \beta_4 \Delta + \varepsilon_t$$

$$unemployment = \alpha_0 + \beta_1 \Delta_{lag\ unemp} + \beta_{inf} \Delta_{inf} + \beta_{dummyinf} \Delta_{dummyinf} + \beta_{dummyunemp} \Delta_{dummyunemp} + \varepsilon_t$$

$$unemployment = \alpha_0 + \beta_1 0.805311^* + \beta_2 0.069475^{***} + \beta_3 -0.029432^* + \beta_4 -0.010471 + \varepsilon_t$$

5.8.5: ARDL Specification Results

Bound Test Approaches to Co-integration:

Table 5.8.7: Result of Bound Test

ARDL Model Model: Unemployment = f (Inflation)		
Model	F-statistics	K
Unemployment	2.641292	1
Critical Values	Upper Bound (1)	Lower Bound(0)
10% level	3.28	2.44
5% level	4.11	3.15
1% level	6.02	4.81
K represents number of independent factors		

The table 5.8.7 shows the F-statistics that suggests that in this result f statistics value is between upper bound and lower bound at 10 percent level of significance and we have no clarity about whether there is a long run relationship or not. In this ambiguous situation, we can also apply long run ARDL because the f statistics value is the upper bound of the critical values as referred by *Pesaran et al.* (2001). This declaration thereby rejects the null hypothesis of no cointegration in the model. This indicates that there is a long run relationship among the variables in the concerned model.

5.8.6 Order of Lag

Table 5.8.8: F-Statistics for Testing the Existence of Long Run Relationship

Order of lag	F-statistics
1	2.641292

5.8.6 Results and Analysis for the Estimated Long Run Coefficients

After confirming the evidence of long run relationship with the Bound Test, furthermore we carry on to settle for the Estimated Long-run results.

Table 5.8.9: ARDL Long Run Model

Dependent Variable Δ Unemployment , ARDL(1, 0) Model based on AIC Criteria				
Regressor or independent variable	Coefficient	Standard Error	t-Ratio	p-value
Ln unemployment	-0.194689	0.091111	-2.136845	0.0452**
Ln inflation	0.069475	0.031766	2.187057	0.0408**
Dummy inflation	-0.029432	0.014832	-1.984337	0.0611***
Dummy unemployment	-0.010471	0.017571	-0.595918	0.5579

****, **And *** show significance level at 1%, 5% and 10% level, respectively.***

This table 5.8.9 shows ARDL model's long run result which clearly shows association between rate of unemployment and rate of inflation. Own lagged of unemployment is negative or inverse impact on rate of unemployment at the 5% level of significance and the rate of inflation has a positive impact on rate of unemployment at 5% level of significance. Although, the shock of Global Financial Crisis is negative or has an inverse impact on the rate of unemployment in the long run. There is also a direct relationship between the two variables in the long run. The (dummy inflation) shock of Global Financial Crisis has negative impact on the rate of unemployment and the Phillips Curve theory exists in both the short run and the long run.

$$unemployment = \alpha_0 + \beta_1 \Delta unemployment_{t-1} + \beta_2 \Delta inflation_{t-1} + \beta_3 \Delta dummyinflation_{t-1} + \beta_4 \Delta dummyunemployment_{t-1} + \varepsilon_t$$

$$unemployment = \alpha_0 + \beta_1_{-0.194689**} + \beta_2_{0.069475**} + \beta_3_{-0.029432***} + \beta_4_{-0.010471} + \varepsilon_t$$

5.8.7 Error Correction Term

Error Correction Model Specification:

$$\begin{aligned} \text{rate of unemployemnt} = & a_0 + \sum_{i=1}^p a_{1i} \Delta unemployment_{t-1} + \sum_{i=1}^q a_{2i} \\ & \Delta inflation_{t-1} + \sum_{i=1}^q a_{3i} \Delta dummyunemployment_{t-1} + \sum_{i=1}^q a_{4i} \\ & \Delta dummyinflation_{t-1} + \lambda ECT_{t-1} \dots \dots \dots (5) \end{aligned}$$

Table 5.8.10: Error Correction representation of the selected ARDL model

	Coefficient	Standard Error	t-ratio	Prob.
Coint-Eq (-1)	-0.194689	0.082665	-2.355146	0.0288**

For the study period, the equilibrium correction coefficient is -0.194689 for the model. The ECT is both negative and less than one and significant at 5 percent.

As shown in the table 5.8.10: 19.46 Percent of disequilibrium from previous period converges back to the long run equilibrium in the current period.

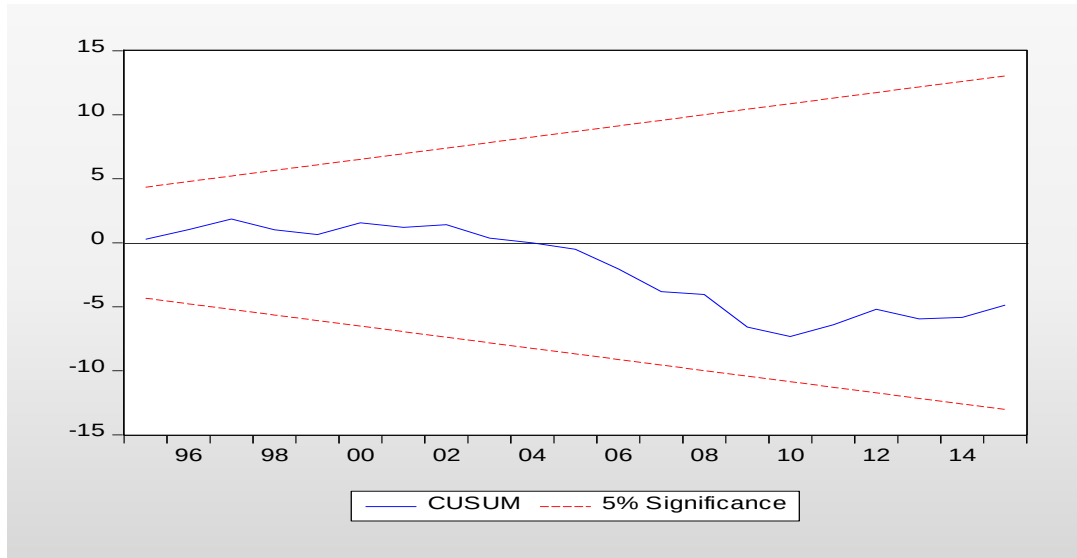
5.8.8: Diagnostic Tests

Table 5.8.11: Diagnostic Tests

Diagnostic Tests			
	Model		
Diagnostic Tests	F-stat	Prob. Value	Obs-R-square
Serial Correlation	2.120940	0.1489	4.577182
Heteroscedasticity	Breusch-Pagan-Godfrey		
	F-stat	Prob. Value	Obs-R-square
	1.484665	0.2463	5.715137
Normal distribution	Jarque-Bera	0.73854	JB 0.673854

The robustness of the estimated model has been verified by numerous diagnostic tests such as serial correlation, Heteroscedasticity test, normal distribution and CUSUM stability test. In the model there is no serial correlation, Heteroscedasticity found, as well error or residual is normally distributed therefore model is good fit. The model stands stable as shown in the CUSUM graph.

Figure 5.8.3: CUSUM Test



Second Model of Inflation

5.8.9: Short ARDL Determination (1, 0) model dependent variable

Table 5.8.12: Short Run ARDL Model

Dependent Variable Δ Inflation , ARDL (1, 0, 0, 0) Model based on AIC Criteria				
Regressor or independent variable	Coefficient	Standard Error	t-Ratio	p-value
Inflation lag one	0.941757	0.032819	28.69522	0.0000
Unemployment	0.205612	0.093795	2.192154	0.0404
Dummy inflation	0.005857	0.006298	0.930084	0.3634
Dummy unemployment	0.020496	0.009412	2.177533	0.0416

The table 5.8.12 shows the short run ARDL model's result, when the inflation is taken as the dependent variable the own lagged value of inflation and the rate of unemployment has positive impact on rate of inflation in the short run period although Global Financial

crisis also has a direct impact of on the rate of inflation. In short, the direct or positive relationship between rate of inflation and rate of unemployment exists in the short run.

5.8.10: Order of Lag

Table 5.8.13: F-Statistics for Testing the Existence of Long Run Relationship

Order of lag	F-statistics
1	30.34332

Table 5.8.14: Result of Bound Test

ARDL Model		
Model: Inflation = f (Unemployment)		
Model	F-statistics	K
Unemployment	30.34332	1
Critical Values	Upper Bound (1)	Lower Bound(0)
10% level	3.28	2.44
5% level	4.11	3.15
1% level	6.02	4.81
K represents number of independent factors		

F-statistics in the table 5.8.14 postulates for the model that the statistics crosses the upper bound of the critical values as referred by Pesaran et al. (2001). This declaration thereby rejects the null hypothesis of no co-integration in the model. This enfolds that there exists a long run relationship among the variables in the concerned model.

5.8.11: Results and Analysis for the Estimated Long run Coefficients

After confirming the evidence of long run relationship with the Bound Test, we carry on to settle for the Estimated Long-run results.

Long run Model Specification

Table 5.8.15: Long Run Model based on Bound Test

Dependent Variable Δ Inflation , ARDL (1, 0, 0, 0) Model based on AIC Criteria				
Regressor or independent variable	Coefficient	Standard Error	t-ratio	p-value
Inflation lag one	-0.058243	0.031924	-1.824464	0.0831***
Unemployment	0.205612	0.089819	2.289174	0.0331**
Dummy inflation	0.005857	0.014786	0.396144	0.6962
Dummy unemployment	0.020496	0.016349	1.253678	0.2244

** **and *** show significance level at 1%, 5% and 10% level, respectively*

The table 5.8.15 shows the long run result between the rate of inflation and rate of unemployment. This model, where the rate of inflation is dependent variable, own lagged of inflation has a negative impact on the rate of inflation at the 10% level of significance and the rate of unemployment has a positive impact on rate of inflation at 5% level of significance. According to the long run results, this model shows that both relationship such as positive and negative between lag unemployment and the inflation rate. However, there is no any impact of structural breaks (Global Financial crisis) in this model.

The long run co-integration relation can be traced in the form of the following equation:

$$inflation = \alpha_0 + \beta_1 I_{t-1} + \beta_2 + \beta_3 + \beta_4 + \varepsilon_t$$

$$inflation = \alpha_0 + \beta_1_{-0.058243***} + \beta_2_{0.205612**} + \beta_3_{0.005857} + \beta_4_{0.020496} + \varepsilon_t$$

5.8. 12: Error Correction Term

Table 5.8.16: Error Correction Representation of the Selected ARDL Model

	Coefficient	Standard Error	T-ratio	Prob.
Coint-Eq (-1)	-0.058243	0.007296	-7.982541	0.0000

For the study period, the equilibrium correction coefficient is -0.058243 for the model. The ECT is both negative and less than one and significant at 1 percent.

As shown in the table 5.8.16: 05.82 Percent of disequilibrium from previous period converges back to the long run equilibrium in the current period.

5.8.13: Diagnostic Tests

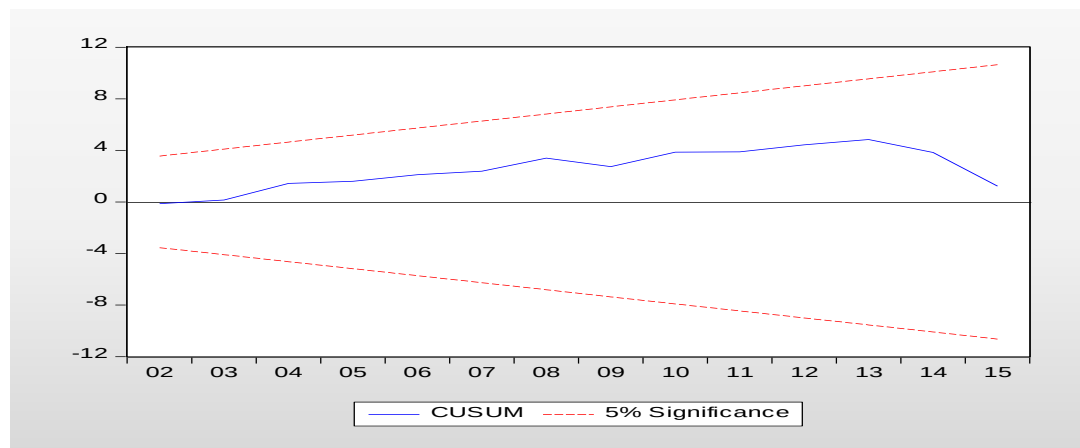
Table 5.8.17: Diagnostic Tests

Table : Diagnostic Tests			
	Model		
Diagnostic Tests	F-stat	Prob. value	Obs-R-square
Serial Correlation	0.933217	0.4115	2.254779
Heteroscedasticity	Breusch-Pagan-Godfrey		
	F-Stat	Prob. value	Obs-R-square
	1.401831	0.2713	5.468932
Normal distribution	Jarque-Bera	0.818316	JB 0.401013

The robustness of the projected model has been check by several diagnostic tests such as serial correlation, Heteroscedasticity test, normal distribution and CUSUM stability test. In the model there is no serial correlation, Heteroscedasticity as well as error or residual is normally distributed, hence the model is a good fit.

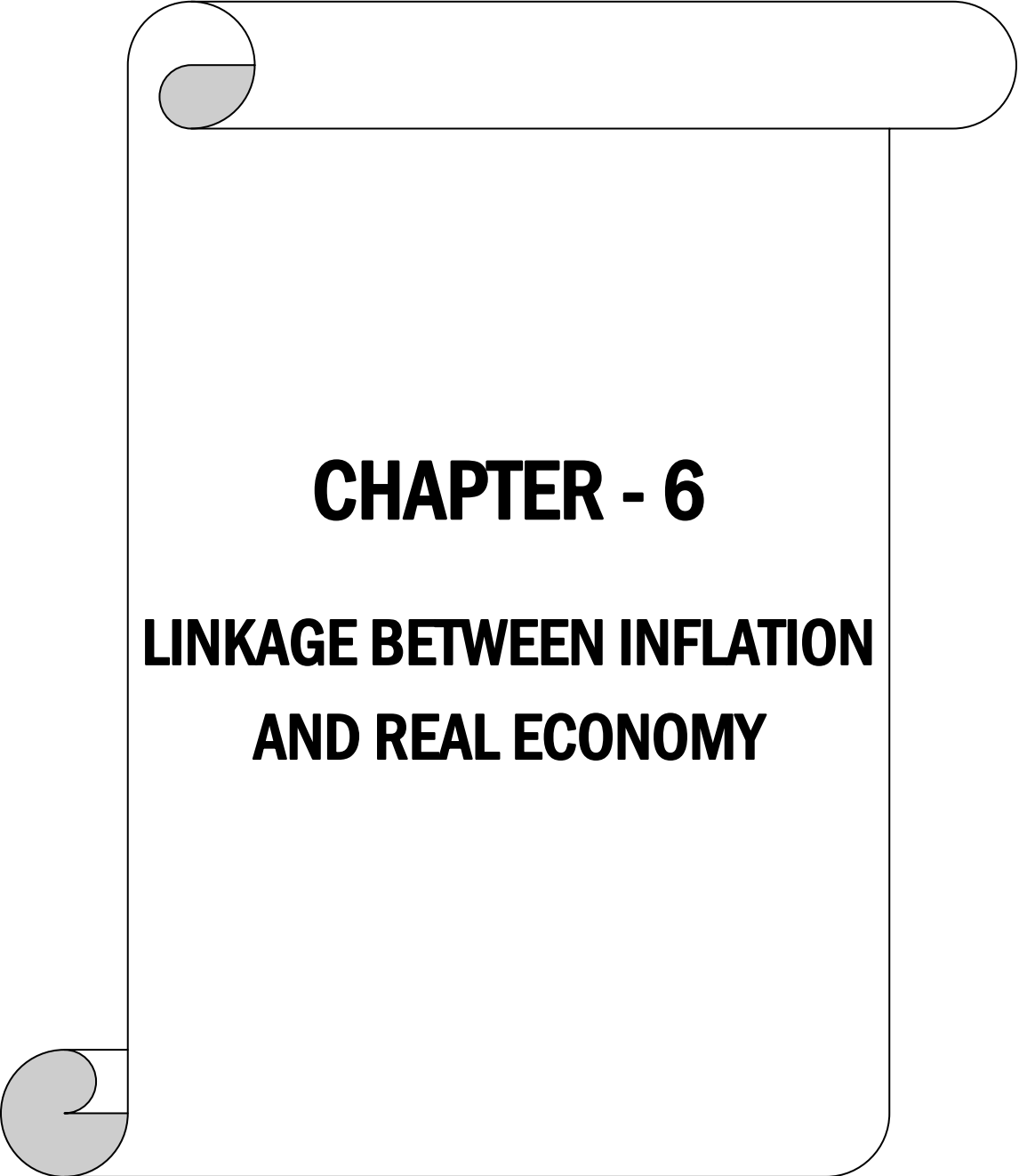
The model stands stable as shown in the CUSUM graph.

Figure 5.8.4: CUSUM Test



5.9 Concluding Facets

Chapter 5 concludes that the Phillips Curve plays an important role in policy making. According to this curve, policy authorities can create expansionary or contractionary situation of money in the economy. We concluded that during the Global Financial Crisis there was inverse relationship between the rate of inflation and the rate of unemployment in the Indian economy, in the Pre-Recession (2002-2008), Post-Recession (2009-2010) and over the period of 2002 -2015. It was noted that when rate of inflation was high, then the rate of unemployment was low and vice versa. It also mentioned few studies which are premised on the Phillips Curve, namely, *Cyril, Ogboko (2005), Fumitaka and Furuoka (2007), Fumitaka Furuoka, Qaiser, Munir and Hanafiah, Harvey (2013)* in other countries and *Singh, et al. (2010), Kumar and Vashist, (2012)* in the Indian economy. These studies found similar results and supported that the Phillips Curve trade-off still existed in the economies. In addition, we examined the Phillips curve relationship in the extended period from 1991 to 2015. We found that the short run and long run Phillips Curve theory also existed in this period. During the phase of the Global Financial Crisis the Phillips curve theory existed for both short-run and long run in the Indian economy. We also found here the unidirectional relationship and not bidirectional relationship between them. In other words, although, the shock of Global Financial Crisis was direct or inversely associated with the rate of unemployment in the long run.



CHAPTER - 6

LINKAGE BETWEEN INFLATION AND REAL ECONOMY

LINKAGE BETWEEN INFLATION AND REAL ECONOMY

6.0 Overview

This Chapter is a follow up of Chapter Fifth and it discusses and examines the output gap concept during the Global Financial Crises from 2002 to 2015. Here we have taken the output gap concept because in Indian economy there is no quarterly or annually data on unemployment rate. Therefore, we have taken Output Gap as the proxy variable of unemployment. The general idea of excess demand or supply is not mean or constant at all times and there could be ups and downs. Moreover, the concept of Output gap has played an important role in the process of inflation and disinflation in the economies and thus this study is based on this understanding. We will first investigate the output gap as a measurement of excess supply or demand and, in addition examine the relationship between the output gap and inflation. Output gap concept indicates the actual situation of economy and foretells whether it is going to be a boom period or a slack period. To understand the association between the real economy and inflation, where the real economy relates to fiscal policy and inflation relates to monetary policy, the formulation of monetary policy is crucial. We can see the impact of inflation on real economy through the output gap. In macroeconomics, the concept of the output gap is an important component of link between real economy and inflation. The Output Gap provides a useful measure of understanding the inflationary pressure in the economy¹⁷.

6.1 Introduction

Policymakers and academicians widely use the potential output to gauge inflation and typically define it as the level of output consistent with no pressure for fluctuations in the prices in the economy. In this context, the output gap is an indicator of the relative demand and supply components of economic activity. As such, the output gap measures

¹⁷Output gap is the difference between the actual and the potential Gross Domestic Product (GDP) and is a valuable indicator in the study of business cycles.

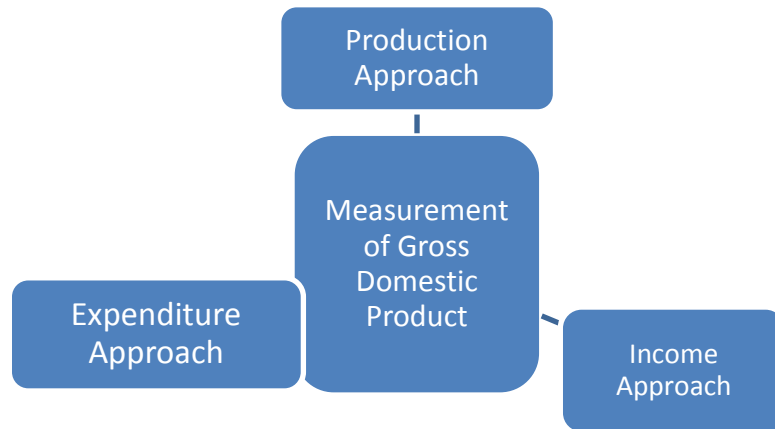
the degree of inflation pressure in the economy and is an important link between the real side of the economy, which produces goods & services and inflation. It processes a central role in policymaking. For many central banks, including the U.S. Federal Reserve, maintaining full employment is a policy goal. Full employment corresponds to an output gap of zero. Nearly all central banks seek to keep inflation under control and the output gap is a key determinant. It gauges when the economy may be overheating or underperforming, it has immediate implications for *monetary policy*

Generally during a recessionary situation, actual economic output drops below its potential, which creates a negative output gap. That below-potential performance may spur a central bank to adopt a monetary policy designed to stimulate economic growth by lowering interest rates, for instance, to boost demand and prevent inflation from falling below the central bank's inflation rate target.

6.1.1 Concept of Gross Domestic Product

Gross Domestic Product is the market value of all final goods & services produced within a country in a given specific period of time which is received money value. The concept of GDP may be simple or easy to explain, however, it is complex to measure and countries across the world have different approaches to arrive at their country's GDP. This definition provides the three approaches for measurement of Gross Domestic Product which are: the Production Approach, the Income Approach and the Final Expenditure Approach.

In India, the collection of macro variable is done by the Central Statistics Office (CSO), under the Ministry of Statistics and Program Implementation (Seth, 2017). The GDP in India is calculated using two different methods. The first method is based on economic activity (at factor cost), and the second is based on expenditure (at market prices). Further calculations are made to arrive at nominal GDP and real GDP. Among the four released numbers, the GDP at factor cost is the most commonly followed figure and reported by the academicians to show the prospectus of countries.



Production Approach: This approach is also called the *Output Approach* and it is the measurement of Gross Domestic Product as the difference between value of output less the value of goods and services used in producing these outputs during the period of time.

Income Approach: It measures Gross Domestic Product as the total of the factor incomes created to the economy.

Expenditure Approach: The expenditure approach measures the all final uses of the produced output as the total of final consumption, Gross Capital Formation and Exports less Imports (Vu Quang, 2009).

When we measure the National or Per Capita Income, equal results are applied for all the methods, as in: Production Approach = Income Approach = Expenditure Approach¹⁸.

$$\text{Gross Domestic Product} = C + I + G + (X-M)$$

Where

C = consumption is total spending by households on goods & services.

¹⁸It is important to note that this holds true only for the final or finished goods and not the intermediates goods. GDP is available in two basis such as GDP at Constant Price or Factor cost and GDP at Current or Market Prices. Since the information on inflation can be misrepresented in case of the economic variable of GDP, we have two versions of GDP. One is corrected for inflation; the other is not which is called the Nominal GDP values output using current prices and it is not corrected for inflation. Real GDP values output is known by using the prices of a base year. Real GDP is corrected for inflation. Gross Domestic Product includes so many factors and variables that we can say that GDP is total expenditure on economy. After that the total expenditure has been divided into four sub categories, for instance.

I = investment is total spending on goods that will be used in the future to produce more goods. G = government expenditure or purchases, is all spending on the goods & services purchased by government at the federal, state, and local levels.

$X-M$ = (net export) and minus import. Exports represent foreign spending on the economy's goods & services and Imports are the portions of C, I and G that are spent on goods & services produced abroad.

In simple words, we can say that gross domestic product (GDP) includes all economic activity of a country within one year. In the economic activity or movement of a country is categorised into the three main sectors. These sectors are primary sector which includes agriculture, agro based commodities and allied activities, forestry, mining and quarrying. The Secondary Sector includes manufacturing industries, construction and electricity, water and gas supply. Furthermore, is the last sector which is the Service sector and this includes banking, insurance, transport, communication, trade and commerce (*Tripathi, 2015*). Gross Domestic Product is an essential variable or indicator of an economy. It has been used by policy makers for measurement of health of the economy. Gross Domestic Production is an amount of final goods and services in economy that is the measure of money term. Real Gross Domestic Product is an important measure of economic activity and it is widely used by policy makers and academicians (*Chakravarty, 2016; Keohane, 2016; Zhong, 2016*).

GDP gap is also called the Output gap, Economics have two concepts of output gap, a Keynesian and the Friedman's, on which Okun's law has based his monetarist concept. The Keynesian concept was formulated and refined in the 1960s in connection with active fiscal policies intended to deliver full employment. The monetarist concept by Friedman was based on the accelerations hypothesis and the natural rate of unemployment with the link of monetary policy. Measuring the level of an economy's potential output and output gap is crucial in pinpointing a sustainable non-inflationary growth and assessing appropriate macroeconomic policies. The estimation of potential output helps to determine the pace of sustainable growth while output gap estimates provide a main benchmark in contradiction of which to assess inflationary or disinflationary pressures suggesting when is the expansion or contraction of the monetary

policies (Denis, Morrow and Roger, 2002). Potential output is considered the best composite indicator of the aggregate supply side capacity of an economy and thus becomes an important aspect of research interest or area. Apart from this, the Potential output is the maximum output an economy could sustain without generating rise in inflation (De Masi, 1997). The potential rate of growth of an economy is the maximum sustainable rate at which an economy can grow without causing a rise in the rate of inflation. The potential growth rate is determined by the growth in the economy's productive capacity which, in turn, depends on the growth in inputs such as labour, capital, land, technology, etc. An economy can develop above the potential rate for certain time but that will trigger expanding inflationary pressures. Growing below the potential rate will imply an increase in the rate of unemployment (Joseph, et al. 2011).

Output gap is the difference between actual GDP or actual output and potential GDP or potential output which can possibly be negative and positive both. Potential output is defined as the level of output that can be achieved without giving any increasing or decreasing pressures on inflation (Okun's Law, 1962); widely used in the literature. Where the output gap is either positive or negative, either one are unfavorable for the economy. Any positive gap in the economy indicates more demand for goods and services in the economy which is beneficial but also a high demand will create even more inflation. This is because the labor and cost of production increases in the economy. On the other hand, the negative output gap shows the lack of goods and services in the economy; thus pointing to the sluggish economy resulting from the deteriorating condition in the demand for goods and services. That's why every economy is targeting the *Zero Output Gap*.

When the Output Gap is zero, there is no upward or downward pressure on inflation, as the actual demand coincides with economy's potential. Shocks can affect actual output and potential output inversely, leading to non-zero output gap levels. According to the Bank of Canada (2012), the positive output gap is usually related to the boom period and this is a sign of economic activity that exceeds capacity; also creating pressures on the labour market and on the price levels. Moreover, the positive output gap is expected to have repercussions towards a lower unemployment and a higher level of inflation.

Alternatively, a negative output gap is usually related with a recessionary period and the pressures would be in the direction of higher unemployment and lower inflation. To measure the output gap, below is a simple formula;

$$\frac{(\text{GDP}_{\text{Actual}} - \text{GDP}_{\text{potential}})}{\text{GDP}_{\text{potential}}} \times 100$$

The percentage of GDP gap is the actual GDP minus the potential GDP divided by the potential GDP.

*Koske and Pain (2008), propounded that “output gaps remain a significant influence on inflation, but their influence is now weaker than in the past, and the usefulness of output gap estimates for real-time inflation projections is limited” (p. 2).*¹⁹

6.1.2 Okun’s Law

Okun’s law is an empirical relationship between changes in aggregate output (relative to its potential trend) and changes in the unemployment rate (relative to its natural rate) given by Arthur Melvin Okun. To summarize, this law intends to tell us how much of a country’s Gross Domestic Product may be lost when the unemployment rate is above its natural rate. Many economists have argued that Okun’s law is a useful guide for monetary policy because it suggests room for policymakers to improve aggregate output by further reducing unemployment (Wen, 2012, P.1).

The general idea of excess demand or supply is not mean or constant all the time and there are frequent fluctuations. Moreover, the Output Gap concept has also played an important role in the process of inflation and disinflation in the economies. Furthermore, we have discussed here three concepts or theories about indicating the relationship between the Output Gap and Inflation Rate. First, the level of Output Gap is connected to the Inflation by the theory of General Equilibrium, which describes that the rate of change in each commodity’s price depends on the extra or excess supply or demand for that commodity. Similarly at macro level, this denotes that the rate of change in price level depends on the level of slack and boom period or the Output Gap. For instance, the

¹⁹Useful information on this topic can be found also in Bouis et al. (2012).

Phillips curve relationship discusses a stable association between the rate of change in money wages and the unemployment rate. Second, the level of the output gap might be connected with the rate at which inflation rate increases, or the acceleration of the general price level to illustrate the Non-Accelerating Inflation Rate of Unemployment (NAIRU). Third, the change in output gap might be connected with the rate of inflation such as the Great Depression. Significantly, the general price level started to increase in the United States economy just after the Great Depression, reflecting the quick shrinking of the output gap where the level measured by the GNP gap still being over 40 percent. Some argue that this sort of relationship was observed in instances other than Great Depression and call it the *Speed Limit Effect* (Romer, 1996).

This study is based on this understanding. We will first investigate the output gap as a measurement of excess supply or demand. Besides this we will examine the association between the Output Gap and Inflation. The Phillips Curve approach is evidenced as a useful tool for a policy investigation and huge evidence also proves that output gap is a significant determinant of inflation for numerous countries.

6.2 Objectives and Hypothesis of the Study

- To examine the negative or positive inclination of the Output gap over the period of study.
- To provide empirical evidence to support the direction of Output Gap.
- To examine the relationship between Inflation and Output Gap.
- H_0 = there is negative Output Gap over the period of study.
- H_0 = there is no significant relationship between rate of Inflation and Output gap.

6.3 Methodology Estimation

We have used time series dataset which is based on purely secondary database. The present study covers the period from 2002 – 2015 at the constant price in the base year 2004-05 and 2011-12. The data was collected from the Hand Book of Statistics on Indian Economy, Reserve Bank of India. In this analysis, we have used SVAR econometrics model and to apply this model, we have used algorithm $\log^{10}$ for change of percentage.

This present study used quarterly available Gross Domestic Product (GDP) and Wholesale Price Index (WPI) rate of inflation data series. The measurement of output gap is calibrated by the Hodrick-Prescott (HP) Filter method and it is also used to calculate growth rate. In addition to the above variables, we have taken two more variables which are: the Total Expenditure by the government and Total Investment from Neeti Ayog statistics.

The simplest methodology to estimate potential output is the Single Variate (SV) filter. This is a purely statistical methodology which filters the actual GDP data to extract the trend as its estimate of potential output. The most common SV filter is the Hodrick-Prescott (HP) filter. The Hodrick-Prescott filter represents one of the most popular methods for trend cycle extraction in macroeconomic time series (*Poloni & Sbrana, 2015*). It is very easy to use the HP filters because it only requires one data series (output).

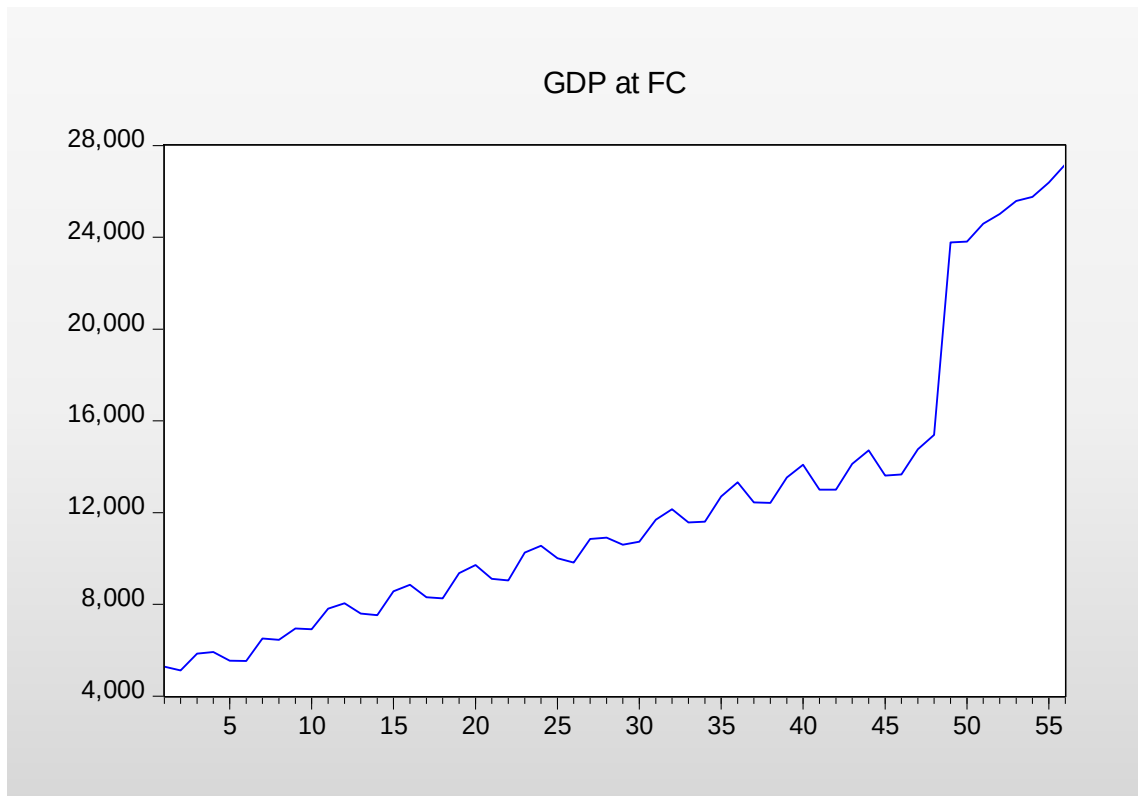
The HP filter techniques proposed by Hodrick and Prescott (1980) is the most commonly used method to estimate the potential growth rate of an economy. It is a data-smoothing technique. The Hodrick-Prescott Filter is commonly applied during analysis to remove short-term fluctuations that are associated with the business cycle²⁰. The Hodrick-Prescott Filter is a smoothing method that is widely used among macroeconomists to obtain an estimate of the long-term trend component of a series. The method was first applied to analyse post-war U.S. business cycles in a working paper and was later published in 1997 *Hodrick and Prescott*(1997). As a matter of fact, this method was suggested a long time before by *Leser (1961)* for trend extraction(*Mills, 2009*). This approach extracts a stochastic trend which moves smoothly over time and is uncorrelated with the random irregular term representing the cyclical component. The ratio between the variances of the two noises (i.e., the signal-to-noise ratio) is the key scalar that determines the smoothness of the extracted trend. For instance (*Hodrick & Prescott, 1997*), propose specific values for time series observed at different frequencies. The unobserved components representation of the smooth-trend model, also known as Hodrick-Prescott filter, was firstly used by *Akaike (1980)*.

²⁰<https://www.investopedia.com> (Financial Analysis)

As we have used only one Data series or Variable, which is named GDP, therefore we have used the Hodrick Prescott (HP) filter method which is frequently used for measurement of output gap. The output gap is unobservable and we can't estimate it directly. So first we have estimate of potential GDP from real GDP by the HP Filter method. After that we estimate the output gap through the potential GDP.

6.4 Results and Discussion

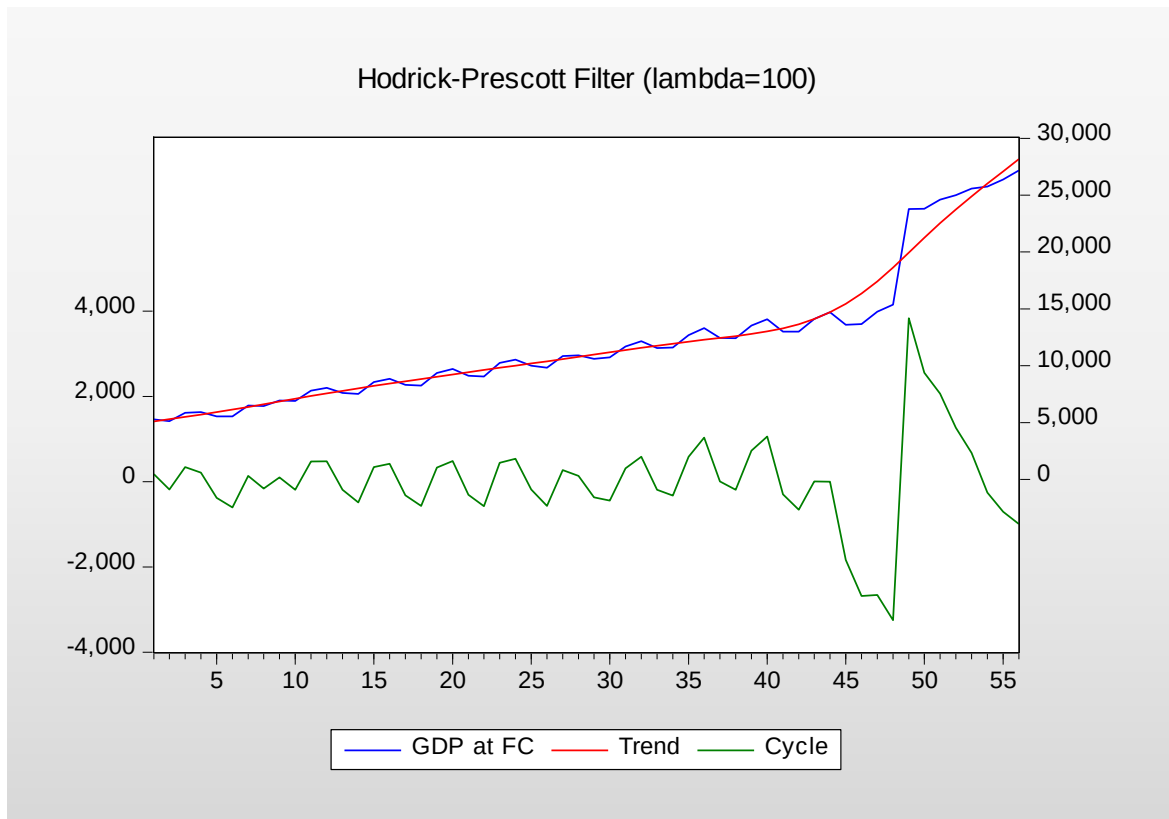
Figure 6.1: Trends of Real Gross Domestic Product (GDP)



Data Source :Handbook, the Reserve Bank of India

The figure 6.1 shows that the real Gross Domestic Product is increasing with a positive pattern but in 2013-14 quarter IV a sudden increase of high rate is observed. According to this figure, economy is working in proper and significant manner.

Figure 6.2: Smoothing of GDP and Potential Output Gap

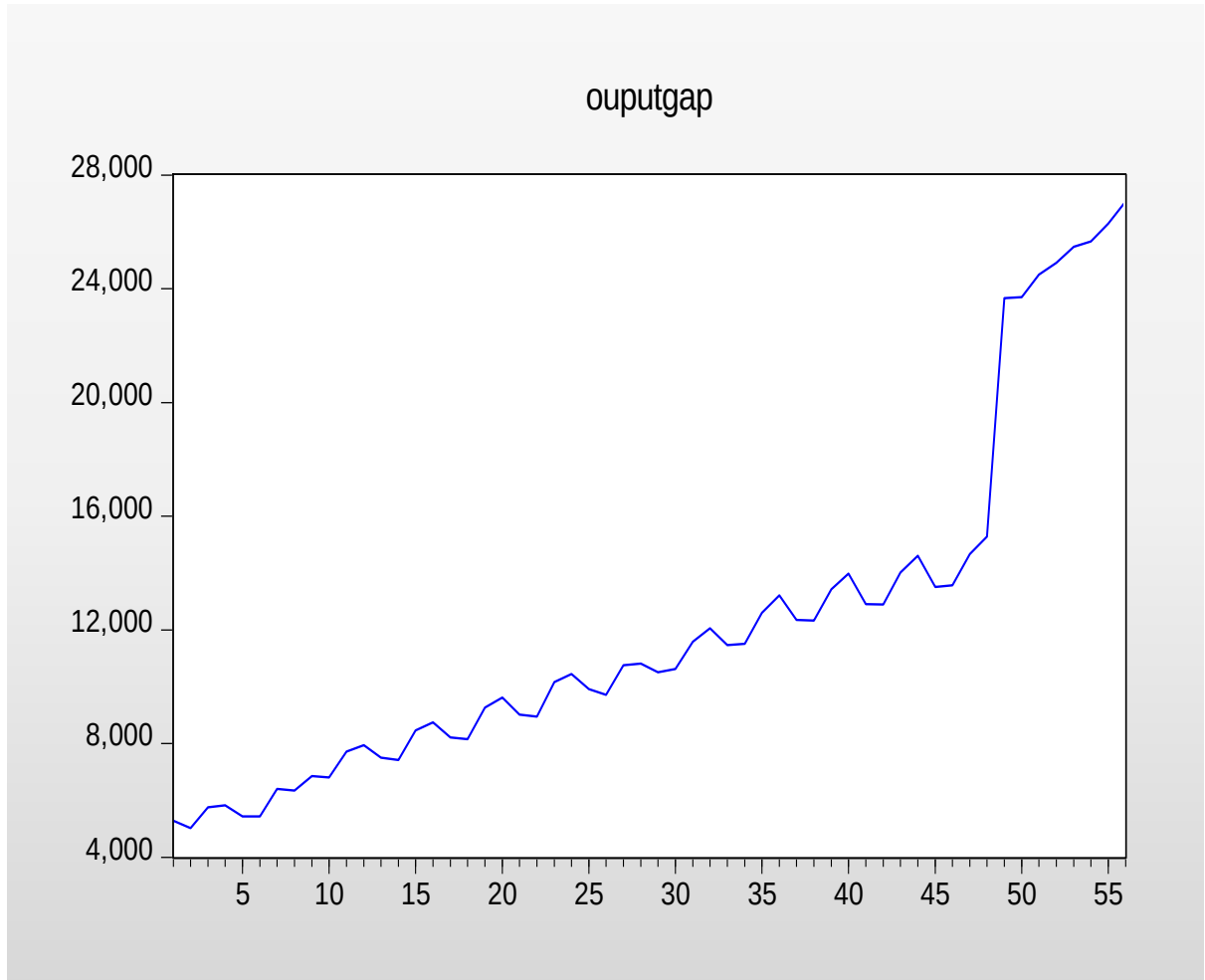


The figure 6. 2 shows the result of Hodrick Prescott filter method. The blue line indicates *the real* Gross Domestic Product (GDP),red line indicates the trend of *real GDP* also known as *potential* GDP while the green line indicates *Business Cycle*. Trend of real GDP is increasing at low rate but in 2013-14 quarter IV we can witnesses a sudden increase at a high rate. Other than the above changes observed, there is also a simultaneous disturbance noted in the short term fluctuation such as cyclical fluctuations with no impact on Indian economy in the lines of Global Financial Crisis. It has affected the others factors as well.

Estimation of the Output Gap with the help of HP filter and this formula

$$\frac{(\text{GDP Actual} - \text{GDP potential}) \times 100}{\text{GDP potential}}$$

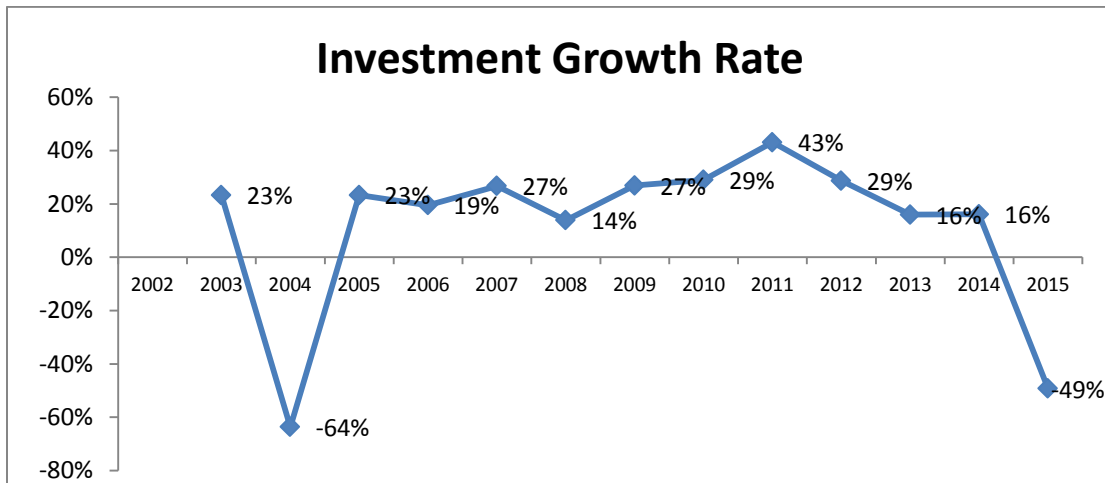
Figure 6.3: Output Gap



Author's Estimation

The figure 6.3 shows the output gap over the time period of study. It shows the positive output gap in the whole study of period. It started at a slow pace and continuously increased at the same rate positively. This propounds that there is no impact of Global Financial Crisis on Indian economy followed by a high demand in goods and services, thus, creating an optimistic environment for employment and inflation in economy. This is evident if we look at the expenditure of the government which was higher on investment and expenditure in Indian economy during 2014.

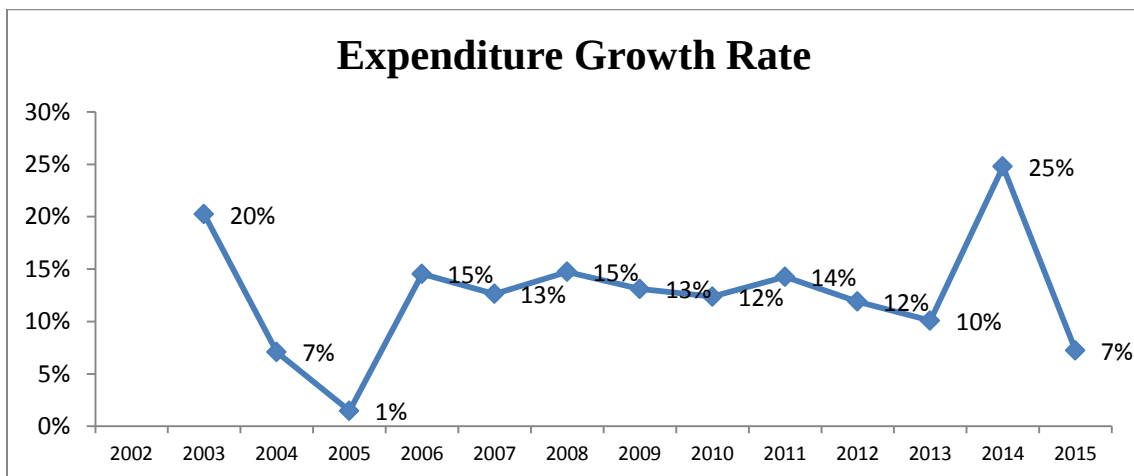
Figure 6.4: Growth Rate of Investment



Data Source: The Reserve Bank of India

The figure 6.4 shows the growth rate of investment in the economy. The graph above clearly shows that the growth rate starts with 23 percent in the year 2003 and completes with a negative value of 49 percent. In this trajectory, we observe the maximum point of fall in the growth rate in the year 2004 at -64 percent. It was only in the year 2011 that it reached its highest possible range. In the whole time period of 2005-2014, the increase was gradual and positive. It is significant to note a sudden decrease to -49 percent in 2015. The analysis of the above growth rate of investment postulates that there was no impact of the Global Financial crisis because of the sudden fall in year 2004 and 2015.

Figure 6.5: Growth Rate of Total Expenditure



Data source: Neeti Aayog Statistics

The figure 6.5 shows the growth rate of total expenditure during 2002 -2015. In 2003, the growth rate of expenditure is at its highest at 20 percent with a consequent drastic decrease to a low rate of 1 percent in the year 2005. Since then the graph demonstrates a continuous increase at a low rate during 2006 to 2013. In a time period of ten years, the growth rate reached its highest point of series which was at 25 percent. Overall in this series, the lowest growth rate of total expenditure was in the year 2005 and the highest growth rate of total expenditure was in the year 2014.

6.5 Relationship between Inflation and Output Gap: Structural Vector Auto Regressive (SVAR)

We have estimated the Output Gap by the HP filter methods. Later we have investigated if there is any relationship such as short run or long run association between the rate of inflation and output gap during same period in the context of India. In simple words, we examined this study period, to understand whether the demand is more or supply is more. To fulfill this objective we applied the SVAR model to capture the demand or supply shocks. VAR models are widely used for macroeconomic forecasting and structural policy examination. The reduced form VARs are sufficient for forecasting the model whereas structural investigation needs economic identification of the model, so structural VARs (SVAR) will be used. The SVAR can be used to inspect the response to the shocks.

For example, SVAR would enable economists to know what would happen to prices and output if a demand shock hits occurs. The Second major use is for the Business cycle fluctuations or they can provide the bench mark against which modern or current dynamic macroeconomic theories can be evaluated, that is VARs can help to distinguish between the computing theoretical models.

VAR model is divided into three sub categories that are:

1.Reduced Form; 2. Recursive;3. A reduced-form. VAR states each variable as a linear function of its own past Values and the past values of all other variables being considered and a serially uncorrelated error term. In theory, the VAR uses all available or relevant

past values. The error terms are viewed as surprises and movements in the variables, after taking its past into account. If the different variables are correlated with each other, then the error terms will also be correlated across equations. A recursive VAR constructs the error terms in each regression to be uncorrelated with the error term in the preceding equation. This is done by adding carefully-selected contemporaneous values as regressor. Estimation of each equation by OLS produces residuals that are uncorrelated across equations. The recursive VAR amounts to estimating the reduced form, then computing the Cholesky factorization of the reduced form VAR covariance matrix (Lutkepohl, 1993). Unfortunately, the result depends on approximate variables. Changing the order changes the VAR equations, coefficients, and residuals. A structural VAR uses economic theory to sort out contemporaneous links among the variables. Structural VARs require identifying assumptions that establish causal links among variables. These produce instrumental variables (Stock and Watson, 2001).

The Structural Vector Autoregressive Model (SVAR) based on Taylor rule was given by John Taylor in 1992 which is mainly used for forecasting of interest rate. It discussed about the how central banks should change interest rates to account for inflation and other economic conditions.

6.6 Taylor rule

Taylor rule is a monetary policy rule that describes the fluctuation in the nominal policy interest rate in response to the goals, viz. inflation, output and other economic circumstances. According to the original version of Taylor rule, the nominal interest should respond to divergences of actual inflation from target rates and actual output from the potential output.

$$it = r^* + \beta_1 (\pi_t - \pi^*) + \beta_2 (y_t - y^*)$$

The above equation, it = is the target short-term nominal interest rate, r = equilibrium real rate of interest, π_t = actual rate of inflation in the present period, π^* = target or desirable rate of inflation, y_t = log of real GDP and y^* = logarithm of potential output calculated by linear trend.

According to the Taylor rule, the coefficient values β_1 and β_2 should be positive and as a rule of thumb β_1 and β_2 must be equivalent to 0.5. The rule thus suggests a higher interest rate when either inflation is above its target or when output is above its potential or full employment.

Table 6.1: Descriptive Statistics of Variables

Variables	Output Gap	Inflation	Dum Output	DumInf
Mean	12146.37	557.7214	0.160714	0.500000
Median	10687.53	540.3000	0.000000	0.500000
Maximum	27076.16	738.0000	1.000000	1.000000
Minimum	5020.460	406.7000	0.000000	0.000000
Std. Dev.	6024.401	83.34078	0.370591	0.504525
Skewness	1.248535	0.406297	1.847623	0.000000
Kurtosis	3.642399	2.472418	4.413712	1.000000
Jarque-Bera	15.51208	2.190188	36.52466	9.333333
Probability	0.000428	0.334508	0.000000	0.009404

Data Source: RBI & MOSPI

Table 6.1 clearly demonstrates the disposition of the data series. Converging over the value of Skewness, the regress and variables have positively skewed, implying long right tail about the mean and the regressors closer to normal distribution though positive. Now if we stress over the value of kurtosis, except the independent variable all the dependent variables have an almost non-normal distribution with kurtosis above or below to 3. The inflation rate has a normal distribution (mesokurtic curve) with closer to 3 value as seen in the table.

6.7 Outliers

Figure 6.7.1: Outliers

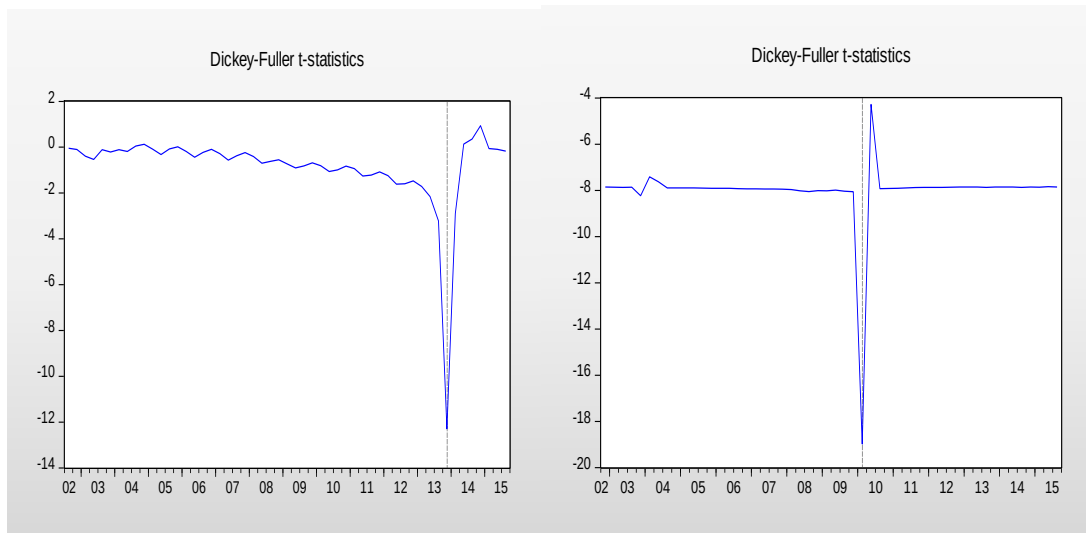


Table 6.7.1: Kim and Perron (2009) Structural Break Unit root Test

Variable	Break period	t-stat.	Prob.	Decision
Unemployment	2013Q4	-3.252691	0.5339	Non-Stationary
Inflation	2009Q4	-4.317981	0.0715	Non-Stationary

* shows the significance at 1 % level of significance

The table 6.7.1 presents the Kim Perron test results that found that structural breaks date in non-stationary data series. We have also applied of chow test above these breaks dates significant or not.

Chow Test: 6.7.2

Table 6.7.2: Chow Test

Model	Break date	f-value
Output gap	2013Q4	35.60361* (0.0000)
Inflation	2009Q4	106.3468 *(0.0000)

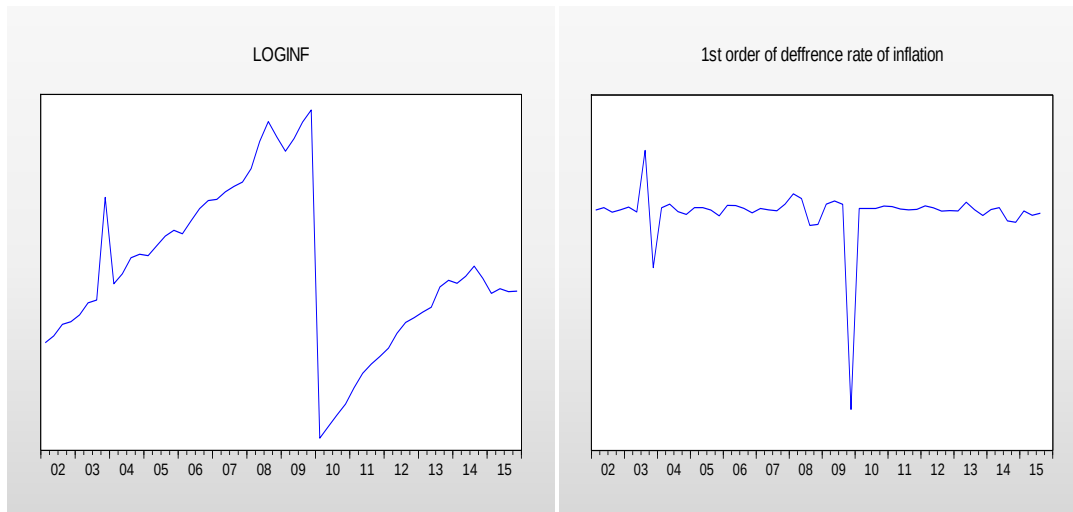
*,** and *** represents result to be significant at 1%, 5% and 10%

Table 6.7.2 shows the chow test result. The breaks have been introduced in 2013Q4 of output gap series and 2009 Q4 in inflation series. The chow test done to check the

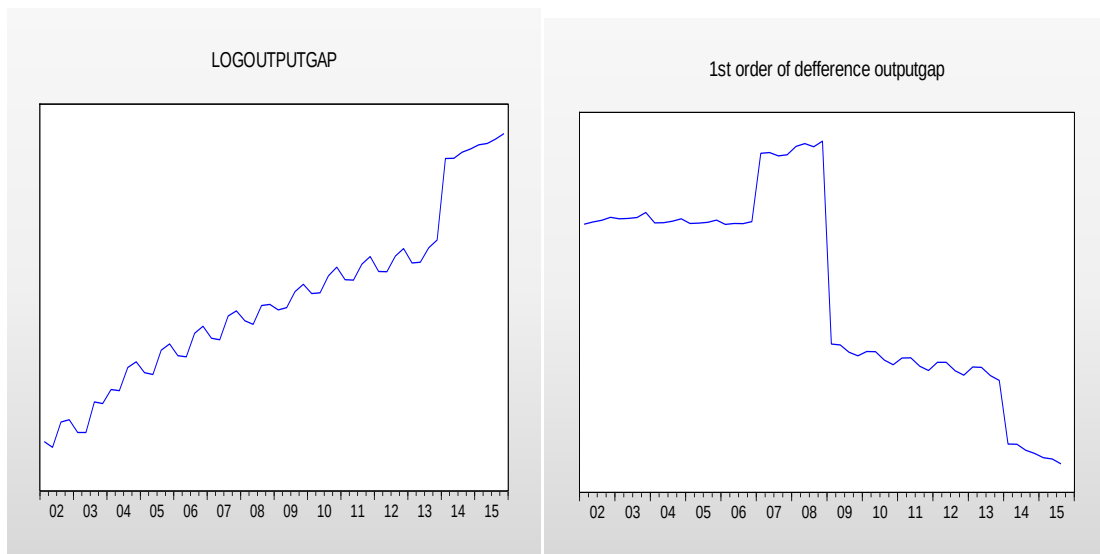
whether this break time is significant. The F- value is significant at one percent showing presence of structural break for we incorporate dummy variables such as dummy inflation and dummy output gap.

6.8 Trends of Inflation and Output Gap

Figure 6.7.2: Trends of Inflation and Output Gap



Data source: MOSPI



Data source: Handbook of Statistics (RBI)

6.8 Augmented Dickey Fuller Test for Stationary

Table 6.8.1: ADF Test for Differences First Order Data (2002 to 2015)

Variables	ADF Value DF-T Statistics	Critical value of Mackinnoon in levels of significance		Result of Test	Stationary or not Stationary
		1%	5%		
Ln Inflation (WPI)	-8.00714	-3.557472	-2.916566	H0 is rejected	Stationary
Ln Output Gap	-7.121630	-3.560019	-2.917650	H0 is rejected	Stationary

Table 6.8.1 describes that the both the series of inflation and output gap is non-stationary at the level after that we have converted it into the first difference order for stationarity. Further, we have applied Phillips Perron test for stationary.

Table 6.8.2: Phillips Perron Test

Variables	Phillips Perron Value DF-t Statistics	Critical value of Mackinnoon in levels of significance		Result of Test	Stationary or not Stationary
		1%	5%		
Ln Inflation	-8.057994	-3.557472	-2.916566	H0 is rejected	Stationary
Ln output gap	-8.638327	-3.557472	-2.916566	H0 is rejected	Stationary

Table 6.8.2 describes Phillips perron test result that the both the series of inflation and output gap is non-stationary at the level after that we have converted it into the first difference order for stationarity. Both tests confirmed that we should apply Structural Vector Auto Regressive (SVAR) model.

Table 6.8.3: Lag Length Criteria

The maximum dependent and dynamic regressor lag limit according to AIC, SC and HQ criteria for quarterly data is chosen one. The table 6.8.3 represents optimal lag criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	142.3041	NA	1.64e-05	-5.345258	-5.117985	-5.258410
1	202.3482	108.3149*	1.82e-06*	-7.543067*	-7.164278*	-7.398320*
2	203.1518	1.386662	2.07e-06	-7.417719	-6.887414	-7.215074
3	208.2267	8.358539	1.99e-06	-7.459870	-6.778049	-7.199326
4	209.9263	2.666122	2.19e-06	-7.369660	-6.536323	-7.051217
5	210.8589	1.389788	2.49e-06	-7.249370	-6.264518	-6.873029

The table 6.8.3 shows the lag length criteria which tell us that many criteria like the AIC, SC and HQ are supported and suggested to choose one lag length.

Table 6.8.4: Johanson Test for Cointegration

Eigen value	Likelihood ratio	Critical Values 5%	Result (Hypothesized) No.of Cointegration(s)
0.095323	None	15.49471	No co-integration
0.003297	206.0614	3.841466	No co-integration

The figure 6.8.4 indicates that there is no cointegration between the rate of inflation and output gap. Since the trace statistics value is less than the critical value, if $TS < CV$, it tells us that variables are not cointegrated with each other. Thereby, meaning that there is no long run association among these variables. If trace statistics value is more than the critical value ($TS > CV$), it tells us that variables are cointegrated.

The previous result and tests prove that we can use SVAR Model for estimation. According to the result of Johnson cointegration test, there is no cointegration between the rate of inflation and output gap. Therefore, we are using Structural Vector Auto Regressive Model (SVAR). We have found two breaks dates such as 2009Q4 and 2013Q4.

We have attempted to develop new SVAR model. General form of SVAR model is follows;

$$\text{Output Gap} = f(\text{Inflation, Output Gap})$$

Used the dummy variables now VAR model became as:

$$\Delta y_t = \alpha_0 + \alpha_1 + \alpha_2 \Delta y_{t-1} + \alpha_3 \Delta X_{t-1} + \alpha_4 \Delta X_{t-2} + \epsilon_t$$

Output Gap = f (INF, OG, DINF, DOGAP)

ΔY = endogenous variable (dependent variable)

ΔX = exogenous variable (independent variable)

ϵ_t = error term

ΔY = Endogenous variable with time, ΔX = Exogenous variable and ϵ_t = Error term. Where INF = Inflation Rate (WPI), OG = output gap DINF= dummy variable for inflation, DOGAP= Dummy variable for output gap. 0 dummy = No Impact of Structural breaks on other variable and 1 dummy = Impact of Structural Breaks on other variable.

We have used the Dummy Variable because even after having a data stationary in the series of Inflation and Output Gap, the structural breakshave been found. So we have used Dummy variables to capture the effect of structural breaks on the dependent variables, in other words, to see effect of structural breaks or changes through the dummy variable.

6.10 Structural Vector Regressive Model (SVAR) variables such as Output gap and rate of inflation

Table 6.8.5: An Analysis of Structural Vector Regressive Model (SVAR) Estimation

(SVAR) Eq.	Coefficient	Std. Error	t-Statistic	Prob.
Ln inflation	0.761292	0.069917	10.88854	0.0000*
Ln output gap	0.171361	0.049759	3.443843	0.0008*
Dummy inflation	-0.007628	0.021924	-0.347924	0.7286
Dummy output gap	-0.070465	0.028241	-2.495100	0.0142**
Ln output gap	0.065845	0.070857	0.929265	0.3549
Ln inflation	0.956163	0.050428	18.96113	0.0000*
Dummy inflation	-0.000663	0.022218	-0.029857	0.9762
Dummy output gap	0.021093	0.028621	0.736982	0.4628

The table 6.8.5 shows the result of SVAR model. The first model where the inflation is the dependent variable, there is positive and significant impact of own lagged value of inflation (past value) output gap and negative impact of Global financial crisis on the rate of inflation at the 1 percent and 5 percent level of significance. This model is a good fit because R^2 value is 0.708182 and Adj R^2 Value is 0.691017. The second model where output gap is dependent variable, there is significant positive impact of lagged value of inflation and output gap on the rate of inflation but the shocks of output gap has negatively affected the rate of inflation. Alternatively, when we take the output gap as a dependent variable, there has been a positive effect of the output gap and no impact of global financial crisis on the output gap at the 1 percent level of significance. This model is a good fit because R-value is R^2 value is 0.966460 and Adj R^2 is 0.964487.

In the economics terminology, we can say that in the study period, there is short run relationship between the rate of inflation and output gap in the Indian economy because demand of goods and services is more. This creates more employment by the consumption and multiplier theory in the Indian economy.

Table 6.8.6: Diagnostic Checking of SVAR Model

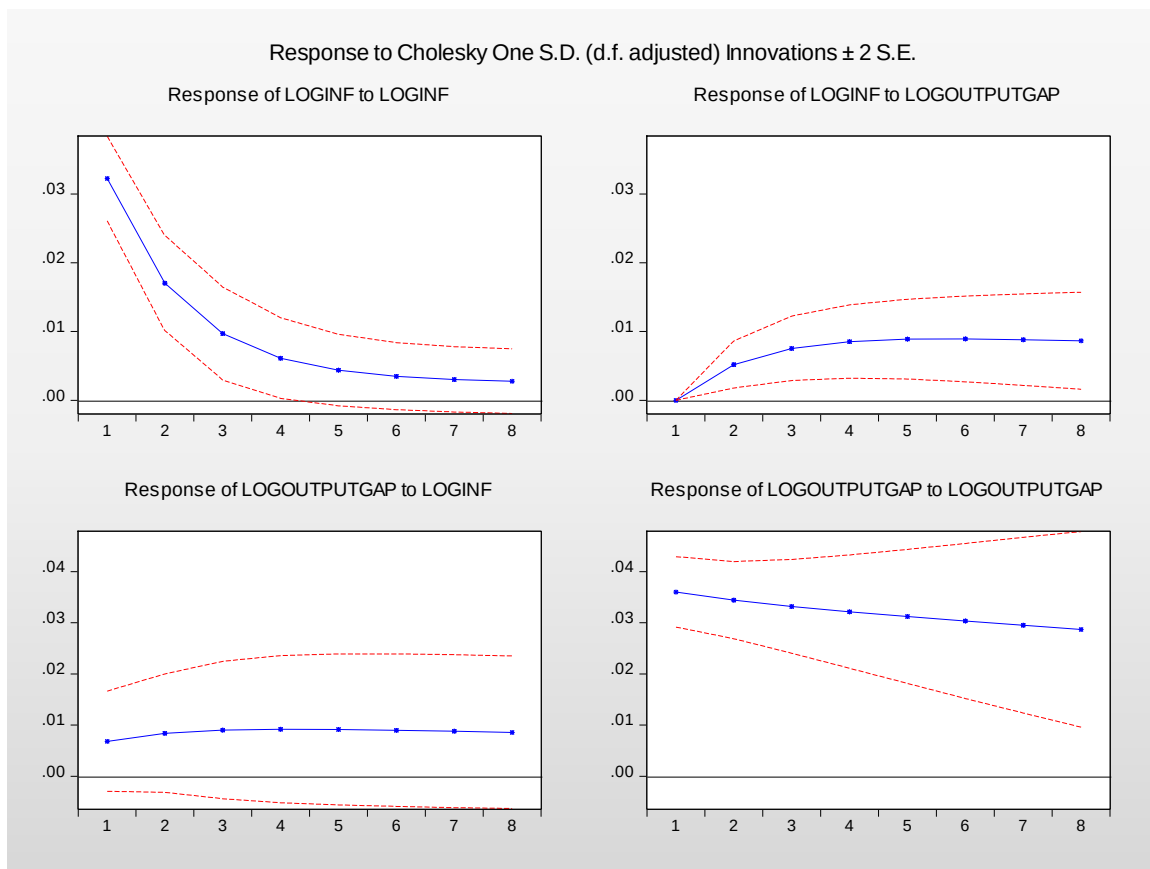
Tests	F-statistic	Obs*R-squared	Prob. F	Prob. Chi-Square
Serial correlation	1.537709	1.641012	0.2207	0.2002
Breusch-Godfrey				
Heteroscedasticity	0.626646	0.642999	0.4322	0.4226
ARCH Effect				

The table 6.8.6 shows that in the diagnostic checking of model in this study there is no serial correlation and heteroscedasticity problem. Breusch-Godfrey test and ARCH effects tests indicate that there is no problem. Therefore, model is accurate but this model's residual is not normally distributed, yet it is acceptable because in real life all things are not perfect or ideal.

Impulse Response Function (IRF): The projected impulse responses demonstrate patterns of persistent common variation measured in one standard deviation innovations

or shocks. Impulse variable means the root of the shock while Response variable means the variable being affected. The impulse response is graphed as a function of forward time periods. **Sims (1980)** popularized the method of choosing P to be the Cholesky decomposition of Σ . The Impulse Response Functions based on this choice of P are known as the Orthogonalized Impulse Response Functions. Choosing P to be the Cholesky decomposition of Σ is equivalent to imposing a recursive structure for the corresponding dynamic structural equation model.

Figure 6.6.3: Impulse Response Function (IRF)



Source: Estimated from unrestricted SVAR model in Eviews

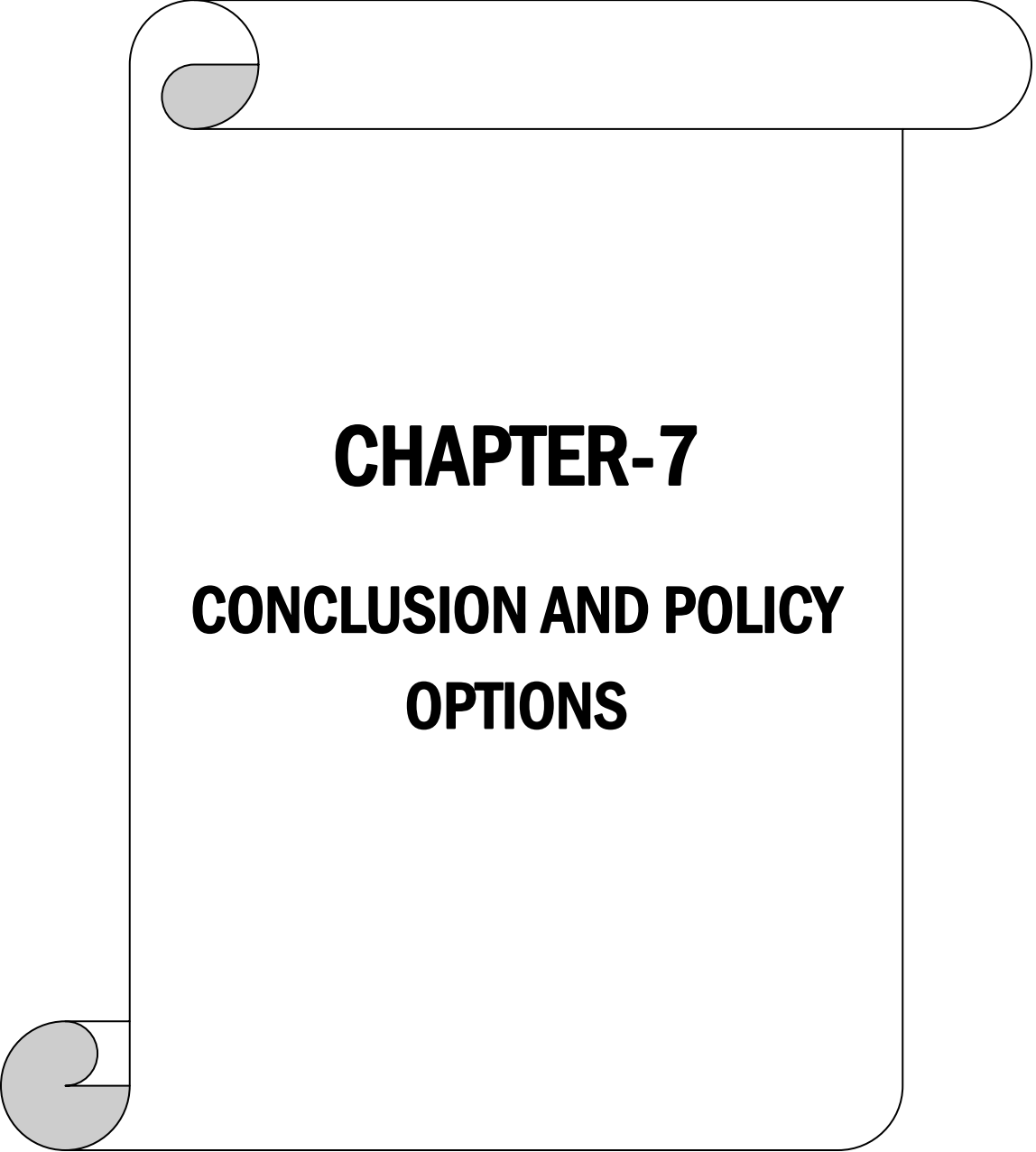
The figure 6.6.3 shows the response of inflation rate shock to impulse in output gap which takes four quarters. It identifies the responsiveness of the dependent variables in the SVAR system when a shock is put to the error term such as U_1 and U_2 , as in the equations given above. A unit shock in U_1 will bring a change in the inflation. It had impacted the output gap during the next four quarters. But before calculating the Impulse

Response Function, the ordering of variable is important. There are many methods. We have chosen the Cholesky dof adjusted, response to Cholesky one standard deviation innovation, shock or residual (error term) + 2 standard error. In the eight quarters, all variables in this entire function had been affected. The graph shows the impulse response function in the next eight quarters. When inflation is impulse variable and output gap is response variable, Inflation has affected the own lagged variable in a downward way. We can see that it has rectangular curve and it has affected the output gap which is positive with increased rate in the next eight quarters. When the output gap variable is impulse variable and inflation is response variable, output gap has affected its own lagged variable in positively with high rate in the next eight quarters.

6.11 Concluding Facets

Chapter 6 concludes while examining the Output Gap and the relationship between the rate of Inflation and Output Gap based on empirical analysis of the data collated during the Global Financial Crises from 2002 to 2015.

To reach its intended objective, this study analysed that since the Output Gap is an unobserved variable and it cannot be observed directly, the Hodrick-Prescott method had to be applied to measure the Output gap. We found positive output gap and short run relationship was found between the rate of inflation and rate of unemployment in Indian economy over the same period. Due to more investment and government expenditure in Indian economy, the role of public expenditure is highly significant. In other words, we can say that in the Indian economy, there was no impact of the Global Financial Crisis because the output gap is positive. On the other hand, we find the short run relationship between the rate of inflation and output gap. This means that the economy was functioning properly and there was more demand of goods and services in the economy. This created favorable condition for inflation and employment under the threshold of inflation that ultimately support the developmental process of an economy.



CHAPTER-7

CONCLUSION AND POLICY OPTIONS

CONCLUSION AND POLICY OPTIONS

7.0 Main Comprehensive Findings

The present study's major objective was to examine whether the Phillips Curve shape or theory exists or not in the Indian context, particularly under the underpinnings of the Global Financial Crisis along with striving to the measurement of the Output Gap from 2002 -2015. The study has been divided into 7 chapters to outline the various foregrounds that inspired this research intent. Chapter 1 and 2 indicate the introduction of variables and theories related to research topic. Chapter 3 details the trends of Inflation; Wholesale Price Index and the Consumer Price Index in the Pre-Recession, During Recession and Post-Recession. Chapter 4 enlists the impact of recession on Macro-variables such as export, lending rate and inflation rate. In the Pre-Recession Period, the lending rate was affected due to supply shocks (permanent effect). The export has been affected due to both supply shocks and demand shocks (permanent & temporary effect) and there was no impact on the inflation rate. During the Recession Period, there was no impact on export and inflation rate. However, the lending rate were affected by supply shocks and demand shocks when structural breaks were also found in export, lending rate, and inflation rate. In the Post-Recession Period, all the variables such as export, lending rate, and inflation rate were affected by supply shocks and demand shocks and it is significant and proved. In addition, this chapter also aimed to comparatively, descriptively analyse the quinquennial unemployment rates taking into account the recession period. We found that there is significant impact of the Global Financial Crisis on recession and post-recession period in the Indian economy. Chapter 5 shows the relationship between inflation and Unemployment which is the main intent of this thesis. During the Global Financial Crisis, there was inverse relationship between the rate of inflation and the rate of unemployment in the Indian economy and this trend continued in the Pre-Recession (2002-2008), Post-Recession (2009-2010) and over the period of 2002 -2015. It was noted that when rate of inflation was high, then the rate of unemployment was low and vice versa. Furthermore, we also examined the Phillips curve relationship in the extended period from 1991 to

2015. We found existence of the short run and long run Phillips Curve theory for the period of study. We also found here a unidirectional rather than a bi-directional relationship between them. Chapter 6 shows the output gap concept which is proxy variable of unemployment. We found positive output gap as well as short run relationship between the rate of inflation and rate of unemployment in Indian economy over the same period. Due to more investment and government expenditure in Indian economy, the role of public expenditure became highly significant. These outcomes conclusively establish that the Phillips curve relationship as a crucial tool for policy makers as a relevant theory even in the present day economic landscape.

This Chapter is a summation of the whole thesis and an enunciation of the findings along with suggestions for further study in the similar domain. The existence or validity of Phillips curve in the present scenario is the most important concept. This theory emphasizes on the notion that ideal concepts are not possible to achieve in either a developing or a developed economy. To achieve full employment, we have to contend with certain inflation. Should the governments keep a cap on the price levels, an environment of unemployment is inevitable. This is indeed a major dilemma for the governments and policymakers. At present, most of the economies use Phillips curve as a controlling tool in an inflationary situation.

7. 1 Suggestions for Policy Recommendations

Developing economies are mostly labour oriented because they are not able to provide all the facilities for improving the standard of living of their citizens. Apart from this, the lack of infrastructure, education awareness, etc., prevents the desired level of development in the developing economies. If we talk about the Indian economy, it is also a labour intensive economy which can develop only by the labor oriented job opportunities. We know that the marginal propensity to consume is very high amongst the labour class and there is more demand for goods and services in the economy. This purchasing power helps to grow the economy. Therefore, government should promote labour class and provide good and quality based facilities. Moreover, the present day Indian demography of educated and skilled youth has varied interests and expects multitude of employment openings with the aspirations to accomplish comfortable, if not

highly affluent, standards of living. At the same time, the global climate for all economies remains pessimistic as many economies, India included, are facing a slowdown. We are living in the scenario where trade wars over tariffs threaten to engulf successful boom phases into depression. Market volatility adds to the inflation woes as Indian consumers' spending potential decreases with the rising inflation imposed upon them due to the global upheavals. In the backdrop of trade wars as well as the very recent USA and Iran confrontations that affected the oil prices, the average Indian consumer is bearing the brunt of sluggish economy. Hence, there is an imminent need to promote the policies for economic growth and development in the slowdown phases in the developing economies. Further, the Phillips curve describes a tradeoff, i.e., a certain rate of inflation can be traded for some rate of unemployment. For example, a lower rate of unemployment can be achieved only at a higher rate of inflation. This curve provides a large number of such tradeoff points that are known as the menu for choice between inflation and unemployment. Thus, the policymakers will always face problem of adjustment between inflation and unemployment in economy.

Suggestions

- India is labour surplus economy; therefore the government should provide more job opportunities. Phillips curve depicts a stable relationship, so the government should manage this relationship from time to time by focusing on both the fiscal policy and monetary policy such as demand and supply management of money.
- Taxation policy through the direct taxes and indirect taxes through the fiscal mechanism will finally assist in reducing unemployment and inflation. High inflation and high unemployment is harmful for a developing economy like India and it is not in the position to tolerate either.
- The main issue is how to achieve a workable balance between inflation and unemployment. This balance requires effective instruments. The policymakers should enlist concepts such as jawboning, wage guide post, wage freeze, tax linked wage policy and carrot & stick policy.²¹

²¹Details concept of these theories in the appendix attached at the end of thesis.

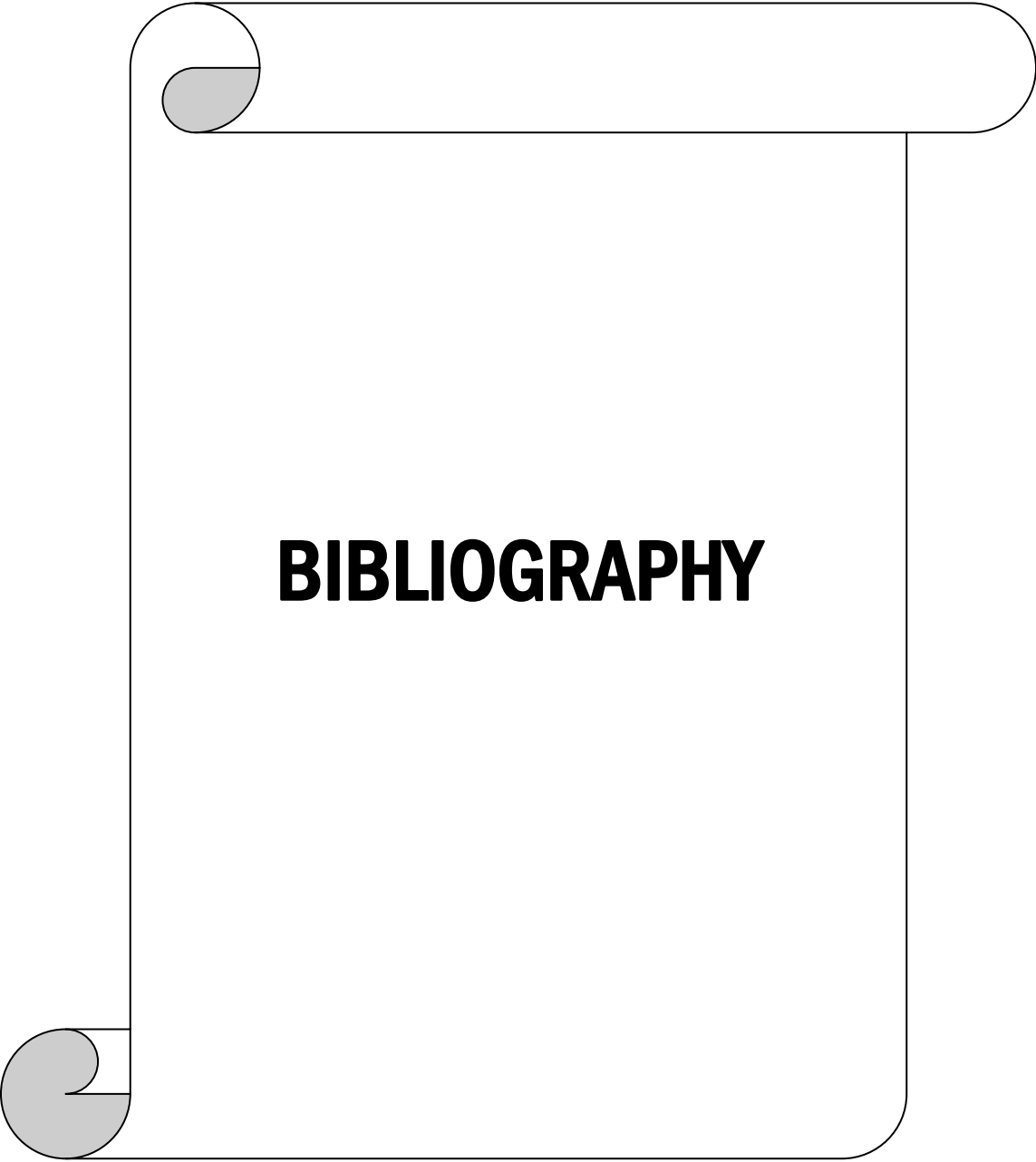
Note: *This research work's results are based on the dataset from the year 2002 to 2015. The current data is not part of the research's ambit. However, few limitations of the research work that could not be addressed are stipulated below:*

7.2 Limitations of the Present Study

- This study is valid only for the Indian economy from 2002 to 2015.
 - This Study has referred to National Sample Survey Organization (NSSO) for its empirical facts. But NSSO conducts its survey only after a period of five years. Hence, the data outsourced could be at variance from the actual one. Furthermore, the number of unemployed registered with the employment exchange is also highly unreliable.
 - This study focuses on only the estimation of Phillips curve shape rather than Phillips curve slope in mathematical form.
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Notes

1. Detailed of unit root test and ADF- breakpoint test attached in the appendix end of the thesis.
2. Detailed of VAR/SVAR/ARDL model attached in the appendix end of the thesis.
3. Detailed theories of policy implication attached in the appendix end of the thesis.



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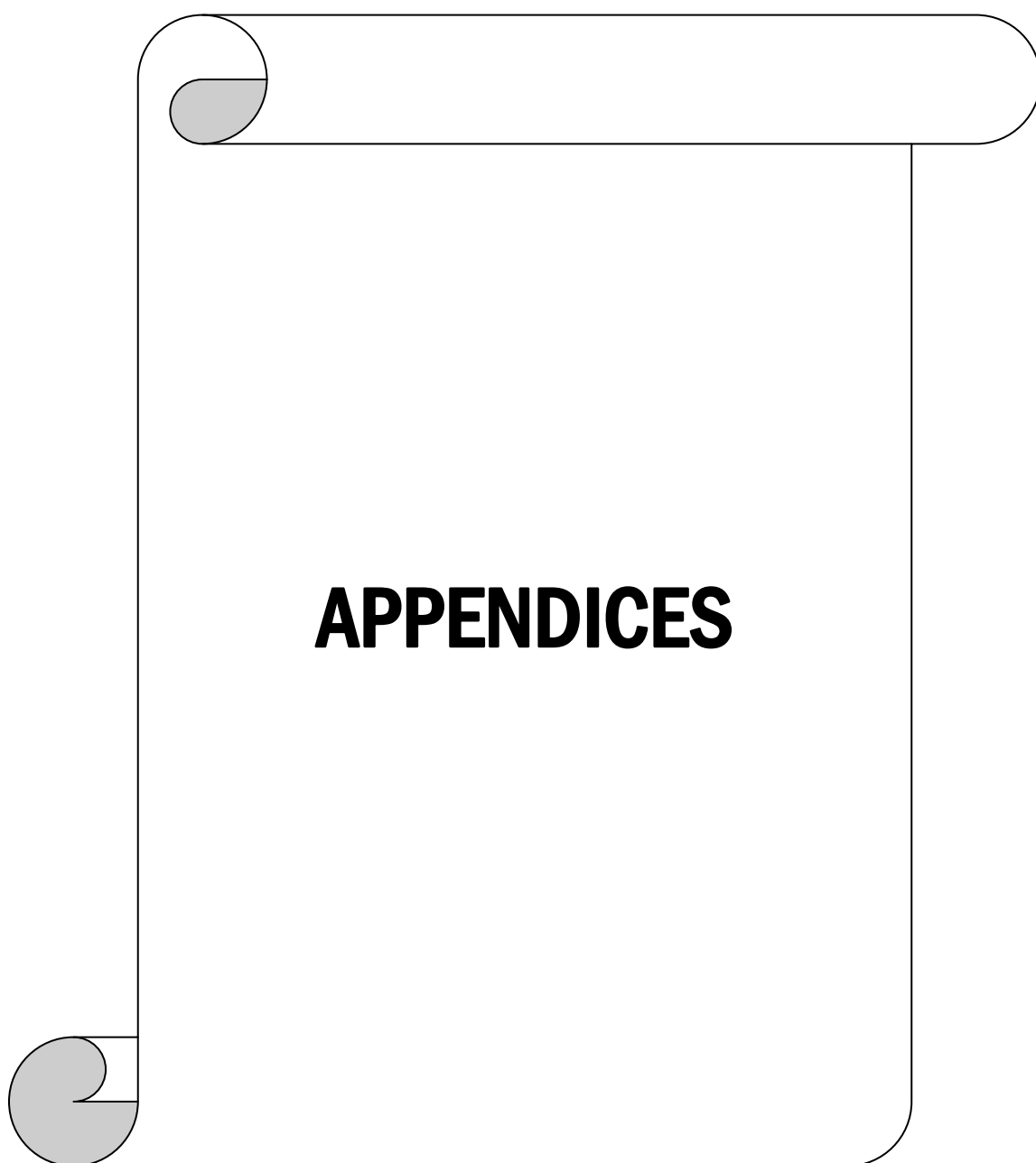
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APPENDIX

ALL ESTIMATION METHODOLOGY

ADF TEST AND ADF-BREAK POINT UNIT TEST

A unit root process is a well-known example of non-stationary processes and testing for a unit root against stationary has been a topic of substantial interest from both theoretical and empirical perspectives. These tests are conducted to eschew the existence of spurious assessment in two folds: One, the Null Hypothesis is that series is stationary using KPSS test. Second, Unit root tests such as Augmented Dickey Fuller tests. The study has used Augmented Dickey Fuller (ADF) where the null hypothesis says that the series possess a unit root. If a series is stationary without any differencing, it is said to be $I(0)$ or integrated of order 0. On the other hand, if a series is stationary after first difference it is said to be $I(1)$ or integrated of order 1.

Recently, Kim and Perron (2009) introduced a structural break unit root test (ADF-break point unit root test) to check the level of integration by identifying single unknown structural break. We are also using this new test in our research. See Vogelsang and Perron (1998) and Kim and Perron (2009) for discussion. The break date is selected where the t-statistic from the ADF test is minimum (most negative). Consequently, the break date elected is the most favorable break out of the various selected by the concerned test. The same can also be achieved and verified through the Additive Outlier (AO) and Innovational Outlier (IO) models. The AO model allows for a sudden change in mean (crash model) while the IO model allows for changes that are more gradual. Perron and Vogelsang (1992, pp.303) argues that these tests are based on the minimal value of t-statistics on the sum of the autoregressive coefficients over all possible breakpoints in the appropriate auto-regression. Perron and Vogelsang (1992) applied these two models for non-trending data (raw data), while Perron (1997) modified them for use with trending data. Applying the procedure for testing the unit root hypothesis, which allows for the possible presence of the structural break, has at least two advantages. First, it prevents yielding a test result that is biased towards non-rejection, as suspected by Perron (1989). Second, since this procedure can identify when the possible presence of structural break

occurred, then it would provide valuable information for analyzing whether a structural break on a certain variable is associated with a particular government policy, economic crises, war, regime shifts or other factors.

VAR' S THEORY

A structural VAR uses economic theory to sort out the contemporaneous links between the variables (Bernanke, 1986; Blanchard and Watson, 1986; Sims, 1986). Structural VAR requires “identifying assumptions” that allow correlations to be interpreted causally. These identifying assumptions can involve the entire VAR, so that all of the causal links in the model are spelled out, or just a single equation, so that only a specific causal link is identified. This produces instrumental variables which permit the contemporaneous links to be estimated using instrumental variables regression. The number of structural VARs is limited only by the inventiveness of the researcher. Until now, we have carefully distinguished between recursive and structural VARs: recursive VARs use an arbitrary mechanical method to model contemporaneous correlation in the variables, while structural VARs use economic theory to associate these correlations with causal relationships. VAR-based impulse response functions has stood the test of time well. The implementation of VAR-based estimations of impulse response functions means that certain technical issues have to be addressed (James H. Stock and Mark W. Watson, 2001, Vector Autoregression).

Impulse responses trace out the response of current and future values of each of the variables to a one unit increase in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. The implied thought experiment of changing one error while holding the 7 others constant makes most sense when the errors are uncorrelated across equations, so impulse responses are typically calculated for recursive and structural VARs.

DETAILED INFORMATION OF ARDL TECHNIQUES

The ARDL approach deals with single cointegration and was introduced originally by (Perason and shin, 1999).

ASSUMPTION OF ARDL

- If variables are stationary at first difference, i.e. integrated to the order 1 but not $I(2)$.
- Estimated with appropriate lags.
- Errors are serially uncorrelated.
- Model dynamically stable.
- In case of mixed form of stationarity, i.e. if variables are stationary at levels and also at first difference.

ADVANTAGES

According to Alam and Quazi (2003) estimation using ARDL model is possible even in challenge of endogeneity of explanatory variable as long as the model is free from residual correlation. This model stands unique against the Engle–Granger cointegration analysis where ARDL method can discern between dependent and independent variables. Moreover this method also has a vantage position in proceeding with consistent long-run parameters that are asymptotically normal regardless of whether the variables are $I(0)$, $I(1)$ or mutually integrated. One of the main advantages of ARDL modeling lies in its flexibility, as it can be applied when the variables are of different order of integration (Pesaran & Pesaran 1997). Another inside track of this approach is that the model uses competent numbers of lags to capture the data generating process in a general-to-specific modeling framework (Laurenceson & Chai 2003). Its popularity also heads from the fact that cointegration of non-stationary variables is equivalent to an error-correction (EC) process (for the linear transformation see: E.g. Banerjee et al. 1993), and the ARDL model has a reparameterization in EC form (Engle & Granger 1987; Hassler & Wolters 2006). The EC integrates the short-run dynamics with the long-run equilibrium without losing long-run information and the existence of a long-run cointegrating relationship can be tested based on the EC representation. In addition, it is also argued that using the ARDL approach avoids problems resulting from non-stationary time series data.

As this empirical and theoretical research intends to enquire about the long-run relations, our focus is towards modeling the series as stationary distributed lag or autoregressive distributed lag (ARDL). The long-run properties of the model are estimated and analysed using standard asymptotic normal theory on variables differenced stationary or $I(1)$. This thesis aims at estimating using the Autoregressive Distributed Lag (ARDL) approach to co-integrating testing rather than the single

Pesaran and Shin (1999) set forth that appropriate lags in the ARDL model are corrected for both residual correlation and endogeneity. Equation testing for co-integration based on Johansen residual based tests where pre- testing is also not required for the order of integration.

Based on Pesaran, Shin (1991) and Pesaran, Shin and Smith (2001), this technique is based on single ARDL equation thus reducing the number of parameters and also number of lags can be applied to each variable separately unlike VAR as in Johansen approach. A data generating process is represented by a general VAR of order p which is rewritten in vector ECM form constituting vector z of variables focusing on the conditional modeling of the dependent scalar variable y . In that front, vector z is partitioned into the scalar y and vector x of dependent variables. To examine the negation of level relationship between y and x , the approach used is F-statistic to test for joint hypothesis that all the coefficients of all lagged variables in the ECM equation are zero. PSS (2001) segregates five cases of ARDL approach to co-integration specifically; no intercepts, no trends, restricted intercepts, no trends; unrestricted intercepts. The resulting ECM may be inference as autoregressive distributed models of orders models where the F-statistic has asymptotic critical value bounds for all the cases. If the computed F-statistic fall outside the critical value bounds, the test allows a conclusive evidence without discerning about the integration situation of the underlying regressors. Whereas, if the F-statistic fall within the bounds, inference stands inconclusive and before advancing further, comprehension of the order of integration is required. If F-statistic lies below the 0.05 lower bound, there is evidence of no level relationship. Hence, no level relationship hypothesis cannot be rejected at 5 percent level.

A VECM envelops the long run relationship and short run dynamics contemporaneously that propels variable back to its long run equilibrium path after shocks that had provisionally driven it away from long run equilibrium. ECM model estimation needs a more parsimonious route.

DIAGNOSTIC TESTING OF THE DATA

Model checking is an important step in statistical modeling. Here the model as a whole would be evaluated using the following diagnostic tests:

(1) SERIAL CORRELATION TESTING: We test for serial correlation by employing the Breusch- Godfrey test. this test is useful in that allows for lagged dependent variables, higher order autoregressive process as well as single or higher order moving average processes. the main idea is to regress the residuals from the old regression on all of the independent variables and on the lagged values of the residuals. The null hypothesis is of no autocorrelation and rejection of null hypothesis would imply presence of serial correlation which must be corrected for.

(2) HETEROSCEDASTICITY TEST: It is essential to have homogeneity of variance (**Heteroscedasticity**) that is the error variance should be constant. It has been tested by the way of Breusch-Pagan-Godfrey test and ARCH.

Breusch-Pagan-Godfrey test is a large sample test for homoscedasticity. it regresses the squared residuals on the original regressor or by default. A finding of significance means the null hypothesis is rejected and homoscedasticity cannot be assumed. This test is more powerful than Goldfeld- Quandt and White's test.

Auto regressive conditional heteroscedasticity or ARCH allows for heteroscedasticity to occur in the variance of the error terms rather than in the error terms themselves. it regresses the squared residuals on lagged squared residuals and a constant. As before here as well a finding of significance means the null hypothesis is rejected and homoscedasticity cannot be assumed.

Presence of heteroscedasticity does not imply, that a good model should not be considered. in fact with the increasing use of heteroscedasticity- constant standard errors

(HAC), which allows for inference without specifying the conditional second moment of error term, testing conditional homoscedasticity is not as important as in the past.

Hence the present study adjusts for heteroscedasticity (if found), by HAC standard errors and covariance (Bartlett Kernel, Newey-West)

(3) CUMULATIVE SUM (CUSUM) AND CUMULATIVE SUM OF SQUARED RESIDUALS (CUSUMSQ) STABILITY TEST: We use the CUSUM test to detect any systemic eventual movements where the coefficients have values effecting a possible structural instability. It allows us to check if any break points prevail in the dataset. If the plot of CUSUM and CUSUMSQ statistics stays within 5 percent significance level then the estimated coefficients are said to be stable.

(4) NORMALITY TEST: the errors should be normally distributed. Technically normality is necessary only for hypothesis tests to be valid estimation of the coefficients only requires that the errors be identically and independently distributed. The Jarque-Bera test has the null hypothesis of normality and rejection of the hypothesis (because of a significant p value) leads to the conclusion that the distribution from the data came is non-normal.

THEORIES RELATED TO POLICY RECOMMENDATIONS

- The concept of *Jawboning* or *Moral Suasion* in economics is an informal method of public and private interactions. The government employs the subtle strategies of persuading the businesses and labour unions to reduce wages and thereby reduce the prices of commodities. Jawboning can contain price rise for a very transient time frame only and as many economists cite, the prices are again revised or increased when the demand or the production costs go up. As aptly put, *Jawboning is a blunt weapon against inflation* (Tucker, 2010).
- The intent of *Guidedposts* to stabilize the price-wage-productivity relationship to control inflation has been a highly contentious issue between the government and the labor and business enterprises. According to the theory, prices are determined by two key forces. The first is the equation of supply and demand in a competitive market. And the second force or contributor to the price rise is the decisions taken by the

business managers. The main objective of this theory was established by the Council of Economic Advisers. The core focus here is to check inflation by assuming that the price decisions by business managers might escalate the prices higher than the prices determined by the modalities of supply and demand. The second focus of this theory is to monitor the accumulation of presumably excessive profits. Huge profits trigger a demand for increased wages as every worker desires a larger share in the profits. As per the theory, the wages should rise only as much as the “national trend” of output per man-hour. This implies that companies in industries where productivity is rising more rapidly than the average- should reduce prices enough to distribute to the industry's customers the labor cost savings it would make under the general wage guideposts. Such a diktat is not a feasible option for any of the stakeholders.

- **Wage Freeze Policy:** Different strategies are usually employed by the governments to control inflation and these include wage and price controls, tax incentives, indexing or other measures to fix income shares. Control of wages or prices are the policies that governments undertake to control inflation induced in the emergencies of war or natural calamities. However, economies are now experiencing the more pervasive, peacetime inflation rates. To counter the inflation levels in this scenario, economists suggest alternatives like the inflation-fighting incomes policies that persuade the participants into willing acceptance.

The government intervenes here to enforce a law that restrains wage push inflation by holding wages at their existing level. Once the wage hike is contained, the employers would not add the extra costs to the goods to amass more profits and with the prices under control, inflation would be well within the confined levels.

There are two types of Remuneration and Price Controls: The Absolute Control and Rate of Growth Controls.

- **Absolute Controls:** It implies that the government can freeze the absolute level of wages and prices to inject income shares. In an inflationary situation, the frozen wages and prices are the maximum prices to be paid. In a deflationary situation, the frozen wages and prices are the minimum prices to be paid.
- **Rate of Growth Controls:** It implies that the government can freeze the annual percentage changes for wages and prices. This is done to ensure that income shares

remain fixed over time. In an inflationary situation, the annual percentage rise in wages and prices is inadequate for some concentrated rate of rise. In a deflationary situation, the annual percentage fall in wages and prices is inadequate for some concentrated rate of decrease.

LEGAL OR AUTHORIZED IMPLICATIONS OF THE CONTROLS

- **Voluntary Controls:** It strictures set as guideposts by the government to control inflation during the peacetime. In this case the government institutes a set of benchmarks for pricing behavior which are not legally binding. Hence the firms may or may not voluntarily adhere to these controls.
- **Mandatory Controls:** If "guidelines" or "guideposts" prove unworkable, the government can impose strictures that are legally binding and violation would entail penalties.
- **Absolute controls:** It intended to fix the wages and prices so that no specific group can raise income other than by the due process of working longer and producing more. This increases real output at current wage and price levels to increase real income. With increase in the real income, the wage-price spiral will be broken as no group can claim higher wages.
- **Tax Linked Wage Policy:** This mechanisms gained currency in the work of *Dawkins et al. 1999*. Dawkins and his colleagues suggest a three year freeze on award wage rates combined with tax (credits equivalent to tax cuts) for low wage workers living in low income families (*Dixon and Rimmer, 2000*). This system draws its example form variant of wage/tax bargain in Australia's current award wage system. This system covers workers accounting for about 21 percent of Australia's wage bill. Award wage rates for these workers are determined by the centarilsed bargaining in the industrial relations commission between the unions of the government and employers. The actual wage rate of workers in the award system is normally reflected in the award wage rates. This is because in determining award wage rates, the industrial relations commission reckons the factors which would be relevant in a freely operating labour market while deciding the wage rates for the group of workers currently in the award system.

- **Carrots and Sticks Policy:** This policy alludes to the popular practice of carrot and stick approach where the reward and penalty are intertwined. The allusion finds its base in the Pavlov's traditional Motivation Theory (*Herrnstein, 1969, Pp. 49-69*). More specifically, in the economic human model, there is a suggestion for containing the selfishness of few individuals or firms by instituting economic awards and supervisory tools. However, as Saylı,H., 2008, contends, such a method would only find and evaluate accusations instead of eradicating the source of the problem. Hence, a more conversant approach would be to encourage the principle that one's economic aspirations should not be achieved at the cost of country's social, economic and environmental goals.

RAW DATA

Chapter- 3

PRE RECESSION PERIOD

time	CPI-AL	CPI-IW	CPI-RL
Jan-02	2.33	4.94	2.64
Feb-02	3.01	5.19	3.32
Mar-02	3	5.17	2.98
Apr-02	2.66	4.69	2.97
May-02	2.64	4.66	2.29
Jun-02	2.61	4.16	2.59
Jul-02	2.27	3.89	2.57
Aug-02	2.24	3.86	2.23
Sep-02	3.22	4.3	3.19
Oct-02	2.88	4.06	2.86
Nov-02	3.19	3.6	3.16
Dec-02	2.88	3.2	3.18
Jan-03	3.9	3.43	3.54
Feb-03	4.55	3.86	4.18
Mar-03	4.85	4.06	4.82
Apr-03	5.5	5.12	5.13
May-03	5.14	4.66	5.11
Jun-03	5.1	4.41	4.73
Jul-03	4.75	4.16	4.7
Aug-03	3.76	3.1	3.74
Sep-03	3.43	2.89	3.41
Oct-03	3.42	3.29	3.4
Nov-03	3.1	3.07	2.76
Dec-03	3.43	3.72	3.09
Jan-04	3.75	4.35	3.73
Feb-04	3.11	4.13	3.4
Mar-04	2.47	3.49	2.45
Apr-04	1.53	2.23	1.83
May-04	1.83	2.83	1.82
Jun-04	1.82	3.02	1.81
Jul-04	2.11	3.19	1.8
Aug-04	3.02	4.61	3
Sep-04	3.31	4.81	3.29
Oct-04	3.6	4.57	3.58
Nov-04	3.3	4.17	3.28

Dec-04	3.01	3.78	2.99
Jan-05	2.71	4.37	2.69
Feb-05	2.41	4.17	2.39
Mar-05	2.41	4.17	2.4
Apr-05	3.02	4.96	2.99
May-05	3	3.74	2.99
Jun-05	2.68	3.32	2.66
Jul-05	3.55	4.06	3.82
Aug-05	3.23	3.45	3.21
Sep-05	3.21	3.63	3.19
Oct-05	3.19	4.18	3.17
Nov-05	4.65	5.33	4.62
Dec-05	4.68	5.57	4.94
Jan-06	4.69	4.75	4.66
Feb-06	5	4.95	4.66
Mar-06	5.29	4.95	5.26
Apr-06	5.57	5.03	5.23
May-06	6.41	6.31	6.38
Jun-06	7.25	7.65	7.2
Jul-06	6.29	6.71	5.95
Aug-06	6.53	6.32	6.21
Sep-06	7.34	6.78	7.02
Oct-06	8.43	7.3	8.1
Nov-06	8.33	6.33	8.01
Dec-06	8.94	6.91	8.31
Jan-07	9.52	6.72	8.91
Feb-07	9.8	7.56	9.47
Mar-07	9.5	6.72	9.17
Apr-07	9.44	6.67	9.12
May-07	8.22	6.61	7.9
Jun-07	7.84	5.69	7.53
Jul-07	8.6	6.45	8.02
Aug-07	8.8	7.26	8.51
Sep-07	7.89	6.4	7.61
Oct-07	6.99	5.51	6.72
Nov-07	6.15	5.51	5.88
Dec-07	5.9	5.51	5.63

DURING RECESSION PERIOD

time	CPI-AL	CPI-IW	CPI-RL
Jan-08	5.63	5.51	5.88
Feb-08	6.38	5.47	6.11
Mar-08	7.91	7.87	7.63
Apr-08	8.88	7.81	8.61
May-08	9.11	7.75	8.84
Jun-08	8.77	7.69	8.75
Jul-08	9.41	8.33	9.41
Aug-08	10.29	9.02	10.29
Sep-08	10.98	9.77	10.98
Oct-08	11.14	10.45	11.14
Nov-08	11.11	10.45	11.11
Dec-08	11.14	9.7	11.14
Jan-09	11.62	10.45	11.35
Feb-09	10.79	9.63	10.79
Mar-09	9.46	8.03	9.69
Apr-09	9.09	8.7	9.09
May-09	10.44	8.63	10.21
Jun-09	11.52	9.29	11.26
Jul-09	12.9	11.89	12.67
Aug-09	12.89	11.72	12.67
Sep-09	13.19	11.64	12.97
Oct-09	13.73	11.49	13.51
Nov-09	15.65	13.51	15.65
Dec-09	17.21	14.97	16.99
POST RECESSION PERIOD	CPI-AL	CPI-IW	CPI-RL
Jan-10	17.57	16.22	17.35
Feb-10	16.45	14.86	16.45
Mar-10	15.77	14.86	15.52
Apr-10	14.96	13.33	14.96
May-10	13.45	13.91	13.68
Jun-10	13.02	13.73	13.02
Jul-10	11.02	11.25	11.24
Aug-10	9.65	9.88	9.66
Sep-10	9.13	9.82	9.34
Oct-10	8.43	9.7	8.45
Nov-10	7.14	8.33	6.95
Dec-10	7.99	9.47	8.01
Jan-11	8.67	9.3	8.69

Feb-11	8.55	8.82	8.55
Mar-11	9.14	8.82	8.96
Apr-11	9.11	9.41	9.11
May-11	9.63	8.72	9.63
Jun-11	9.32	8.62	9.14
Jul-11	9.03	8.4	9.03
Aug-11	9.5	9	9.71
Sep-11	9.4	10.1	9.25
Oct-11	9.4	9.4	9.73
Nov-11	8.9	9.3	9.14
Dec-11	6.4	6.5	6.72
Jan-12	4.9	5.3	5.27
Feb-12	6.3	7.6	6.68
Mar-12	6.8	8.6	7.19
Apr-12	7.8	10.2	8.01
May-12	7.8	10.2	8.11
Jun-12	8	10.1	8.54
Jul-12	8.6	9.8	8.94
Aug-12	9.2	10.3	9.34
Sep-12	9.4	9.1	9.93
Oct-12	9.9	9.6	9.84
Nov-12	10.3	9.5	10.47
Dec-12	11.3	11.2	11.31
Jan-13	12.3	11.6	12.28
Feb-13	12.7	12.1	12.52
Mar-13	12.6	12.1	12.62
Apr-13	12.3	10.2	12.15
May-13	12.7	10.7	12.5
Jun-13	12.8	11.1	12.65
Jul-13	12.8	10.8	12.61
Aug-13	13.2	10.85	12.89
Sep-13	12.8	10.7	12.44
Oct-13	12.6	11.1	12.48
Nov-13	13.4	11.5	13.27
Dec-13	11.2	9.1	11.18
Jan-14	9.1	7.2	9.21
Feb-14	8.1	6.7	8.27
Mar-14	8.4	6.7	8.51
Apr-14	8.4	7.1	8.72
May-14	8.1	7	8.33
Jun-14	7.7	6.5	7.81

Jul-14	8	7.2	8.1
Aug-14	7.2	6.8	7.57
Sep-14	6.9	6.3	7.11
Oct-14	6.1	5	6.4
Nov-14	4.6	4.1	5.02
Dec-14	5.5	5.9	5.74
Jan-15	6.21	7.2	6.46
Feb-15	6.1	6.3	6.19
Mar-15	5.24	6.3	5.49
Apr-15	4.41	5.8	4.66
May-15	4.38	5.7	4.62
Jun-15	4.46	6.1	4.7
Jul-15	2.9	4.4	3.25
Aug-15	3	4.3	3.21
Sep-15	3.5	5.1	3.69
Oct-15	4.4	6.3	4.66
Nov-15	4.9	6.7	5.02
Dec-15	5.7	6.3	5.8

Data Source: Labour of Statistics Bureau, Ministry of Labour & employment, the GOI

Pre-Recession Time (WPI)	All Commodity	Primary Articles	Fuel &Power	Manufactured Product
jan 2002	161.0	166.4	228.1	144.2
feb 2002	160.8	166.7	227.3	143.9
Mar-02	161.9	167.3	233.0	144.1
Apr-02	162.3	169.0	230.4	144.9
May-02	162.8	168.9	230.4	145.5
june 2002	164.7	171.9	233.8	146.8
july 2002	165.6	172.3	238.4	147.1
Aug-02	167.1	175.4	237.8	148.5
sep 2002	167.4	176.1	238.8	148.6
Oct-02	167.5	175.2	240.9	148.4
nov 2002	167.8	176.5	240.8	148.5
n dec 02	167.2	174.7	238.8	148.6
jan 2003	167.8	173.8	241.8	149.2
feb 2003	169.4	176.5	244.3	150.3
Mar-03	171.6	177.9	254.1	151.0
Apr-03	173.1	179.9	254.2	152.6
May-03	173.4	180.8	247.6	154.3
june 2003	173.5	183.8	246.1	153.8
Jul-03	173.4	180.5	249.3	154.1
Aug-03	173.7	178.6	249.5	155.1

Sep-03	175.6	181.2	254.6	156.1
Oct-03	176.1	183.2	253.9	156.3
nov 2003	176.9	183.3	255.2	157.2
dec 2003	176.8	180.8	257.1	157.6
Jan-04	179.8	180.8	261.7	159.0
Feb-04	179.8	182.4	262.2	160.6
Mar-04	178.7	182.2	262.6	161.0
Apr-04	97.5	97	92.8	98.6
May-04	98	98.5	93	99
Jun-04	98.3	99	94.8	98.9
Jul-04	99.2	101	96.3	99.4
Aug-04	100.6	103.5	99.2	100
Sep-04	100.5	102.2	99.8	100.1
Oct-04	100.7	102.9	99.6	100.3
Nov-04	101.5	103.7	103.8	100.3
Dec-04	100.5	98.6	103.2	100.4
Jan-05	101	97.7	105.9	100.8
Feb-05	101.1	97.5	106.4	100.9
Mar-05	101.4	98.1	106.4	101.3
Apr-05	102.7	99.1	107.1	102.8
May-05	102.5	98.9	107.2	102.4
Jun-05	102.9	101.1	108.9	102.1
Jul-05	104	104.6	112.2	102
Aug-05	104.1	105.2	112.1	102
Sep-05	104.9	105.8	115.7	102.1
Oct-05	105.4	107.5	116.6	102.1
Nov-05	105.5	108.2	116.5	102.2
Dec-05	104.9	105.3	116.3	102.1
Jan-06	105.4	106.1	116.1	102.6
Feb-06	105.6	105.5	116.9	103.1
Mar-06	105.7	104.3	117.3	103.5
Apr-06	107.8	106.7	117.6	105.9
May-06	108.7	108.4	118.5	106.5
Jun-06	109.9	111.3	121.5	106.8
Jul-06	110.8	112.5	122.5	107.5
Aug-06	111.5	114.5	122.9	108.1
Sep-06	112.2	115.6	123.6	108.4
Oct-06	112.7	117.5	123.4	108.6
Nov-06	112.6	117.6	122.6	108.7
Dec-06	112.2	117	120.3	108.9
Jan-07	112.4	116.2	120.3	109.5

Feb-07	112.6	117	119.2	109.7
Mar-07	112.8	117.6	118.6	110
Apr-07	114.5	120.8	118.8	111.6
May-07	114.7	121.2	118.9	111.7
Jun-07	114.8	121.1	118.9	111.9
Jul-07	115.7	124.2	119.1	112.2
Aug-07	116	125.2	119.5	112.3
Sep-07	116	125.3	119.4	112.4
Oct-07	116.3	124.7	119.8	113
Nov-07	116.8	125.6	120.8	113.2
Dec-07	116.7	123.2	122.1	113.5

Duration of Recession Time	All commodities	Primary articles	Fuel & power	Manufactured products
Jan-08	117.5	121.2	122.8	115.1
Feb-08	119	124.8	124	116
Mar-08	121.5	128.9	127.4	117.8
Apr-08	123.5	132.1	130.2	119.2
May-08	124.1	134.2	131.4	119.2
Jun-08	127.3	138.3	141.7	120.7
Jul-08	128.6	141.1	143.2	121.4
Aug-08	128.9	139.2	145.6	121.8
Sep-08	128.5	138.3	144.6	121.8
Oct-08	128.7	140.8	143.1	121.6
Nov-08	126.9	141.4	136.2	120.2
Dec-08	124.5	137.5	129.1	119.3
Jan-09	124.4	137.2	127.2	119.8
Feb-09	123.3	134.4	124	119.7
Mar-09	123.5	135.8	123.1	119.8
Apr-09	125	140.8	124.2	120.2
May-09	125.9	143.3	124.8	120.8
Jun-09	126.8	146.5	125.7	121
Jul-09	128.2	149.3	130.5	121.1
Aug-09	129.6	152.9	131.5	122
Sep-09	130.3	153	132.9	122.6
Oct-09	131	155.3	133.4	122.9
Nov-09	132.9	161.6	134.7	123.6
Dec-09	133.4	162.2	135	124.2

Post-recession

Duration of Recession Time	All commodities	Primary articles	Fuel & power	Manufactured products
Jan-10	135.2	164.9	135.8	125.9
Feb-10	135.2	163.6	136.6	126.1
Mar-10	136.3	165.9	140.1	126.2
Apr-10	138.6	171	141.1	127.9
May-10	139.1	172.6	142.8	127.9
Jun-10	139.8	176	143.2	127.8
Jul-10	141	177.8	147.8	128.1
Aug-10	141.1	177.3	148	128.3
Sep-10	142	180.8	147.6	128.7
Oct-10	142.9	183.4	148.1	129.2
Nov-10	143.8	185.3	148.6	129.8
Dec-10	146	192	150.2	130.9
Jan-11	148	195.3	151.3	132.6
Feb-11	148.1	189.6	153.5	134
Mar-11	149.5	188.2	157.6	135.6
Apr-11	152.1	196.8	159.5	136.6
May-11	152.4	194.9	160.4	137.4
Jun-11	153.1	195.9	161.6	137.9
Jul-11	154.2	198.2	165.6	138
Aug-11	154.9	199.4	167.1	138.4
Sep-11	156.2	202.9	168.3	139
Oct-11	157	203.5	170	139.6
Nov-11	157.4	201.8	171.6	140.4
Dec-11	157.3	198.9	172.7	140.9
Jan-12	158.7	200.7	177	141.5
Feb-12	159.3	203	176.7	141.8
Mar-12	161	207.8	177.8	142.6
Apr-12	163.5	215.6	178.8	143.8
May-12	163.9	215	178.9	144.6
Jun-12	164.7	215	181.1	145.3
Jul-12	165.8	219.1	179.5	146.1
Aug-12	167.3	221.8	181.7	147.2
Sep-12	168.8	221.6	188.5	148
Oct-12	168.5	219.4	189.8	147.9
Nov-12	168.8	221.1	188.7	148
Dec-12	168.8	219.9	190.4	148
Jan-13	170.3	223.6	193.4	148.5
Feb-13	170.9	224.4	195.5	148.6

Mar-13	170.1	223.1	191.6	148.7
Apr-13	171.3	226.5	193.7	149.1
May-13	171.4	227.3	191.9	149.3
Jun-13	173.2	233.9	194.7	149.5
Jul-13	175.5	240.3	199.9	149.9
Aug-13	179	251.9	204.7	150.6
Sep-13	180.7	252.7	210.6	151.5
Oct-13	180.7	251.4	209.8	152.1
Nov-13	181.5	254.9	209.6	152.3
Dec-13	179.6	243.7	211.1	152.5
Jan-14	179	238.8	212.4	152.9
Feb-14	179.5	238.5	212.6	153.6
Mar-14	180.3	239.4	214.2	154.2
Apr-14	180.8	242.4	211.8	154.6
May-14	182	246.8	212.1	155.1
Jun-14	183	250.3	212.3	155.4
Jul-14	185	256.6	214.6	156
Aug-14	185.9	261.2	214	156.1
Sep-14	185	257.8	213.4	156
Oct-14	183.7	253.3	210.8	155.9
Nov-14	181.2	250.8	200.1	155.2
Dec-14	178.7	244.4	194.6	154.7
Jan-15	177.3	242.1	189	154.5
Feb-15	175.6	240.9	181.2	154
Mar-15	176.1	239	188	153.9
Apr-15	176.4	243.6	184.3	153.9
May-15	178	244.2	192.1	154.3
Jun-15	179.1	249.1	193.5	154.2
Jul-15	177.6	246.4	189.8	153.6
Aug-15	176.5	250.2	179.3	153
Sep-15	176.5	251.9	175.6	153.3
Oct-15	176.9	253.4	176.4	153.3
Nov-15	177.5	256.2	178.1	153
Dec-15	176.8	255.6	176.8	152.4

Data source: MOSPI

Chapter-4

<u>obs</u>	EXPORT	LENDING RATE	CPI-IW
1	20555	17202.7	467
2	17212	17227.5	466
3	20182	21435.4	468
4	19740	19791.7	469
5	19992	14826.4	472
6	19407	14826.4	476
7	22350	16980	481
8	21970	15867.7	484
9	21723	15502.7	485
10	22987	14185.1	487
11	19537	12392.6	489
12	19184	12434.9	484
13	23246	10841.9	483
14	20459	12448.7	484
15	24541	12448.7	487
16	20438	9284.37	493
17	22111	11080.9	494
18	20543	8840.5	497
19	21435	9697.02	501
20	20744	10972.3	499
21	25129	10780.1	499
22	25456	8079.14	503
23	22315	7347.23	504
24	27902	7662.76	502
25	23711	5222.18	504
26	28188	6021.22	504
27	35396	5543.88	504
28	24791	5422.5	504
29	26983	5911.2	508
30	27614	3520.44	512
31	26792	5777.3	517
32	27726	7346.8	522
33	31894	8674	523
34	29846	7682.7	526
35	31974	9300.1	525
36	32354	8867	521
37	35854	8787.3	526
38	35147	5150.1	525

39	44367	7237.06	525
40	33595	7263.38	529
41	34689	8156.2	527
42	34402	9138.1	529
43	32619	6837.37	538
44	37392	6875.43	540
45	37138	7741.8	542
46	38643	9616.5	548
47	33348	9679.2	553
48	42151	7804.3	550
49	40703	6030.2	119
50	40141	7802.57	119
51	51426	7408.9	119
52	38769	8037.6	120
53	45905	7658	121
54	47990	8620.9	123
55	49244	8460	124
56	50118	10777.7	124
57	49609	10956.2	125
58	45143	11755.6	125
59	44758	12211.1	127
60	48360	10116.5	127
61	48619	10276.6	127
62	46636	10257.4	128
63	56628	13812.3	127
64	47741	9251.3	128
65	50796	7743.3	129
66	49340	7935	130
67	50571	10346.2	132
68	51600	10343.3	133
69	50512	7531.24	133
70	57982	9205.8	134
71	50910	7615	134
72	57682	12045.7	134
73	58624	12045.7	5.51
74	60061	10823.4	5.47
75	69631	10336.2	7.87
76	73883	8060.8	7.81
77	78717	9583.9	7.75
78	82133	10191.6	7.69
79	81523	11725	8.33

80	76254	10281	9.02
81	71941	10224.3	9.77
82	68754	11071.6	10.45
83	54699	10449.9	10.45
84	65016	9754.6	9.7
85	62844	8475	10.45
86	58822	9523.6	9.63
87	66169	10742.2	8.03
88	62460	7430.4	8.7
89	59780	8776.43	8.63
90	65000	8646.69	9.29
91	69520	6531.12	11.89
92	65670	6655.7	11.72
93	70840	8043.4	11.64
94	69180	6831.1	11.49
95	69540	6441.4	13.51
96	76910	5944.2	14.97
97	71500	5960.8	172
98	73000	5740.5	170
99	92150	7698.86	170
100	80720	8832.64	170
101	79170	7986.77	172
102	96240	6215.72	174
103	79410	8107.16	178
104	82660	7297.17	178
105	87440	7827.08	179
106	84740	8376.72	181
107	101630	8662.94	182
108	105440	7657.21	185
109	103010	7468.02	188
110	105610	8760.63	185
111	136860	9949.67	185
112	104134	10804.4	186
113	119095	10507.8	187
114	119024	9748.25	189
115	117380	10684	193
116	112148	8381.04	194
117	126520	9951.68	197
118	116406	9847.68	198
119	118341	8699.32	199
120	133619	10958.8	197

121	130294	13522.5	198
122	123874	10321.2	199
123	145123	14428.6	201
124	123271	19294.9	205
125	135211	15161.7	206
126	139651	11903.1	208
127	128192	10872.6	212
128	128535	9459.4	214
129	135979	11825.3	215
130	127432	10933.4	217
131	127359	10392	218
132	139120	10750	219
133	140003	13167.4	221
134	143408	11676	223
135	166159	14301.1	224
136	133354	15252.3	226
137	137103	12645.3	228
138	140144	12673.5	231
139	154430	10943.8	235
140	166479	10245.1	237
141	179372	10444.5	238
142	169320	9621.88	241
143	151583	10892.5	243
144	163400	11298.7	239
145	166932	11672	237
146	156540	9433.58	238
147	185123	13890.1	239
148	157123	10863.8	242
149	166035	11174.5	244
150	154862	11530.2	246
151	155045	7349.72	252
152	163353	8108.53	253
153	175837	8511.77	253
154	158823	8894.61	253
155	163428	7859.8	253
156	164242	9527.77	253
157	151926	10335.5	254
158	136380	8393.74	253
159	150083	10685	254
160	138400	8683.02	254
161	142573	8683.02	258

162	142342	8282.43	261
163	148150	8278.59	263
164	140443	8301.82	264
165	144814	10488.7	266
166	139589	11190.2	269
167	129331	10164	270
168	150462	13467.7	269

Data Source: EWPRF & Handbook of Statistics, RBI

Chapter- 5

YEAR	WPI INFL	lnwpi	unemployment rate	lunem
1991	31.89418753	1.503711544	3.832000017	0.583426
1992	35.67793008	1.55239965	3.717000008	0.570193
1993	38.34531659	1.583712328	3.740999937	0.572988
1994	42.38769638	1.627239815	3.65199995	0.562531
1995	46.34721181	1.666023613	3.71600008	0.570076
1996	48.4213579	1.685036964	3.813999891	0.581381
1997	50.61430184	1.704273251	4.059999943	0.608526
1998	53.59066937	1.729089182	4.06400013	0.608954
1999	55.44006279	1.743823713	4.063000202	0.608847
2000	59.07142382	1.771377439	4.316999912	0.635182
2001	61.91936126	1.791826468	4.326000214	0.636087
2002	63.48299771	1.802657426	4.43200016	0.6466
2003	66.9217136	1.825567053	4.308000088	0.634276
2004	71.32365523	1.853233592	4.368999958	0.640382
2005	74.69173456	1.873272545	4.395999908	0.643058
2006	78.23319453	1.893391064	4.236999989	0.627058
2007	82.05234979	1.914091023	4.059999943	0.608526
2008	89.17311124	1.950233919	4.116000175	0.614475
2009	91.27305175	1.960342572	3.750999928	0.574147
2010	100	2	3.539999962	0.549003
2011	108.8875669	2.036978294	3.529000044	0.547652
2012	117.6680547	2.070658574	3.621000051	0.558829
2013	125.0684117	2.097147634	3.463999987	0.539578
2014	129.964307	2.113824095	3.414000034	0.533264
2015	126.3747769	2.101660402	3.49000001	0.542825

Data source: World Bank

Chapter-6

time	GDP_AT_FC	HPTREND02	output gap	inflation rate
1	5277.76	5157.636919	5177.76	483.7
2	5120.46	5370.298998	5020.46	489.8
3	5850.55	5583.036154	5750.55	500.1
4	5922.6	5795.767314	5822.6	502.5
5	5536.54	6008.578603	5436.54	508.8
6	5535.22	6221.635414	5435.22	520
7	6506.7	6434.808117	6406.7	522.7
8	6448.84	6647.538073	6348.84	629.8
9	6950.01	6859.311575	6850.01	538.3
10	6907.79	7069.490728	6807.79	548.2
11	7810.54	7277.494326	7710.54	564.4
12	8046.29	7482.6401	7946.29	567.9
13	7600.8	7684.578932	7500.8	566.6
14	7522.77	7883.313988	7422.77	576.9
15	8561.39	8078.79607	8461.39	587.1
16	8845.78	8270.750642	8745.78	593.2
17	8308.76	8459.204787	8208.76	589.5
18	8258.33	8644.544983	8158.33	603.4
19	9362.37	8827.06368	9262.37	617.1
20	9714.18	9006.811943	9614.18	626.2
21	9116.02	9184.175404	9016.02	627.5
22	9045.29	9359.981798	8945.29	636.1
23	10258.18	9535.016266	10158.18	642.5
24	10546.85	9709.867265	10446.85	647.5
25	10009.47	9885.57523	9909.47	663.5
26	9816	10063.70371	9716	697.0
27	10849.93	10245.89368	10749.93	722.7
28	10911.35	10433.63132	10811.35	702.9
29	10601.26391	10628.78032	10501.26391	684.7
30	10725.12398	10833.50294	10625.12398	700.8
31	11682.50585	11049.94424	11582.50585	722.1
32	12151.82176	11280.18157	12051.82176	738
33	11564.66439	11526.68759	11464.66439	406.7
34	11608.78875	11792.47977	11508.78875	415.5
35	12698.77402	12080.5993	12598.77402	424.1
36	13313.08387	12393.97256	13213.08387	432.7
37	12447.06	12735.9123	12347.06	445.6
38	12421.35	13110.3057	12321.35	457.6
39	13525.51	13520.85943	13425.51	465.3
40	14081.36	13970.84954	13981.36	471.7
41	13002.21	14463.555	12902.21	479
42	12994.61	15002.32384	12894.61	492.1
43	14117.85	15589.59075	14017.85	501.9
44	14706.45	16226.53562	14606.45	506.1
45	13607.57	16913.41846	13507.57	511.3
46	13664.41	17649.54928	13564.41	515.9
47	14762.12	18432.17188	14662.12	535.2

48	15383.8	19256.03938	15283.8	541.8
49	23774.18367	20113.61113	23674.18367	538.8
50	23809.06082	20994.92629	23709.06082	545.8
51	24595.09509	21892.3119	24495.09509	555.9
52	25011.89948	22799.85385	24911.89948	543.6
53	25579.48972	23713.32725	25479.48972	529
54	25760.44475	24629.88973	25660.44475	533.5
55	26389.0485	25547.86529	26289.0485	530.6
56	27176.15689	26466.28452	27076.15689	531.2

Data Source: Handbook of Statistics, RBI

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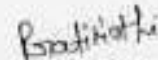
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Place: Lucknow

DECLARATION

I declare that the thesis entitled "**Short Run Linkage between Inflation and Unemployment during Pre and Post-Recession : A Study of India**" submitted to Babasaheb Bhimrao Ambedkar University, (A Central University), Lucknow, for the award of Doctor of Philosophy in Economics, is my original work and it has not previously been produced for the award of any degree, diploma, fellowship or similar other titles anywhere.

This research study is carried out under the supervision of **Prof. NMP Verma**, Department of Economics, School for Ambedkar Studies (SAS), Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, Uttar Pradesh, India. This is also declared that the thesis is essentially free from all kinds of plagiarism.


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Date: 20-03-2020

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The thesis submitted to Babasaheb Bhimrao Ambedkar University, Lucknow, satisfies all the requirements as stipulated in the Doctor of Philosophy (Ph.D.) regulations - 1999 as amended in 2013 and it is fit for submission and evaluation for the award of the degree of Doctor of Philosophy of the University.

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Pratinidhi

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LIST OF ABBREVIATIONS USED

AD	Aggregate Demand
ADF	Augmented-Dickey Fuller
AIC	Akaike Information Criterion
AIG	American International Group
ANOVA	Analysis of Variance
AO	Additive Outlier
ARCH	Autoregressive Conditional Heteroskedasticity
ARDL	Auto Regressive Distributed Lag
AS	Aggregate Supply
CDS	Current Daily Status
CIDP	Chartered Institute of Personnel and Development,
CoS	Committee of Secretaries
CPI	Consumer Price Index
CPI-AL	Consumer Price Index- Agricultural Laborer
CPI-IW	Consumer Price Index- Industrial Worker
CPI-RL	Consumer Price Index- Rural Laborer
CPI-UNME	Consumer Price Index Urban Non-Manual Employees
CSO	Central Statistics Office
CUSUM	Cumulative Sum
CV	Critical Value
CWS	Current Weekly Status
DF	Degree of Freedom
DGET	Director General of Employment and Training
ECM	Error Correction Model
ECT	Error Correction Term

EPWRF	Economic Political Weekly Research Foundation
EUS	Employment-Unemployment Survey
FPE	Final Prediction Error
GDP	Gross Domestic Product
GNP	Gross National Product
HP	Hodrick-Prescott
HQ	Hannan-Quinn Information Criterion
ILO	International Labor Organization
IMF	International Monetary Fund
IO	Innovational Outlier
IRF	Impulse Response Function
JB	Jarque-Bera
LFPR	Labour Force Participation Rate
LM	Lagrange Multiplier
LRPC	Long Run Phillips Curve
MOSPI	Ministry of Statistics and Program Implementation
NAIRU	Non- Accelerating-Inflation Rate of Unemployment
NBER	National Bureau of Economic Research
NRU	Natural Rate of Unemployment
NSC	National Statistical Commission
NSSO	National Sample Survey Organization
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Square
OPEC	Organization of the Petroleum Exporting Countries
PC	Phillips Curve
PIN	Pin Index Number
PP	Phillips Perron

PPI	Producer Price Index
PU	Proportion Unemployed
RBI	Reserve Bank of India
RMSE	Root Mean Square of Error
SBCs	Schwarz Bayesian Criteria
SC	Schwarz Information Criterion
SNA	System of National Accounts
SPCL	Statistics of Prices and Cost of Living
SRPC	Short Run Phillips Curve
SS	Sum of Square
SV	Single Variate
SVAR	Structural Vector Auto Regressive
TAC	Technical Advisory Committee on
TS	Time Series
TS	Test Statistics
UK	United Kingdom
UPSS	Usual principal and subsidiary status
UR	Unemployment Rate
US	United States
US	Usual Status
VAR	Vector Auto Regressive
VECM	Vector Error Correction Model
WPI	Wholesale Price Index
WPR	Working Population Ratio

PREFACE

This research study entitled “***Short Run Linkage between Inflation and Unemployment during Pre and Post-Recession: A Study of India***” was inspired by the author’s intent to add to the policy initiatives taken by the economists to address two travails of every economy which are: Inflation and Unemployment. These two macro variables may threaten to choke the economic aspirations of any country. With most of the economies in the world reeling under the impact of Global Financial crisis, the study also investigates the effects of Recession on inflation and unemployment in India. Basing its rationale on the empirical evidences in the context of the Phillips Curve, the study recommends that policymakers and strategists should allude to the efficacy of Phillips Curve. With the advent of globalization, no economy can remain immune to financial turmoil unleashed in any part of the world. Hence the economists need effective tools as the Phillips Curve to accurately analyse Inflation and unemployment. This study posits to be a repository of solutions that the governments and strategists need to employ to contain inflation while ensuring that every stakeholder in society who is seeking an employment opportunity is not deprived of.

INTRODUCTION

1.0 Introduction

Inflation and unemployment are probably the most pressing concerns for all economies in the world. Economists and policy mappers across the world are consistently devising strategies to overcome the anomalies created through these two macro variables. These variables are perhaps two of the most used economic indicators to gauge how well a country is performing in terms of economic growth. The adverse consequences that inflation and unemployment can cause on the living standards of people cannot be overstated. In its extreme form, unemployment alone can lead to political upheavals and perpetrate a host of social evils. Uncontrolled inflation can cripple economies and retard the industrial output, thus adding to the woes of unemployment. Hence, it is imperative to carefully measure inflation and unemployment. Moreover to contain inflation while ensuring healthy levels of employment in the country, the strategists must enlist the most accurate means to analyse unemployment and inflation.

As early as the mid-1950s, the types of inflation were based on the Caucasian model that was premised on the demand principle. The unemployment in the United States in the period immediately after the war was higher than it was in the late 1950s. Yet it seemed that prices were rising and at the same time the fear of lethargy after the war was taken over by serious apprehensions related to the problem of inflation. The result was that a long debate broke out. On one side of the dispute, cost-push inflation was ideological, which said that there is no excessive demand. On the other side, the demand- pull was ideological related. When the dispute between cost-push and demand-pull ideologies was in full swing in the United States, Phillips developed a very interesting approach to the problem of inflation and the anti-inflation policy (*Johnson, 1970, P. 391*).

The macroeconomics target is to achieve full employment, price stability, high productivity and economic development (Verma, 2017). Inflation and unemployment are crisis areas for all economies, be they developed or a developing one. In fact the health of

a country's economy can be assessed by the rate of inflation and unemployment in the country. Therefore, these variables can lead to drastic fluctuations in the economy. Inflation is the procedure of increasing prices levels of goods and services that cause an increase in the total consumption to expand, a standard measure of the price of inflation rate is the rate where prices escalation over time causing a reduction in the purchasing power of the money (*Parkin, et al., 2005*). According to John Maynard Keynes, a bit of inflation can help in the growth of the economy; the accurate measurement also helps to distinguish between currency values and real values in the economy (*op cit.* 2005).

Inflation is rightly considered as the big enemy of any economy. It reduces consumption, investment and standard of living. This leads to slow developmental process in the economy. It has a negative impact on income distribution. Though the price increase looks to be beneficial for some people, it is detrimental for many others. While the income increases quickly for some earners during high inflation, it is the opposite for most earners who have fixed incomes. Since the real income declines during the periods of Inflation, the earning and the spending potential of many people decreases, thus retarding the economic growth. Inflation also has an effect on the lending and savings. It is usually the borrowers who benefit from Inflation while the lenders and the savers remain disadvantaged. Due to the decline in the saving rate, the investment rate is affected negatively. Inflation also affects the foreign trade of a country. The competitiveness of a country may be affected by Inflation (*Kumar, 2012 P. 11*) which can be measured by the Consumer Price Index (CPI). Inflation is classified into two distinct types, namely, the Demand Pull Inflation and the Cost Push Inflation.

The miasma of unemployment unleashes both economic and social turmoil, more so in a country like India. Unemployment refers to the condition in which the skilled workers who wish to be employed do not find work. According to a report on the impacts of economic slowdown on employment in India, about half million workers lost their jobs during October to December 2008 (GoI, 2009). Unemployment continues to plague India and remains the most critical of our country's problems. Lack of employment is a harbinger of host of economic, political and social ills in the society. An employable individual who is not engaged in work not only suffers monetarily but also faces social

ostracism. When the organisations of a country do not hire, the country risks losing its skilled human resource as unemployed youth often take to illegal means for generating income. This increases the crime graph besides widening the gap between the haves and have-nots. Thus, unemployment is at the root of both social and economic disparity in any country. With limited availability of work, the unemployed often resort to corruption to find work. Frustration due to declining standards of living among the unemployed leads to disenchantment with the social fabric of the nation. Moreover, increased inflation with no earning potential further entrenches poverty in the society, unleashing a vicious circle of economic gloom. With no income to support a household, the members of a family stand to be deprived of adequate healthcare, quality education or at times even nutritious food becomes unaffordable. Lack of income inevitably leads to reduced consumption and this creates recessionary or deflationary situation in the economy. Thus, the two variables of inflation and unemployment are connected by the *Phillips Curve Theory*.

The Phillips Curve theory found an association between the rate of inflation and rate of unemployment in the economy. This theory guides the policymakers about the stability of prices in the economy. According to the Phillips Curve shape, the two variables of inflation and unemployment expand or contract based on the liquidity of economy. Several economists, academicians and researchers still argue about the connection between inflation and unemployment. The Phillips Curve is one of the best known, most debatable and most often used to examine the Macroeconomic relationships. The present study is based on the Financial Crisis 2008, because it was a major crisis in the United States (US). The impact of economic crisis in the USA was not merely confined to United States. The US economy is the biggest economy in the world. United States is the largest exporter, importer and food supplier to the other economies in the world. Hence, any upheaval in the economy of the USA is bound to have a direct or an indirect impact on rest of the world economies. Many people lost their jobs in the wake of the Financial Crisis. The Indian economy was also affected with reduced jobs for skilled labour force. Even the inflation was less as compared to the other normal phases in the Indian economy. As observed by (karuna, 2011), the unemployment rate usually jumps and

inflation falls slightly because the overall demand for goods and services is curtailed during the recession. As stated by (Kose, 2009, P. 53), the house and equity values recession is also associated with the turmoil in financial markets. According to the International Labor Organization (ILO), as many as 51 million workers were fired in 2010 globally, while 30 million more jobs were at risk. Moreover, the United Nations also predicted that 200 million workers, mostly in the developing economies, could be pushed into more poverty. The global unemployment rate was estimated at 7.5 percent in 2010, up from 6.5 percent in 2009 and 6.7 percent in 2008. This implies that the Global Recession was already resulting in a drastic increase in the number of people joining the labor market and swelling the rank of unemployed. As observed by the (ILO, 2010), “*the labor market epidemic downsizing was also a result of the recession*”. According to (Kumar, 2009, P.8), the global economic downturn, which started with the collapse of Lehman Brothers on 23 September 2008, had an immediate impact on the Indian economy. Credit flows suddenly dried-up and, overnight, money market interest rate spiked to above 20 percent and remained high for the ensuing months. Financial Crisis started in 2007 with a problem in the *subprime mortgage market* in the United States. This problem later metamorphosed into an international banking crisis with the collapse of the Investment Bank which was named the Lehman Brothers on September 15, 2008 (Mark, 2010). In the words of Mark, “*the speed of the contagion that spread across the world like a wild fire was rather unprecedented.*” Due to Globalization, the impact of Global Financial Crises spread to the rest of the other economies in the world. The impact of the global crisis was transmitted to the Indian economy through three distinct channels which were: the financial sector, exports and exchange rates (op.cit, 2009). According to (Szabolcs Szentmihályi, & Világi, 2015, P.5), during the prolonged global recession that unfolded due to the Global Financial Crises of 2007–2008, special attention was paid to the issue of the slope of the Phillips Curve. It is significant to note Stock and Watson’s, 2009, remark here which states, “*The Phillips curve framework relating inflation to economic activity continues to be the workhorse model for understanding inflation dynamics, even as it has faced a number of challenges in the past and is confronted with new complexities in the aftermath of the Great Recession*”. Ball and Maunders (2011), found that the Phillips Curve predicts deflation unless the expectations are at least

partially anchored to the Federal Reserve's target inflation rate. The International Monetary Fund observed in 2013 that the Global Financial Crisis caused a significant decline in economic activity. This further reiterates the link between economic activity and price inflation. Elsewhere, while the inflation decline was much less, the very recent downward pressures on inflation seemed to suggest otherwise. There was the general impression that during the *Great Recession*, inflation fell by less than one might expect. This has been attributed variously to long-term inflation expectations being firmly anchored at pre-defined inflation targets (*Matheson, and Star view, 2013*). A flatter Phillips Curve implies a weakening of the tradeoff between rate of inflation and the rate of unemployment (*Kocherlakota, 2010*). *Stock and Watson* also state that with an increase in the Structural Unemployment and a related decline in the potential output, the output gaps were not as negative as they might appear. *Stock and Watson* argue that inflation in the U.S. had been affected by domestic real activity mainly recessions. *Meier, (2010)*, provides more ambiguous evidence for OECD countries; in particular, pointing to difficulties in identifying such a relationship in an environment with very low inflation. The Financial Crisis came about in 2007 and changed to an economic crisis, commonly known as the Great Recession affecting the output produced inflation and unemployment. Many OECD countries entered into a long recession period with a significant decline in Gross Domestic Product and an increase in the unemployment rate. Data on unemployment rate as tallied with NAIRU shows that the unemployment rate was higher than NAIRU and this difference became greater and during the recession period. One of the characteristics of this *last recession* was the great decrease of the output during this period, and the slow growth and the considerable weakness that many countries faced after the recession period. Thus the period of recession and its drastic effect became apparent in the slow growth that led to a downward pressure on prices. This developed into a deflation period (*Fendal, et al. 2008*). A study by *Carlos et al. (2012, P. 1)* states that, “after the collapse of Lehman Brothers Investment Bank in 2008-09, which resulted in a significant loss of output (GDP), there was a large amount of increase in unemployment and a deflationary scare in many countries and the forecasters' expectations of inflation and Gross Domestic Product growth deteriorated in 2008”.

In addition, the present research endeavor has added one more concept which is the Output Gap. This study examines the Philips Curve relationship in the context of the India. In India, there is no regular or yearly data on unemployment. Therefore, we added Output Gap. Output Gap is a difference between the Actual Output and the Potential Output. It provides the idea or guidance for policymakers about the expansion or the contraction of money in the economy. The output gap indicates a summary measure of demand situations in the economy and is a useful indicator of the state of the macro economy. It is also an important input for monetary policy. Conventionally, inflation has been seen as the sole symptom of macroeconomic imbalances in the economy captured by fluctuations in various measures of the output gap (*Rath, 2018*). In other words, output gap demonstrates that how much extra capacity an economy has in case of a chance of a rise in demand.

India is a rich country and the main reason of India's poverty and backwardness is unemployment. Even in the present globalized context, most Indians are still engaged in agriculture and its related work through agro-industry. Unfortunately, the agriculturalists are totally based on monsoon with limited access to advanced knowhow of farming. Lack of better vocational education and the weak structure of our economy further compound the problems. On the other hand, inflation has also increased leading to substantial increase in the general price level of goods and services in our economy over a period of time. Thus, with the increase in the cost of living, there is a dismal decline in the standard of living of the people who are unable to afford the expensive costs of daily utilities. Low purchasing power reduces consumption and depletes saving and further reduces investment. This situation ultimately increased unemployment. Moreover, it also creates ups and down in the economy.

In context of the aforementioned issues and facts, the present Research study intends to examine whether the Philips Curve shape or theory exists or not in the Indian context, particularly during the Global Financial Crisis. Furthermore, we have also mapped the measurement of the Output Gap from 2002 to 2015.

1.1 Introduction of Inflation and Unemployment: A Phillips Curve Approach

The Inflation and unemployment are the most discussed and debatable problems of the Indian economy. High inflation and high unemployment are the major crisis zones of India. Inflation refers to the increase in the general price level of goods and services in an economy over a period of time. There are many direct and indirect effects of Inflation on the economy. In the words of *Dr. Singh, the Former Prime Minister of India*, “*Inflation poses a serious threat to the growth momentum. Whatever be the cause, the fact remains that inflation is something which needs to be tackled with great urgency*” (February 4, 2011, New Delhi).

Unemployment refers to a condition in which the workers despite being skilled do not find any work.

To address the various woes that emanate in the economy due to Inflation and Unemployment, it is extremely important to reduce or eliminate simultaneously both inflation and employment. In fact it would be extremely desirable to cut or wipe out altogether, if possible, the threat inflation and unemployment. This type of relationship is described by the Phillips Curve theory and A.W. Phillips demonstrates this theory.

1.1.2 Introduction of the Phillips Curve theory

The iconic economist *A. W. Phillips* is the proponent of the Phillips Curve theory which he promulgated in 1958. The theory is based on UK Data and describes the relationship between the rate of inflation and the rate of unemployment in an economy. Phillips concludes that there is an inverse relationship between the rate of inflation and the rate of unemployment. As per the theory, when the rate of inflation decreases, then the rate of unemployment increases and vice versa. Phillips asserted that negative relationship between the rate of inflation and the rate of unemployment leads to a stable relationship. Phillips Curve is the most preferred tool of the economists to describe the link between inflation, unemployment price stability and full employment in the economy. Phillips curve assumes a significant and pivotal role in the modern monetary economics.

Furthermore, Phillips also found an inverse relationship between the rate of change in the money wage rate and the rate of unemployment in the short-run (*Hall & Taylor, 1991*). Moreover, the Phillips Curve also takes into account the Output gap. “*The Output Gap estimates can signal the cyclical position of the economy by providing information on inflationary or contractionary pressures*” (*Bukhari & Khan, 2008*). In addition, how much extra capacity does an economy have for a possibility of the rise in demand? How close does an economy have to be for working at its productive potential? Has the recession damaged the economy’s productive potential? These types of questions are essentially related with the output gap. The output gap is an economic measure of the difference between the actual output of an economy and its potential output. *Riley, 2012*, considers the Potential output as the maximum amount of goods and services an economy. The Central Bank of India is mostly used to create the policy implication, financial instability and price stability, by the Phillips curve.

On the other hand, according to *Milton Friedman*, in the long run Phillips curve doesn’t portend an inverse relationship between the rate of inflation and the rate of unemployment in the economy. Due to rational expectations, Phillips curve becomes a vertical slope in the long run. This is termed as the Non- Accelerating-Inflation Rate of Unemployment (NAIRU). Despite the concept of the output gap measures, there is a difference between the inflation pressure and capacity utilization in the economy. In other words, the concept of output gap is the difference between actual output and the potential output. The potential output is referred to as the capacity utilization in the economy. It is the most important indicator for examining the business cycles and the main benefit is that it provides several facts (information). This has led to the formulation of relevant statements about the economy. The positive output gap is generally correlated with the boom period and indicates that the economic activity exceeds capacity and creates pressure on the labour market and on the price levels. A positive output gap is expected to have repercussions towards a lower unemployment and a higher level of inflation. “*While a negative output gap is generally correlated with a recessionary period and the pressure would be in the direction of higher unemployment and low inflation*” (*Bank of Canada, 2012*).

According to *Goyal & Arora (2013)*, the potential output growth should be measured and then used to drive the Indian monetary policy stance. As stressed by *Pybus (2011)* in his study of United Kingdom's historical output gap, estimates of the output gap during comparable stages of previous recessions can be helpful in evaluating the plausibility of estimates of the current level of the gap and how it might be expected to evolve over time. *Titan and Georgescu (2013)*, show that the output gap can be used to investigate macroeconomic stability in general and business cycle dynamics in particular. The potential output and output gap can be used to study specific macroeconomic issues. For instance, *Johnson (2013)* argues that potential output is a key factor for debt sustainability analysis and for developing strategies for growth.

1.1.3 Study of Background of the Phillips Curve

The discussion of the Phillips curve is especially appropriate to think about in the context of the actions initiated by the Central Bank. Several financial publications mentioned the efforts undertaken by the Central Bank to boost or slow the measure of economic activity. Such discussions frequently also touched on the impact of the Central Banks' actions on inflation and on the picture of the modeled inverse relationship between inflation and unemployment that is known as the Phillips curve.

In 1958, *A.W. Phillips* published a paper in which he exhibited, using UK data, the empirical assessment of United Kingdom (UK). Data had been taken from 1861 to 1957, for 100 years. The author found the stable relationship between the nominal wage rate and the rate of unemployment, the higher rate of wage inflation and the lower the rate of unemployment (*Phillips, 1958*).

1.1.4 The Phillips Curve in the 1950s and 1960s

The equation that captures the relationship between developments in inflation and the real economy can be outlined back historically to the study of Phillips (1958). The author found a stable correlation between the nominal wage rate of inflation and the rate of unemployment; the higher wage inflation and the lowest rate of unemployment.

After two years, two economists provided a significant contribution to Phillips curve, thus making it more popular among the academicians and policy makers. Firstly, they restarted the Phillips view by expressing the relationship between rate of unemployment and rate of inflation. Secondly, they also indicated an alternative policy that was based on the combinations of unemployment and inflation rates for policymakers. This means that it is not possible to achieve the economic goals of low inflation and low unemployment simultaneously, thus policy makers can control the level of inflation by sacrificing unemployment in the economy (*Samuelson & Solow, 1960*). By the end of the 1960s, inflation and unemployment trade off introduced by the Phillips curve had become an essential part of the Keynesian approach and used by the policy makers in their economic strategies. However, during the 1970s, Phillips curve started to be questioned on both empirical and theoretic grounds in the late sixties. In 1970, due to oil price shocks, Phillips curve relation did not exist in the economies. That time both the inflation and unemployment were rising simultaneously and this created deflationary situation in economy.

Whether is the similar relationship between inflation and unemployment despairs from the inverse relation between wage inflation and unemployment from two aspects? First, is that the Keynesian theory did not deal with the mechanism of price adjustment, and thus the Phillips curve generated for price inflation could be interpreted as the absent equation.

Second contention is that for the modern economic policy typical of the period, a stable relation between inflation and unemployment would have provided an opportunity to set unemployment to the desired level by dealing with the aggregate demand. Besides, if necessary, to raise the prices to a level higher than before.

1.1.5 Application of the Phillips Curve

It is the most popular tool among the policy makers and is widely used for policymaking. The shape of the curve expands or contracts given the availability of money in the economy. For instance, during the 1960s and 70s, it was a common instrument practice for government around the world to select a rate of inflation that they wanted to achieve and then increase or reduce the economy to achieve the desired target rate. This policy

became known as stop-go and was trusted strongly on fiscal policy to generate the growths and reductions required.

1.1.6 The Breakdown of the Phillips Curve

By the mid-1970s, it looked that the Phillips curve trade-off no longer existed. These no longer looked a stable pattern. The stable relationship between unemployment and inflation looked broken. It was possible to have a number of inflation rates for any given unemployment rate. Phelps (1967) and Friedman (1968), rejected the concept of a short run inverse relationship between inflation and unemployment. Friedman and Phelps added two new independent variables into the Phillips curve equation. First, was the Inflation Expectation and second was the Natural Rate of Unemployment. It is assumed that the Inflation Expectation Adaptively in terms of Past Inflation is called the Adaptive Expectation while the Natural Rate of Unemployment is determined by the real economic factors. According to them, actual inflation is defined as the functions of the adaptive inflation expectation and the gap between natural rates of unemployment.

Phelps and Friedman not only involved two new terms in the Phillips curve, but also changed its policy implications deeply in the framework of expectations-augmented Phillips curve. They introduced that in the long run, the actual unemployment rate could not be below the Natural Rate. Moreover, even if this possible in the short run, whatever the inflation rate is, if the actual inflation is greater than inflation expected, then the actual level of unemployment would be smaller than the natural rate of unemployment.

Thus, in the short run, policy makers could push the natural rate of unemployment by creating a higher inflation rate than expected inflation by the public. However, in the long run inflation expectations will be the adjusted upward and equalized to the actual level while the actual unemployment rate ultimately returns to its natural rate at the higher rate of inflation.

1.2 The Review of Literature

In this study, we have collected literature that is based on the past studies at both the international and the national level. These studies provide evidence in favour of significant interactions between Inflation and Unemployment in macro economy, more so in the period of the Global Financial Crisis.

The International Level

Few examples are:

- *Szomolanyi, et al. (2012)*, states that the Phillips curve is a basic tool to understand relations between the growth rate of money wage and unemployment rates.
- *Jaromir(2013)*, states that there was a sharp increase in unemployment accompanied by a relatively muted inflation during the Great Recession.
- *Rafery et al. (2010)*, this study doubts the validity of the Phillips curve with the aid of dynamic model averaging. The authors' study aims to highlight that the existence of a systematic relation between real activity and inflation is blurred due to the failure to capture inflationary pressures, by means of a single measure of economic activity and second is the existence of a nonlinear response of inflation to the driving variable based on data for the USA and other G7 countries.
- *Murphy and Robert (2013)*, attempted to ascertain whether the Phillips curve could explain the behavior of inflation in the United States. The authors modified the traditional Phillips curve to explain time variation in its slope and showed that the modified model was more conversant a tool to analyse the recent behavior of inflation without relying on set expectations.
- *Bersch & Tara (2013)*, in their study compare the output gap estimates based on a number of difficult methods.
- *Layzian& Shahrier (2014)*, their study presents three models to estimate the output gap for the Malaysian economy; univariate, multivariate and structural.
- *Simionescu (2014)*, examined the reality and stability of the Phillips curve for Romania. The Data has been taken over from 1990 to 2013, using ARDL and DOLS.

- *Alichi (2015)*, in his study, focused on the gap between potential and actual output.
- *Hulej & Grabek (2015)*, following Nyman's work (2010), provide an indicator of resource utilization (RU) for the Polish economy based on survey and labor market data. The indicator is subsequently used to identify output gap.

Some Empirical Review of Literature on the Indian Economy

- *Singh, et al. (2010)*, this empirical study is based on the data taken from 1997-Q1 to 2010-Q3. This study examines the empirical existence of the Phillips curve in the Indian economy.
- *Dholakia (2011)*, in this study, the author estimates the short run aggregate supply curve for the Indian economy from 1950-51 to 2008-09. The study employs the technique of estimating adaptive expectations, constrained estimation consistent with long run equilibrium, and also introduces the extended Phillips curve.
- *Ray (2011)*, analyses the empirical existence of the Phillips curve in the Indian economy.
- *Das & Martin (2013)*, this study used three different estimates of the output gaps to obtain estimates of the Phillips curve based on the Indian data.
- *Kotia (2013)*, analyzed the inflation and output dynamic of Indian economy and estimate a Phillips curve in India from 1997 quarter one to 2012 quarter three.
- *Dua (2013)*, this study investigated the determination of inflation in the framework of an economies that were both forward looking as well as conventional backward – looking and analysed the Phillips curve for eight Asian countries – Japan, Korea, Hong Kong, Singapore, Philippines, Thailand, China and India.
- *Singh and Verma (2016)*, this study analyzed the short run tradeoff between inflation and unemployment for the Indian economy from 2009 to 2015.

1.3 Research Gap

This research study has reviewed many relevant research articles related to the present study area at both the international and national level. At the international level, many studies have been done on short-run linkages of inflation and unemployment during the

recession period. However, no studies have been done on the developing countries like India during the Pre and Post-recession periods. Many studies have been conducted on Inflation and Unemployment but are based on different dimensions in India. Therefore, under this study, we will show short run linkages between Inflation and Unemployment in three phases which are, the Pre- Recession, during Recession and Post-Recession periods with special reference to the Indian context. We will try to fulfill the research gap of this dimension. Hence, this Research Endeavor's intent is to investigate an aspect of the Indian economy which was not undertaken before by any other researcher. In short, after an in-depth review of literature, the present study has tried to validate of Phillips curve relationship in the Indian economy taking account of the financial crisis.

1.5 Need for the Study

In macroeconomics, Inflation and Unemployment are always current and debatable issues in each economy. This cause and effect relationship fluctuates around the economy and these two variables are effective facets for measuring the health of an economy. Inflation is a monetary phenomenon, while Unemployment is a real phenomenon. In other words, Inflation is the cause of Unemployment. Thus, it is very necessary to reduce these problems together. Both these problems are connected by the Phillips Curve theory. Phillips Curve is the most important tool for policymakers for mapping policies or plans in order to achieve price stability and full employment in the economy. This theory is very help for understanding the expansion and contraction of money in the economy. Hence, the present study aims at examining the Phillips curve theory taking into account the Global Recession of 2008. It is also helpful if economy faces slow down or recessionary condition.

1.6 Contribution of the Study

- The research study contribution is more inclined around the temporal factors of recession unlike the other major works that focused more around the current scenario.

- The examination will prove a help to the economy to better judge whether the Phillips curve is best applicable in such recessionary situation in Indian environment with its shocks included. Any unlike situation would divert our attention towards search of better measures on fiscal terms.

1.7 This research study has been conducted with the following objectives

1. To examine the comparative study between inflation and unemployment (2002-07) Pre-Recession, (2008-09) During-Recession and (2010-15) Post-Recession period.
2. To examine the impact of the global financial crisis on macro-economic variables.
3. To examine the Philips curve shape & the output gap from 2002-2015 for 14 years.
4. To study the policy implications of targeting inflation and unemployment in India

1.8 The Hypothesis of the Study

The following hypotheses have been formulated as the basis for the study:

1. H_0 : There is no impact of global financial crisis on trends of inflation, unemployment and other macro-variables
2. H_0 : Output gap fluctuations are negatively associated with the pre and post-recession and over the total period of the study.
3. H_0 : Inflation and unemployment are positively associated with recession or over the period of the study.

1.9 Data and Methodology

The present Study is wholly based on the secondary data. The study uses time series database, taken from authentic data source such as the published official reports and data. Following are the reference points for collecting data:

1. Report on Inflation published by the Reserve Bank of India.
2. Annual Report published by the Ministry of Labour and Employment Labor Bureau, the Government of India.
3. Ministry of Statistics and Program Implementation (MOSPI), the Government of India.
4. Handbook of Statistics on Indian Economy via the Reserve Bank of India.
5. National Sample Survey Organization (NSSO) India.
6. Economic Political Weekly Research Foundation (EPWRF)
7. World Bank Database

We have used quantitative and time series data such as monthly, quarterly and annual data on Wholesale Price Index, Consumer Price Index, Gross Domestic Product and unemployment rate. The present study has taken data pertinent to the time period from 2002 to 2015. This study has been divided into three sub periods.

The table 1 is given the below:

Table 1: Sub-Categories of Study Period

First Period	Second Period	Third Period
Pre-Recession Period	Duration of Recession	Post-Recession Period
2002;M1 to 2007;M12	2008;M1 to 2009;M12	2010;M1 to 2015;M12
We considered this period is pre-recession period. It shows the trends of inflation and unemployment, impact of recession on macro variables, to examine the Phillips curve relationship and output gap in this period.	We considered this period as the recession period. It shows the trends of inflation and unemployment, impact of recession on macro variables ¹ .	We considered this period as the post-recession period. It shows the trends of inflation and unemployment, impact of recession on macro variables, to examine the Phillips curve relationship and output gap In this period.

¹Recession period is considered only in the third and fourth chapters. Further we have not considered this period due to lack of observation (annual data) and we have replaced this period by the overall period.

After collecting of data, according to the objective of this research, we present the data in various ways and various graphs such as the *bar chart, trend line, histogram and pie-chart and descriptive statistics*. This study uses some statistical tools and techniques. In addition, we have used econometrics method and models which are: the Least Square method, Simple Regression Model, Vector Error Correction Model (VECM), Vector Autoregressive Model (VAR), Auto Regressive Distributed Lag Model (ARDL), Chow test, Kim & Perron test and Hodrick Prescott Filter (HP) method. To find the estimation of the different models mentioned above we have used various software like: Microsoft Excel 13, Stata 13, Eviews 10, Minitab, 16 and Amos, 22.

Description of Different Tools

1. Least Square Method: It is widely used for trend analysis because this method provides more authentic and realistic information than the other methods. In the broad way, least square is a method of fitting curve for a given data. It is the most prevalent method used to determine the position of the trend line of a given time series. The trend line is technically called the best fit.
2. Regression Model: It provides the cause and effect relationship among the variables as well as it indicates whether the whole information is statically significant or not. In regression models, two factors that are complicated in a simple linear regression analysis are chosen as *x variable* and *y variable*. We can write this in equation form of:

$$y = (\beta_0 + \beta_1 + \varepsilon_t)$$

The equation that demonstrates how *y* is related to *x* is known as the regression model.

The linear regression model also contains an error term that is represented by ε_t . The error term is used to account for the variability in that cannot be explained by the linear relationship between *x* and *y*.

3. Vector Auto Regressive/Vector Error Correction Model/Auto Regressive Distributive Lag: All these models are also called VAR family models. It demonstrates the short run causality and long run causality between the variables. In other words, it specifies

that variables fluctuate due to demand pressure and supply pressure. It determines whether the economy is in equilibrium condition or not. We applied these models according to assumption, requirement of analysis and data's nature. In addition, also applied chow test and Kim & Perron test for structural breaks.

4. Double Log Model: A log transformation is a comparatively common process that permits linear regression to perform curve fitting that would otherwise only be possible in nonlinear regression. We have used double log model because we have taken both side logs which are the dependent and independent variable.
5. Polynomial Regression Model: When the data is not linear then we can try to use the polynomial regression to fit a polynomial line so that we can achieve a minimum error or minimum cost function. Polynomial provides the best approximation of the relationship between the dependent and independent variable. This model provides the significance of curvilinear relationship between dependent and independent variables.
6. Hodrick Prescott Method: It is widely used for output gap estimation and we have used this method because we have taken only one variable which is named GDP, therefore, the Hodrick Prescott method is very useful for univariate analysis. The Hodrick-Prescott (HP) filter refers to a data-smoothing technique. The HP filter is commonly applied during analysis to remove short-term fluctuations associated with the business cycle. Removal of these short-term fluctuations reveals long-term trends. This can help with economics or other forecasting associated with the business cycle. The HP filter is often used to produce new time series such as potential GDP and the output gap that are useful in macroeconomic modeling and monetary policy research.

1.10 Significance of the Study

The Phillips curve is the core theory in this inductive study and it establishes the relationship between inflation and the unemployment rate from 2002 to 2015 in India. The significance of this present study is in determining how the policymakers can formulate effective strategies to ensure employment while containing inflation. Undoubtedly, inflation and unemployment have played a central role in monetary policy. The Central banks have tried to use this relationship by influencing unemployment through their inflation policy. Theory of Phillips curve is not only strong theoretically,

but is also important for political foundations. The central banks' objective has always been to use their monetary policies to keep inflation and unemployment low, but they could only do so at the expense of high unemployment. On the other hand, an acute knowledge of the nature or relationship of inflation and unemployment in the short-run enables the policy makers to outline policies to minimize the harmful effects of inflation and unemployment for the society. Additional approach, the output gap is an important variable for monetary policy and it is a key source of inflationary pressures in the economy. When the demand for goods and services is high, then economy has the capacity to produce while influencing high pressures on prices. When the rate of inflation actuates higher than expected, it is typically a sign that demand for goods and services are pushing against the limits of capacity. When the rate of inflation always ends lower than expected, it is generally a sign of weak demand and of spare or unused capacity.

1.11 According to the objectives of this study, the following chapters have been envisioned

The present study entitled as “**Short Run Linkage between Inflation and Unemployment during Pre and Post-Recession: A Study of India**” consist of seven chapters, the **first** chapter deals with the introduction parts enlisted in the background of the study, research objectives, hypothesis, data and methodology, significance and limitations of the study. The **second** chapter discusses about the conceptual and theoretical framework of inflation and unemployment with relevance to Phillips curve analysis. While in **third** chapters deals, the trends of Inflation is dealt along with concept of inflation and trends of (inflation) with two measurement approaches such as the Wholesale Price Index and Consumer Price Index. This has been analyzed by the econometric tools such as least square and regression model which are used for trend estimation and analysis. The **fourth** chapter deals with trends of unemployment and impact of recession on macro variables. It analyses the impact of Global Financial crisis on three macro-variables such as export, lending rate and inflation rate. There is empirical analysis to determine if the short run causality or long run causality exists in this study or not. In addition, the concepts of unemployment, measurement approaches and comparative and descriptive analysis have been discussed by referring to the three

Quinquennial National Statistics Survey Organisation, rounds. ***Fifth*** chapter discusses about the Wholesale Price Index based Inflation, Linkage with Unemployment. It also provides the short run linkage between inflation and unemployment such as Phillips curve relationship. The ***sixth*** chapter deals with linkages between inflation and real Economy. It discusses the output gap and the potential output gap that is related to the Phillips Curve theory. In addition, this chapter also examines whether the short run and long term relationship exists or not between inflation and output gap. The final chapter deals with major findings of the study, conclusion and policy implications along with summary of the present study. In addition, to this, there are some other formalities including reference, annexure and glossary.

CHAPTER -2

**CONCEPTUAL ISSUES:
THEORIES AND ECONOMIC
RELEVANCE**

CONCEPTUAL ISSUES: THEORIES AND ECONOMIC RELEVANCE

2.0 Introduction

This Chapter discusses the theoretical conceptual framework of macroeconomic variables which are: Inflation, Unemployment and Gross Domestic Product which is also connected to the Global Financial Crisis. These macro variables have been connected by Phillips curve theory and the concept of output gap. In addition, it also discuss the business cycle theories and present the linkages between inflation and unemployment during the financial crisis 2008, hence making this study more pertinent to the present scenario of research on both unemployment and inflation basis.

2.1 Inflation

The issue of inflation continues to be a perennial problem in all economies. The problem of inflation has received more focused attention from the early 1970s. A continuous rise in the general price level over a long period of time has been the most common feature of both developed and developing economies who are facing the problem of rate of inflation (around 5 percent) even though the US economy was facing recession. Similarly, India which is a fast developing nation growing at the rate of 9% per annum, also faced a high rate of inflation of 12% in the second half of 2008. This had severe economic, social and political consequences for the country (Deweidi, 2010, P. 439).

2.1.1 The Concept and Definitions of Inflation

Inflation means an increase in the price level of essential goods and services in the economy for over a time period. According to Samuelson, “*Inflation indicates an escalation in the general level of prices*”. This definition of inflation is used to analyse the price behavior. For instance, the rate of price rise in India during April-May, 2009 was below 1% and it went down to 0.13% in May 2009 which was the lowest in 30 years.

This almost zero rate of rise in the general price was called inflation in the public report. This is practice across all countries and has been adopted by the International Organization like the World Bank and IMF as well (Samuelson & Nordhaus, 1995, P. 574). Durnberg and MacDougall further highlight inflation as a continuous increase in prices as measured via the Consumer Price Index (CPI).

2.1.2 Theories of Inflation

Several theories and concepts have been propounded for analyzing and estimating inflation. This study has attempted to profile a few of them below.

2.1.2.1 The Classical Theories of Inflation

As defined by the classical economists, *Jean Bodin, Richard Cantillon, David Hume, Adam Smith and William Petty*, Inflation is the continuous rise in the general price level of essential commodities. However this definition is not premised on any systematic theory of rising prices. Irving Fisher was the first among the classical economists to formulate a systematic theory of inflation which was known as the Classical Theory of Inflation. In the words of Irving Fisher, *“Inflation comes in direct proportion to increase in money supply given the point of output”. If money supply increases then it will also increase price level of economy. The classical theory of inflation is derived immediately from the Fisher’s quantity theory of money (Fisher, 1926)².*

2.1.2.2 The New Classical Theory of Inflation

The Neo-classical theory of inflation was the genesis of Cambridge economists who postulated that increase in demand for money as the causal agent of inflation (Pigou, 1917) as explained by: $m_d = kPQ$

2.1.2.3 The Keynesian Theory of Inflation

According to Keynes, an increase in general price levels of inflation is created by an increment in the aggregate demand which is over and above the increase in mass supply

²In Fisher’s Quantity Theory ($MV = PT$), where is M = money of circulation, V = velocity of money, P = Price level and T= time.

when the given economy is at its full employment output level. An increase in government expenditure (G), private consumption (C) and private investment (I) will create an increase in aggregate demand. This leads to increase in the general price and the inflationary gap becomes the cause of inflation. The inflationary gap generates only money income without creating the parallel real output because the economic system is in full employment equilibrium. The money income would produce a multiplier effect depending on the Marginal Propensity to Consume.

2.1.2.4 The Monetarist View of Inflation

The monetarist view on inflation is an improvised version of the definitive theory of inflation, especially the one based on Fisher's quantity theory of money. In fact, the modern monetarism is also referred to as the '*modern Fisherism*' and was visualized by Milton Friedman, the leader of the monetarist school (Friedman, 1970, P. 24) This view of inflation states that general level of prices rise only due to the increase in money supply.

2.1.3 The Modern Theory of Inflation

The modern and inventive approach to inflation follows the theory of price decision. According to the modern theories of inflation, "*The general price level is defined by the aggregate demand, aggregate supply and mutation in the aggregate price level is caused by mutation in the aggregate demand and aggregate supply*".

The detailed analysis of inflation shows that both demand side and supply side cause rising prices factors. Inflation essentially has two forms, the demand side factors are referred to as the demand-pull factors and supply side factors which are called the cost-push factors.

2.1.3.1 Demand Pull Inflation

The demand-pull inflation is the increase in the general price level when aggregate demand increases more quickly than the aggregate supply. Demand pull inflation is the conventional and most prevalent type of inflation. It happens when the aggregate demand grows and the supply of commodities decreases.

Demand pull inflation is caused by monetary factors, given the money supply and the level of output. If this price point is a reasonable one, it is neither inflationary nor a deflationary situation. As convincingly observed by (Dwivedi, 2010, Pp. 467-469) monetary expansion in excess of the growth in real output is one of the most significant factors causing demand-pull inflation. The monetarists stress the use of money on the demand-pull inflation and state that when the money supply is increased in order to increase production and engagement, it creates an inflationary situation within an economic system. Demand pull inflation is caused by material factors, the real factors or the non-monetary factors that cause demand to pull inflation, thus resulting in upward shifts in the IS Curve.

2.1.3.2 Cost push inflation

The cost of production rising prices is caused by the monopoly power exercised by some monopoly groups of the company and this is usually witnessed in firms that are part of monopolistic and oligopolistic market setting which can control the prices of production. Strong labor unions force the employers to increase wages and this can lead to increase in the prices. This kind of rise in the price level is called wage- push inflation (*Op. cit 2010, p. 471*).

2.1.3.2.1 Wage push Inflation: The wage push inflation is often caused by monopoly power of the labor unions to raise their wages above the competitive labor market salary rate. Labor unions force the employers to increase their wages. In the context of the wage push inflation, the wages are increased above the competitive level without a parallel growth in labor productivity. Growth in money wages causes an equal growth in the price of production. The increment in the price of production causes the aggregate supply curve shift backward. A backward shift in the aggregate supply leads to an increase in the price level. This is called wage push inflation (*Op. cit 2010, Pp. 471- 472*).

2.1.3.2.2 Profit Pushes Inflation: This is yet another phenomenon caused by the supply side factor that leads to inflation in the use of monopoly power by the monopolistic and oligopolistic firms to raise their price to enhance their net margin. This has a reactionary effect on other prices which leads to inflation (*Op. cit 2010, P.475*).

2.1.3.2.3 Supply Shock Inflation: This is another form of cost push inflation. Supply shock is an abrupt decrease or lack of availability in the provision of major commodities or key industrial inputs. The supply shock inflation usually happens due to a sudden rise in the prices of high weightage items in the Price Index Number. This would include abrupt rising of prices of food due to crop failure and also here to rising prices of coal, steel, cement, petroleum and basic chemicals. The rise in the prices may be caused by problems in the supply in the domestic economy or any disruption caused by international events. Hence, the shortage of supply leads to high inflation. The most relevant example in this case is that of the sudden voluminous increase in the oil prices. For example, the upsurge in the OPEC oil prices during 1970s due to Arab Israel war is an apt case in point. During the mid and late 1970s, the problem of inflation had become a worldwide phenomenon because the OPEC had quadrupled the oil prices between 1972 and 1974 (*Arabian Lights/ Dubai*).

2.1.3.2.3 Structural Inflation: Also known as *mixed inflation* and is a combination of demand pull and cost pull inflation. The theory of structuralism emphasizes rigidities in supply as the key force in the hypothesis. The contention is that inflation will stay as long as the structures are not ruled out. The obstacles are in production, institutional and social culture dimensions.

2.2 The Impact of Inflation on the Indian Economy

Inflation affects both the nation's economy and the all the income groups of the society besides unleashing a host of social and economic disparities. Following are the ramifications of Inflation which need a concerted mention here:

- 1. Social Effect:** Inflation widens the gulf between the rich and the underprivileged. As the poor of the nation get poorer, the rising prices bring about discontentment among the masses.
- 2. Business:** All types of business gain during inflation, due to the increase in the costs of commodities and services. Hence, a section of the nation reaps benefits further entrenching the economic disparity.

3. **Debtors and Creators:** During inflation debtors (borrowers) gain profits and creators (lenders) loss. This is because, while their incomes remain fixed, the value of money remains to fall with rising costs.
4. **Reduction in Savings:** When prices are rising, the propensity to save declines because people need more money to spend on goods and services.

2.3 Methods of Measuring Inflation

2.3.1 Measuring inflation by Pin

There are two general methods of measuring inflation; first is the percentage change in Price Index Numbers (PIN), and the second is a change in GNP deflator. There are many price index numbers, but mostly two PINS are widely used for measurement of inflation which are the Whole Price Index (WPI), also called producer price index (PPI) and the Consumer Price Index (CPI). WPI is used to measure the general rate of inflation and CPI is used measure the change in the cost of living.

$$\text{Consumer Price Index (CPI)} = \frac{\text{Current Price Index}}{\text{Base Year Price Index}} \times 100$$

Measuring inflation by GNP deflator

The GNP deflator is the proportion of nominal GNP to the real GNP of the same year, i.e.

$$\text{GNP deflator} = \frac{\text{Nominal GNP}}{\text{Real GNP}}$$

Where Nominal GNP is GNP at current prices and real GNP is GNP at constant prices.

2.4 Types of Inflation

2.4.1 Perfectly Anticipated Inflation: When the inflation can be predicted it is called perfectly anticipated inflation. Say, for instance, if an economy has been experiencing a given rate of inflation at 6 percent, so the people will predict that the pace of rising prices will continue to be at 6 percent. Hence all contracts would be done on the basis of

expected 6 percent inflation rate. During inflation, debtors gain and creators will lose. To avoid this, nominal interest rates are raised by 6% by lender.

2.4.2 Imperfectly Anticipated Inflation: This phenomenon is a rare one. In fact, actual inflation is different from the expected inflation. When the inflation rate is higher or more depressed than the expected level, it is the unanticipated rate of rising prices. When the rate of inflation is not predictable as in the case of unanticipated inflation, it can be an extra element of risk for any economy.

2.4.3 Types of Inflation along with the rate of Inflation are noted below

2.4.3.1 Creeping Inflation: The rate of creeping inflation is 3 percent. This type of inflation promotes economic development and maturation.

2.4.3.2 Walking or Trotting Inflation: The pace of walking inflation is in between 3 to 6 percent and it is the initial state of alarm for an economic system.

2.4.3.3 Running Inflation: The rate of running inflation is in between 10 to 20 percent and this type of inflation has a drastic impact on poor the middle-income groups.

2.4.3.4 Hyper Inflation: The rate of hyperinflation exists between 20 to 100 percent leading to zero savings.

2.4 The Concept of Unemployment

Unemployment is one of the most noticeable indicators of economic action in a nation. The rate of unemployment typically rises considerably during recessions and then falls as the economy recovers. Unemployment can render people economically deprived and socially marginalized besides retarding their standard of living. Hence, the media rightly publicizes high unemployment as a great social problem (*Jeffrey Parker, 2010*).

2.4.1 Unemployment: Unemployment has no accurate definition in the economics literature and unemployment would mean lack of jobs for those who are able and willing to work for the stipulated wage.

Definitions of Unemployment

1. **International Labor Organization:** *“The labor force of a country consists of the persons in the age group of between 15 65 years who are employed and those who are unemployed but are looking for a job, labor force doesn't include full time students, full time house wife's and retired persons”.*

Unemployment would mean any individual who is skilled and is able to work and looking for work but does not find one. Unemployment is a complex phenomenon and has many connotations for the economists.

2.4.1.1 Theories of Unemployment: In the economics literature, there are many theories of unemployment. Classical and Keynesian theories of work and unemployment begin from a general theoretical account. The classical and Keynesian theories of unemployment have been briefly discussed below.

2.4.1.2 The Classical Theory of Employment or Unemployment

Classical theory gained base by the contribution of the economists of the 18th century and the noted amongst them were *James Mill, Adam Smith or David Ricardo*. These economists advocated a full employment labor market (*Rodriguez, 2015, P. 5*).

According to classical economists, when an economy is working at full employment level and there is no inflationary pressure on the economy, then the full employment situation is normal. In such a scenario, if unemployment is created because of any minor reason, it would automatically rest able because unemployment in this context would be a temporary condition. Moreover, nominal deduction in the wages would ensure that the economy is in the equilibrium phase.

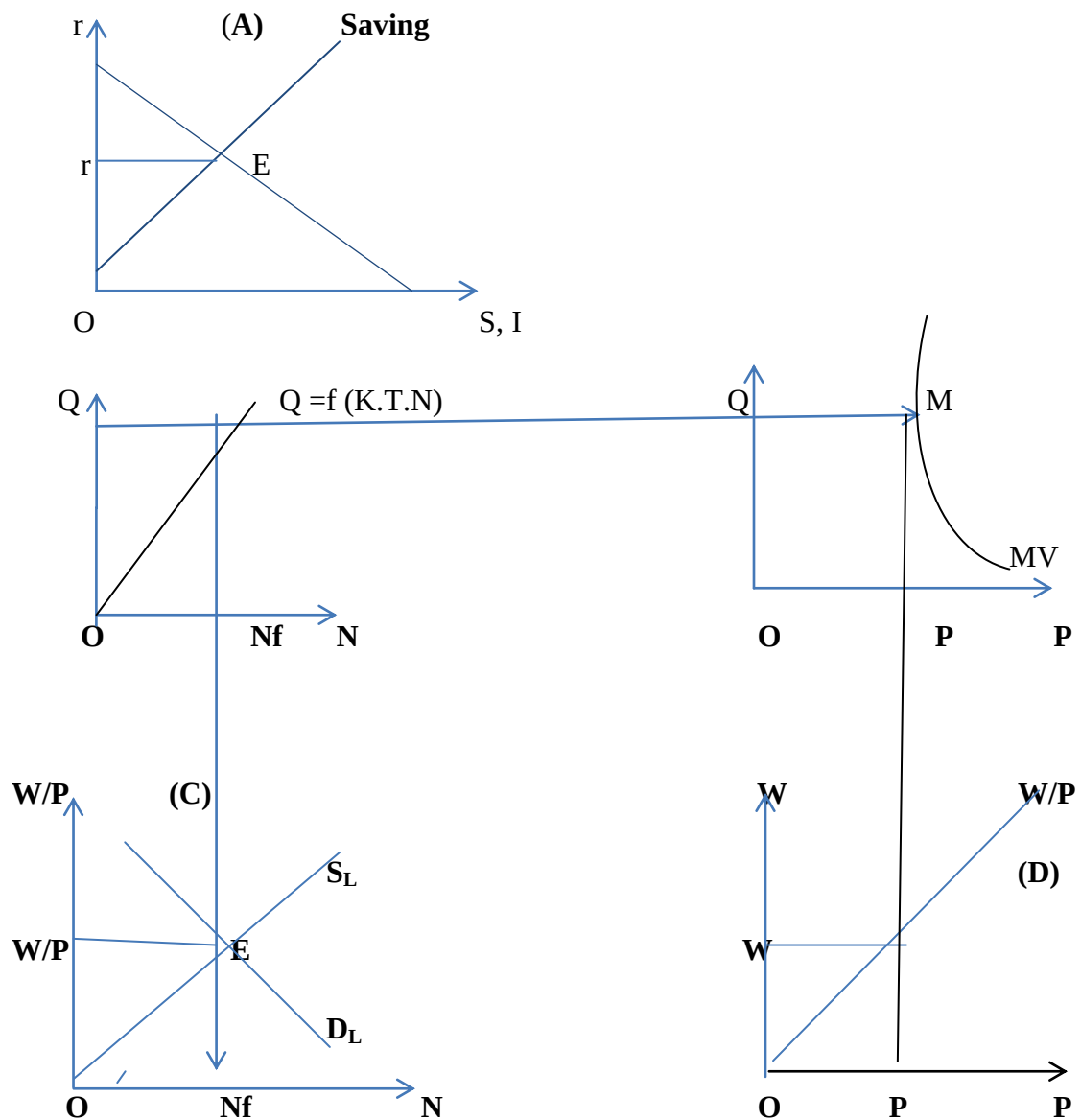
In the classical theory, the determination of employment and production is done on the basis of three types of markets. These are: the labour, goods and money market in the economy.

Labour Market is driven by the employment created due to the demand of labour and supply of labour.

Goods Market is and the equilibrium point which is determined by the investment and savings which are inversely related.

Money Market is an equilibrium point is that gauged by the demand of money and supply of money and this is also explained by quantity theory of money. This shows the direct relationship between price level and quantity of money for example, $MV=PT$. The diagram below illustrates the concept:

Figure 2.1: Classical Theory of Employment



Source: ML, Jhingan, Marco-Economics, P. 73

The diagram 2 above depicts the Classical Model. Diagram A indicates equilibrium of E between investment and saving, which is assessed by the mechanism of interest rate in the case of full employment when there is equal level of demand of goods and demand of supply. Diagram B demonstrates the employment and production level. The aggregate production, labour of supply and labour of demand can be equated as $Q = f(K, T, N)$. Diagram C demonstrates that in the labour market, employment and production is assessed by demand of labor and demand of supply. E is the intersection point between demand of labour and supply of labour. The equilibrium wage rate is at full employment level ($D_L = S_L = N_F$). Diagram B, E and D are connected with each other at money market equilibrium. In the money market, the equilibrium is established by the demand of money and supply of money. This is explained by the quantity theory of money and has been given by Fisher ($MV=PT$). MV = supply of money and PT = demand of money. Money market equilibrium, price level gives equity with production and full employment that is connected to MQ line from E and B. Determination of price level (OP) by the total production (Q) and quantity of money (MV) is demonstrated in the diagram B and E. Diagram D shows the w/p curve which indicates direct relationship between price level and money wage rate. As the diagram depicts, the real wage rate has decreased and there is no impact of production on employment. Given this analysis, it can be concluded that to achieve full employment, there should be wage price flexibility. This is also suggested by the classical economists.

The classical theory, as analyzed by *Pigou* (1933) and *Solow* (1981), argues that the labor market consists of demand and supply of labor. Demand for labor is a derived demand, obtained from the declining portion of the marginal product of labor. The demand curve is a negative function of real wage. That is, if the wages increase, the quantity demand for labor will decline and the opposite is correct. The supply of labor is derived from worker's choice whether to spend part of time working or not working. Supply hours of work is a positive function of the real wage because if the real wage rises, workers supply more hours of work. In equilibrium, demand and supply of labor are intersected at a clear point that determines the equilibrium real wage rate and full employment (*Mouhammed, 2011*).

2.4.1.3 The Keynesian Theory of Unemployment

According to Classical Theory, unemployment is due to wages being unnaturally kept above the equilibrium through minimum wages. While the classical theory posits the solution for unemployment to be to deduct wages and allow wages to clear up, the Keynes contends that this is impractical.

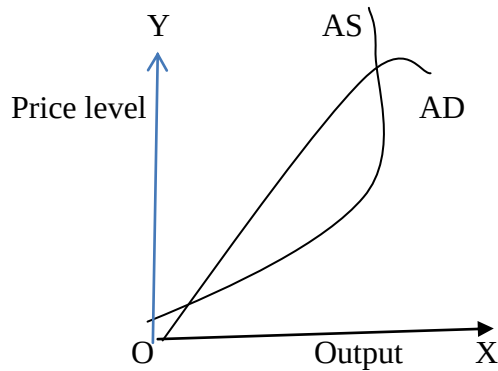
In 1936, *John Maynard Keynes* presented his hypothesis in '*The General Theory of Unemployment, Interest and Money*'. This report etched a cornerstone in modern economy and promoted a new school of opinion, the Keynesian school of thought (Op. cit 2015, P. 10). The necessary element of Keynesian economics is the idea that the macro economy can be in disequilibrium (recession) for a considerable time. Keynesian economics describes government interference to help overcome the lack of mass demand to cut unemployment and increase growth (Tejvan Pettinger, 2013).

The Keynesian theory of unemployment was premised on the short run position. Keynes's cited that in the short run, the factors of production like the capital goods, supply of labor, technology and efficiency of labor remain constant while gauging the level of employment. Keynes emphasized that the level of unemployment is dependent on the national income and output. In addition, Keynes postulates that if there were an increase in the national income, there would be an increase in the degree of work and vice versa. Thus, Keynes theory of employment is also too known as the *Theory of Employment Determination* and *Theory of Income Distribution*

2.4.1.3.1 Principle of Effective Demand

The nodal aspect associated with the setting out points of Keynes's theory of engagement is the principle of effective demand. Keynes propounded that the degree of work in the short run is dependent on the aggregate effective demand of goods and services.

Figure 2.2: Effective Demand Curve



The Figure 2.2 shows the effective demand curve, *Y-axis* denotes the price level of the economy and *X-axis* denotes the output level of economy and *O* represents origin. There are upward slopes of *AS*, *AD* curve. The aggregate demand curve is intersecting the aggregate supply curve. This point represents the effective demand curve or equilibrium point of economy. If there is any condition of disequilibrium, the economy faces the upheavals of recession.

2.4.2 Types of Unemployment

2.4.2.1 Unemployment: It refers to the workers' choice of not opting to work at the prevailing wage rate and this could be regarded as a national waste of human energy.

2.4.2.2 Frictional Unemployment: Frictional unemployment is a temporary phenomenon and may result when some workers are temporarily out of work while changing jobs. It may also result when the work is suspended due to strikes or lockouts. To some extent, frictional unemployment is also done by the imperfect mobility of labor.

2.4.2.3 Casual Unemployment: It is usually seen in daily wage earners who work on contractual hours in construction, logistics or agriculture, etc., and are employed on a day-to-day basis. These contracts are prone to termination and render the worker unemployed.

2.4.2.4 Seasonal Unemployment: It refers to those job opportunities that are available only for a specified time period in year. Thus the term seasonal and relevant examples in this context are that of jobs in agriculture, catering in holiday resorts, agro driven

activities like sugar mills and rice mills. Since people who are associated with such work have a very limited earning potential, seasonal unemployment is a major debacle.

2.4.2.5 Structural Unemployment: Morphological changes in the economic system lead to structural unemployment which is created by a decrease in demand for production in a particular industry. During this phase, there is a marked decrease in the need for manpower and increased possibilities of disinvestment.

2.4.2.6 Technological Unemployment: As manufacturers and industry, units introduce new machines or automated systems to boost production and minimize the cost invested, the demand for manual labour declines. So, the skilled labour is retrenched and replaced by improved technological means. Thus the term technological unemployment have been seen in maximum cases of present day automotive industries where manual work is being replaced by robots in manufacturing auto parts.

2.4.2.7 Cyclical Unemployment: It is caused by the cyclical pattern of the recessionary and depressionary phases of the Trade Cycles. Due to the decrease in demand in the contraction phase, there is a decline in the production, and on the other hand, there is more disinvestment. However, cyclical phases are transient and hence cyclical unemployment is debilitating for a short span only. The apt solution to tackle this unemployment is to introduce measures for increasing total spending in the economy. More spending potential would create more demand, thereby increasing the industrial output. Hence, easy monetary policy and promptly introduced fiscal measures like deficit financing would be effective to counter the debacle of cyclical unemployment.

2.4.2.8 Chronic Unemployment: Identified by its long presence in a country's economy where unemployment becomes a sustained feature. Very often the underdeveloped countries are worst affected by this due to the ills of poverty, paucity of resources for development, dearth of educational means and the overall abyss in technological knowhow which prevents astute utilization of the available resources. This gap is compounded further because of high population growth and low or limited capital formation.

2.4.2.9 Disguised Unemployment: Disguised unemployment is the allusion to a place of work where some employees have zero or marginal productivity. Such employees are usually retrenched as they are not required for the given job and their leaving would make no difference to the production levels. This is a common feature in the underdeveloped economies with high population which often leads to overcrowding in a specific occupation.

2.4.3 Measurement of Unemployment

The Rate of Unemployment is measured by the following formula.

$$\text{Unemployment Rate} = \frac{\text{Labor Force} - \text{Employed Labor}}{\text{Labor force}}$$

There are three primary measures of Employment and Unemployment.

2.4.3.1 Usual Status: This measurement estimates the number of persons who may be chronically unemployed. This measure generally gives the lowest estimate of unemployment, especially for a poor economy because only a few can afford to remain without work over a long period.

2.4.3.2 Current Weekly Status: This estimate reduces the reference period, i.e., the period for which data has been accumulated in one workweek. According to this estimate, a person is said to be employed in a week, even if he is employed only for a weekday during that week.

2.4.3.3 Current Daily Status (CDS): This is the day activity status of the worker over the week. For working out the rate of unemployed person days, the aggregated count of unemployed days during the reference weeks constitutes the numerator and the aggregated of the total number of labor force days constitutes the dominator.

2.5 Inflation and Unemployment: A Phillips Curve Approach

In 1920s, an American Economist Irving Fisher noted that there was the Phillips curve relationship between Inflation and employment. However, the Phillips curve's original curve only described the behavior of Money wages. The concerns of the Phillips curve

were mainly related to the policies of central bank and how it guided their initiatives to control inflation. We have noticed that many financial publications talk about central banks endeavors to boost or slow the pace of economic activity. This discussion also focuses on the impact of the central banks' activities on inflation illustrations on the proposed contrary relationship between inflation and unemployment that is known as the *Phillips curve* theory. William Phillips, an economist from New Zealand, deliberated his theory in "*The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom*" in the Quarterly Journal Economics in 1958. The data mapped was from 1861 to 1957.

A.W. Phillips's seminal study was premised on the concept that there was a negative relation between Money wage rate changes and Unemployment in the British economy in the time period chosen for the study. Furthermore, Phillips's empirical evidences concluded that there was an opposite relationship between the Rate of change in the Money Wage Rate and The Rate of Unemployment. called the Phillips Curve. Phillips established this curve through an empirical study which proved that there was an (trade-off) negative association between the Rate of Unemployment and the Rate of inflation.

This implies that Inflation reduces Unemployment. In addition, other economists found similar pattern. In 1960, *Paul Samuelson and Robert Solow* took Phillips work and made explicit the link between Inflation and Unemployment. When Inflation was high, then Unemployment was low and vice versa.

The general conclusion that is drawn from the Phillips empirical finding is that a rise in Money wage Rate reduces The Rate of Unemployment and a fall in Money wages increases The Rate of Unemployment. Besides, from a policy point of view, Phillips curve reveals that there exists a trade-off between The Rate of Unemployment and The Rate of change in money wage rates, that is, a lower Rate of Unemployment can be achieved only by allowing Money wage rates to increase up to a certain level.

2.5.1 The Extension of the Phillips Curve

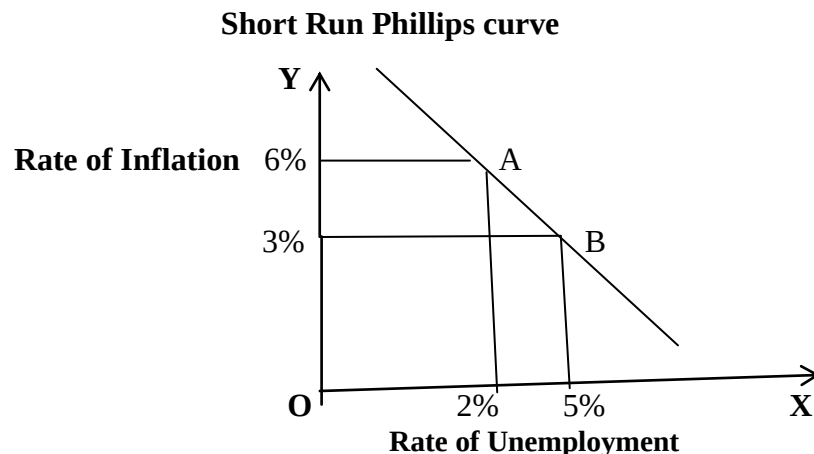
Although Phillips had traced the relation between the rate of change in money wages and the rate of unemployment, his analysis was subsequently expanded to analyze the

relationship between the rate of rising prices and the rate of unemployment. A plausible cause for this might be the fact that trends in wages and prices are interlinked and they go in the same way. Under this interpretation of the curve, some economic experts have used the US data to verify the Phillips curve in the short run phases of different periods (*Op. cit 2010, P. 499*). For example Durnberg used US data for the period 1951-61, Dornbusch and Fisher for 1961 – 1969, Ackley for 1955-69, and Glahe for 1961-70. They all find Phillips curve relationship to be consistent with the US data in the short run. Their Phillips curve shows a positive relationship between the rate of inflation and the rate of employment.

2.5.2 Modifications in the Phillips Curve theory

The Phillips curve short run phenomenon is only valid for a short run period. In the long run, Phillips curve keeps shifting up on the downward. For example, the subject fields which were held out on the foundation of the US data for the 1060s, 1070s, and 1080s confirm the existence of the Phillips curve only in the short run. The Phillips curve has found to be relevant only for 1961-69, for the 1970 and for late 1980s, though at different rates of inflation and unemployment. Only when the entire unemployment and wage data for 1961-93 is plotted together, it brings out a Phillips curve that keeps switching up and down in the long run in a spiraling way (*Sameulson, 1994, P. 588*). Hence, it can be concluded that there exists either no relationship or a weak one between the rising prices and unemployment in the long run.

Figure 2.3 The Short Run Phillips Curve



Source: Jhingan, Macroeconomics, p. 502

The figure 2.3 shows the short-term relationship between the inflation rate and the unemployment rate. Y-axis is a vertical line representing the rate of inflation and x-axis horizontal line represents the rate of unemployment. When the rate of inflation is 2%, then the rate of unemployment is at 3%, the equilibrium point is A and the shift of inflation rate is 6%. The rate of unemployment is 5%, the equilibrium point is B. When the point of A and B are added, we can gauge a downward slope, this curve is called the Phillips curve. As conclusively drawn by the Phillips curve theory, if there is increase in the liquidity of money in the economy, it would create more job opportunities because people would be interested in making investments. More investments would generate more demand in the economy due to multiplier effect. With the upsurge in demand, the production levels would get a boost and to achieve the production targets, the production units would hire more workers. Thus, employment would see a major upscale in the economy.

Another explanation shows that the inverse relationship between inflation and unemployment rate as represented by Phillips curve is only a short-term relationship and unstable because it prevails for a limited period. Many economists continue to be intrigued by the reasons for fluctuations in the Phillips curve in the long run. *Edmund Phelps and Milton Friedman* attempted to address this pattern of the Phillips curve. The envisions are explicated in the ensuing section.

2.5.3 The Theory of Natural Rate of Unemployment: Milton Friedman

Milton Friedman integrated the logic of short run Phillips curves into the macroeconomic theory and explained the spiraling Phillips curve. In the process he made a long run Phillips curve. Friedman began by showing graphically that the Phillips curve holds only in the short run. Friedman asserts that there is always a rate of unemployment in the long run, irrespective of the inflation. Friedman marked out such unemployment with what he termed as the *Natural Rate of Unemployment*. The natural rate of unemployment was later denoted as the “*Non- Accelerating- Inflation Rate of Unemployment*” (*NAIRU*). As per Friedman’s contention, NAIRU sustains even when the labor market is realized and it aligns with the potential level of turnout. Even the government’s expansionary and remedial fiscal strategies cannot eradicate NAIRU. The expansionary policies would

increase inflation and cause an upward shift in the Phillips curve showing a higher degree of unemployment and inflation rate. Hence in Friedman's final estimation, the Phillips curve becomes a vertical line (Friedman, 1968). Friedman's theory of Natural Rate of Unemployment underscores that in the long-run there is no inverse relationship between inflation and unemployment. Furthermore, there is a direct relationship between the pace of rising prices and the rate of unemployment. In this situation Phillips curve slope becomes a vertical line.

Figure 2.4: Long Run Phillips Curve



Source: Jhingan, Macroeconomics, p. 505

The figure 2.4 shows the long term relationship between the rate of inflation and the rate of unemployment. The Y-axis is the vertical line and represents the rate of inflation and the X-axis is the horizontal line that represents the rate of unemployment. The shift of the short run Phillips curve happens because people do not have any money illusions. Hence, there is direct relationship between the rate of inflation and the rate of unemployment rate, in other words the actual inflation rate and the expected inflation rate are equal. Phillips curve slope becomes a vertical line in the long-run, which is called the natural rate of unemployment.

2.5.4 Gross Domestic Product

The most widely use macroeconomics variables is Gross Domestic Product (GDP). This is the aggregation of all market transactions and government expenditures. The market transaction includes domestic use of commodities and services. GDP measures the money

value of the market prices or cost prices of government services, of all paid goods and services in an economic system. Hence, the GDP measures of the economy exclude all unpaid goods and services that are provided by society and nature. Gross Domestic Product (GDP) is gauged as the amount of the market value of all final goods and services produced in a nation during a given time frame and it is a major economic indicator.

2.5.5 Concept of Output Gap

The actual output gap represents what the economic system actually grows. An important related concept is potential output. Potential output is what the economy would produce if all resources, land, labor and productive capacity were fully employed at their normal levels of utilization. This concept is also referred to as potential income and is sometimes called full employment or high employment income. Output gap measures the difference between what would have been produced if full employment, GDP had been produced and what is actually produced, as measured by the current GDP. The output gap is calculated by subtracting potential GDP from actual GDP ($y - y^*$). Where y is the actual GDP and y^* is the potential GDP.

When the potential GDP exceeds the actual GDP, the gap measures the market value of commodities and services that could have been produced if the economy's resources had been optimally employed. The goods and services that are not produced when the economy is running below potential output are permanently lost to the economic system. Because these losses occur when employable resources are idle, they are frequently called the *Dead Weight Loss of Unemployment*. When the economy is operating below its potential level of output, the negative output gap is called a *Recessionary Gap*. In booms, actual output may exceed the potential output, causing the output gap to become positive. When the actual GDP exceeds the potential GDP, there is generally an upward movement of the prices. Hence, the positive output gap is often called the inflationary gap (*Lipsay & Christal, 2012, P. 339*).

2.6 Concept and Theories of Business or Trade Cycle

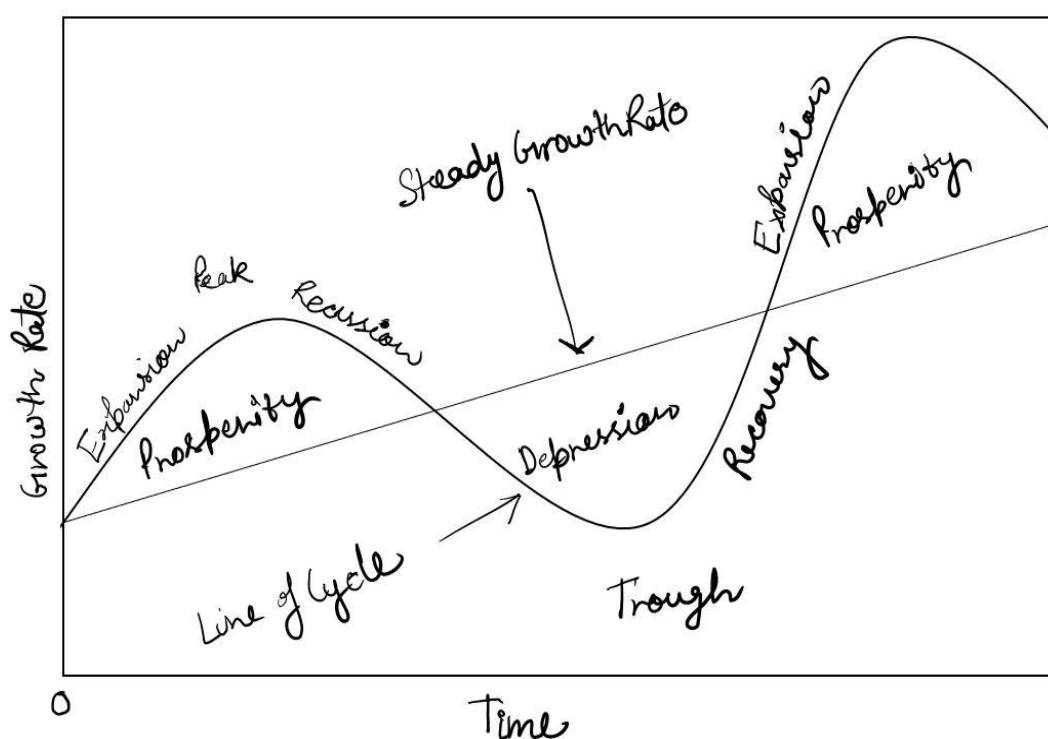
The present Global Financial crisis yet again marks out several limitations that the economists have to contend with in explaining and estimating accurately the business cycle mechanism. More essentially, in absence of a conclusive analysis, there solutions posited to deal with the crisis become ineffectual. Several theorists have introduced main research paradigms in this context. The New Classical economists analyzed the business cycle within the market-clearing model. The New Keynesians cited market failures happened because of business fluctuations. The Austrian economists analyzed the cycle in terms of inter-temporal disequilibrium. From yet another set of theorists, there has been an attempt to understand if the monetary business cycles could influence the cyclical behavior observed in the economy (*Dobrescu, Badeab and Paicuc, 2012*).

Kaya and Engkuchik (2013), attempted to explain the mechanisms of business cycle and their bearing on the workings of an economy. Business cycles map “ups and downs” in the economic activity and depict the periodic phases of expansion or recession. From the macro prospective, the industrial output and employment see a marked increase in the expansionary phase vis-à-vis an apparent downswing in the recessionary period. Economy witnesses a major upsurge in growth when the cycle is in expansion whereas the economy contracts on all indices of production, sales, and employment when its recession. Kaya & Engkuchik’s study also addresses queries pertaining to the prediction of business cycles to contain business fluctuations and aid in formulating effective macroeconomic policies.

The Business Cycles were the trusted recourse to characterize the free enterprise industrial world for over a century and a half. The Great Depression of 1930 was also explicated through this purview. However, between 1930 to about 2008-09, a financial crisis of a similar magnitude had not been seen by the global markets. Thus the 80 year long gap led to many economists assuming that Business Cycle, as a measurable entity, had become dysfunctional. Nevertheless, with the advent of the Global Financial Crises of 2008-09, the prevalence of business cycle and its significance in understanding the economic fluctuations gained strong impetus. In this context, it is important to reckon that all growth theories also indicate that the possibility of instability cannot be negated completely. Furthermore, it would not be possible to maintain the critical balance between the various growth variables such as saving, investment, capital output ratio, rate of increase in labour force and money supply at all times. According to *Sameulson and*

Nordhaus, “A business cycle is a swing in total national output, income and employment usually lasting for a period of 2 to 10 years, marked by a widespread expansion or contraction in most sectors of the economy” (Samuelson & Nordhaus, 1995, P. 551). The upward and downward momentums outline different phases of a business cycle. Though there are two phases: *Prosperity* and *Depression*, economists also consider the intermediate stages between prosperity and depression which are: *Expansion*, *Peak*, *Recession*, *Trough*, *Recovery* and *Expansion*. These phases are depicted in the figure below.

Figure 2.5: Phases of Business Cycle



Data source: Macroeconomics, Dwivedi, 2010, p. 499

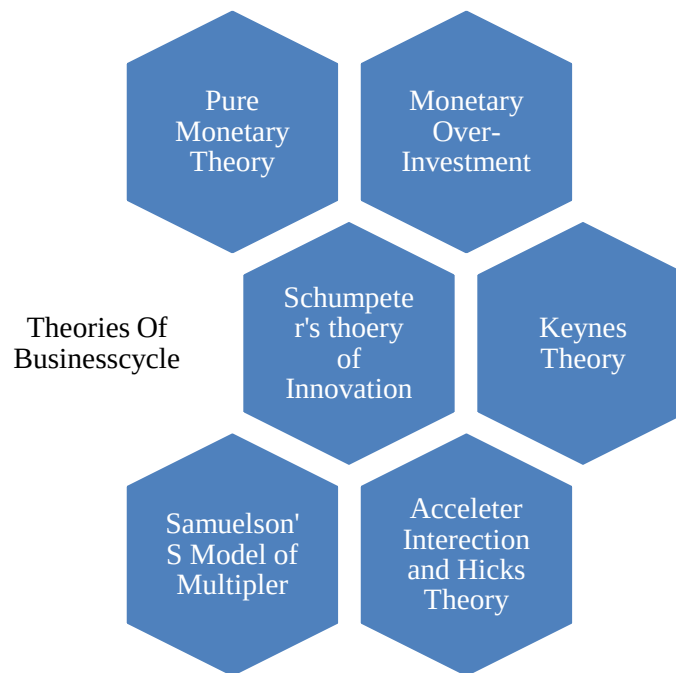
As per the figure 2.5: Y-axis is the growth rate and the X-axis is the time. The first steady growth line marks growth of the economy, increase in national resources and no economic fluctuations. The different phases of cycles are shown by the *line of cycle* as it moves up and down the steady growth line. The line of cycle moving above the steady growth line marks the start of the *Expansion* or *Prosperity* in the economy. Expansion is output, employment, investment, aggregate demand, sales, profits, bank credits,

wholesale and retail prices, per capita output and rise in standard of living. The growth rate eventually slows down and reaches the peak. The *Peak Phase* refers to the highest level of prosperity and downward slide in the economic activities starts from the peak point onwards. The *Recession Phase* commences from the downward slide in the growth rate becoming rapid and steady. This phase witnesses a decline in the output, less employment, though the realized growth rate might still remain above the steady growth line. Till the time the actual growth rate exceeds or is equal to the expected steady growth rate, the economy enjoys the period of prosperity high and low. When the growth rate falls below the steady growth rate, it marks the beginning of depression in the economy. The growth rate at times may fall to zero or even below zero. This was the case of the GDP of many developed countries during the Global Recession 2008-09. *Trough* is that phase of depression during which the downtrend in the economy slows down and finally stops. From this point onwards, the economic activities once again show an incline (Op. cit, 2010, Pp.409-410)

2.6.1 Theories of Business Cycle

A number of theories has been developed by the economists to explain the Business Cycle. However, in the Nineteenth century many of the classical economists such as Adam Smith, Mill and Ricardo did a convincing study on business cycles. They linked economic activities with the Say's law that postulates that supply creates its own demand. These economists opined that stability of an economy was dependent on the market forces. After that, many other economists, such as Keynes and Hicks provided a framework to understand business cycles. For instance, Pure Monetary Theory, Monetary Over-Investment Theory, Schumpeter's Theory of Innovation, Keynes Theory, Samuelson's Model of Multiplier Accelerator Interaction and Hicks's Theory.

Figure 2.6: Theories of Business Cycle



The **Business** or **Trade Cycle Theories** are divided into two schools of thoughts: **The Monetary theories** or the **Non-monetary theories**. This doctoral study focuses only on the Monetary Business theories because the study's objective is premised on the Financial Crises of 2008.

The traditional business cycle theorists based their findings on the monetary and credit system of an economy to investigate the business cycles. Hence, the theories propounded by the traditional theorists are called the Monetary Theory of Business Cycle.

2.6.1.1 The Pure Monetary Theory: It is theory cites that business fluctuations are caused by the instability of the monetary and credit system. The oscillations in the supply of money and bank credit are the basic factors at work in the cyclical process. **Hawtrey**, the architect of the Pure Monetary theory, advocates that business cycles are the alternate phases of inflation and deflation. Hawtrey asserted that changes in the level of economic activities were caused by the changes in money flows. When the money supply is more, the prices increase bringing in more profits, thus creating advents for increase in the industrial output. In a reverse situation, when the supply of money falls, the prices

decline and profits dwindle. This norm translates into low levels of production. Hawtrey relied on the quantity theory of money to explain the price behavior.

2.6.1.2 The Monetary Over-Investment Theory: F.A. Hayek instituted this theory in which he cited that when there is more investment in capital than in the consumer goods industry, it is a cause of imbalance and instability. This theory emphasises that to keep the economy in equilibrium, investment pattern must align with the pattern of consumption and for any economy to remain in stable equilibrium, it is necessary that voluntary savings are equal to the actual investment. As long as this equilibrium is maintained, the economy would witness a spell of stability. The changes in the money supply and the saving investment relations are the key reasons for disrupting this equilibrium. The saving investment relation might change due to the increase in investment without an equivalent increase in the voluntary savings. Investments may increase due to the increase in marginal efficiency of capital, fall in the rate of interest, over optimism about the future prospect. Very often, when new investments are financed through increased bank credit, it could lead to over investment. This is a usual feature in capital goods industries. Though there is expansion of investment, there is no contraction in consumption. New investments coupled with sustained levels of consumption and increased employment generates a climate of increase in money supply. This phase eventually leads to a rise in the general price level. As the prices rise, there is a consequent decline in the purchasing power. For this reason, the real demand does not increase at the rate of increase in the investments.

2.6.1.3 Schumpeter's Innovation Theory of Trade Cycle: Joseph A. Schumpeter postulated that innovations in the industrial and commercial organisations were the main reason for the phenomenon of Business Cycles. Innovation includes changes at various levels that could be improvisation in the methods of production and transportation or changes in industrial organisations. Innovation as a strategy would also involve the commercial application of new techniques, new material or new source of energy. Schumpeter developed a model in two stages which he termed as the first approximation and second approximation. First approximation dealt with the initial impact of the

innovative ideas. The second approximation depicted the deals with the subsequent waves that were created by the application of innovation (Op. cit, 2010, Pp. 410-415).

2.6.1.4 Keynes Theory: Keynesian theory is premised on the fact that increased investments accelerate demand. To meet this demand, production levels increase thus leading to an upsurge in employment levels. However, due to the probability of overproduction, the chances of recession become strong. Such a scenario calls for effective policy to restore equilibrium. In this situation, Keynesian theory contends that accelerator principle must be implemented. This implies that at some point, the investment needs to be done for producing capital goods as in plant or machinery instead of investments in consumer goods production to overcome the recession due to overproduction (Kates, 2002). The intent was to rely on total demand for determining the various economic factors like income, employment, and output. The total demand is understood to be the demand in both the consumer and capital goods. Keynes referred to the expected rate of profit as the marginal efficiency of capital. Expected rate of profit is the difference between the expected revenue generated by the capital employed and the cost incurred to employ that capital. As viewed from the perspective of Keynes theory, **Expansion Phase** encourages an optimistic outlook for investors who invest more because they overestimate the rate of return from an investment. The rate of return keeps increasing till the full employment condition is achieved. The phase in which the economy meets the ideal mark of full employment, is denoted as the **Boom Phase**. In the boom phase, the investors are unable to determine the reduction in the marginal efficiency of capital and are not mindful of the rate of interest also. In this backdrop, the profits from investments start declining due to the increase in the cost of investment and production of goods and services. This leads to *Contraction* or *Recession* in the economy. Recession sets in because the rate of decrease in the marginal efficiency of capital is more than that of current rate of interest. Moreover, the climate and avenues for investment also contract. Due to the paucity of funds, the banks are also unable to provide credit. Banks are not also able to provide credit because of the lack of funds. Because the Current rate of interest is higher, people are wary of investing and prefer to save. There is an apparent decrease in the demand for both the consumer and capital

goods. Low demands, less consumption together with retarded production shelves the employment opportunities and the economy is pushed into the phase of Depression.

Keynes suggested a triad of Propensities to explain the business cycles. These three types being: *Propensity to save*, *Propensity to consume*, and the *Propensity of marginal efficiency of capital*. Keynes also propositioned that the expansion of business cycle occurs due to increase in marginal efficiency of capital. This enables a climate of increased investments by individuals and enterprises alike. Organizations boost productions and open forms for hiring. More jobs enhance purchasing power and propel consumption. With more sales, business enterprises register profits and the chain of investments and increased income further accelerates. This marks the **Recovery** phase of the economy. Thus the three propensities coordinate to unravel the mechanisms of business cycles, demonstrating how they affect the economy.

2.6.1.5 Samuelson Model of Accelerator Interaction Theory of Business Cycle: J.M.

Clark underlines the role of acceleration in business fluctuations. The theorist's model is reckoned as the first step in the direction of integrating the Theory of Multiplier and the Principle of Acceleration to explicate the business cycles. Samuelson's model portrays how multiplier and acceleration interact with one other to create an impetus for generating additional income, consumption and investment demands more than expected. Model also explains the concept of the economic fluctuations. For a better understanding of Samuelson's Model, it is integral to be apprised of the difference between the Autonomous and Derived Investments. Autonomous investments are those that are done in external factors, as in investing in new inventions in technology, production process, production methods, etc. Derived Investment comprises those investments that are done in the capital equipment to meet the increase in consumer demand. More autonomous investments lead to rise in the incomes, thus resulting in the process of multiplier effect. Increased incomes create more demand for the consumer goods. To fulfill the rising demand and to sustain the momentum of more production, the firms undertake new investments. Thus, rising levels of consumption determine the demand for investments. This is termed as the Derived Investment. This marks the beginning of the Acceleration Process. So, a chain of various scenarios becomes evident as the derived investments

increase and the enhanced incomes propel the demand and growing capacity for consumption. This becomes an ideal backdrop for both multiplier Process and the Principle of Acceleration integrating with each other. A noticeable common feature in this case being that these phases see a marked growth in income levels which is better than expected³.

2.6.1.6 Hicks's Theory: Hicks associates the Business Cycles with the *Growth Theory of Harrod- Domar*. Hicks contends that Business Cycles and economic growth are simultaneous phenomena. Hence, both should be understood and analysed as an integrated pattern for formulation of policies.

2.7 The Concept of Recession

Recession is an economic phase when several aspects of the economy reflect working at the bottom for at least two-quarters of a calendar year. Recession is marked by declining investments, more unemployment, income decline, falling the growth rate, asset values collapse, reduced consumption and GDP falls for at least two consecutive calendar quarters. According to the National Bureau of Economic Research (NBER), Recession is also termed as “contraction” or “slump”. Recession is often followed by a boom, i.e., expansion, and thus this reverses the effects of a recession. In a recession, there is a reduction in productivity resulting in high unemployment. During the boom, however, there is a rapid rise in prices. The period of recession to recovery and boom is called a business cycle. There are short-term macro problems, but these do not last long because of corrective measures taken by one or many market players, including interventions by the government ⁴ (NMP and Dutta, 2013). The demand and supply shows the parameter. The growth in demand indicates the level of consumers' satisfaction who feel secure in investing. The reduction in demand implies that the general consumer does not intend to brook expenditure. Therefore, it can be supposed that when the demand falls, then supply chain is also affected due to the initial stage of decay. Economic recession depends on demand. Unemployment in a recession is like a cyclical unemployment, which is caused

³businessjargons.com/multiplier-accelerator-interaction-theory.html

⁴Recession is an economic instability that touches every person, the economy and society. It ultimately also affects other economies depending upon the volume of cross- country integration openness and trading.

by fluctuations in many macro variables. There is a fall in aggregate demand for goods and services in the national boundaries (Op. Cit, 2013, P. 3). Although there are four types of recession, this Study only pertains to the financial crises.

A fiscal crisis is a usual feature of market based economic systems. Market failure at medium intervals is inevitable in a capitalistic economic system. Such failures may not be viewed in a serious light in the short-run because the marketplace adapts to demand through hoardings of inventory or import of needed commodities and services. The market also adjusts in the long run to demand through the expansion of industrial output and also by the entry of new firms in the market. The important variable is cost, which also adjusts the commodity and project market. A problem comes up when there is over production and over capacity. Excess liquidity and excess supply of money, and a change in demand because of changes in taste and habits of consumers, and the public are other factors in the reckoning. Every economy is likely to face it sometimes and all these create knife-edge disturbances in the economy. Hence, these variables need adjustment by, *“utilization and the development of the population, saving propensity, technology exhaustion of existing inventory, and monetary and fiscal policy”*⁵The Global Financial Crises started with the US subprime mortgage problem in mid-2007. Since the crises had originated in the heart of the world economy, its contagion effect spread very quickly first to Europe and then the rest of the world.

2.7.1 What happened in the Recession of 2008?

The big recession in the USA began in December 2007. With it formally ending after 18 months (June, 2009), it was considered to be the largest economic contraction since the great Recession. The 16 month recession of 1973 – 1975 and the 1981- 1983 also were not as detrimental as the Global Recession of 2008. The situation in 2008 worsened because of the federal government’s refusal to rescue the collapsing investment giant i. e. the Lehman brothers. Considering the depth and duration of the new recession, it led to freezing of the credit marketplace. Giant financial institutions like the Citi Group, bank of America, and the American International Group (AIG) were in imminent risk of

⁵Verma, NMP, ed., 2013, P. 257.

insolvency. Within 2 years a significant gap (8%) opened between the economy's possible and actual output despite efforts of the monetary and fiscal policy makers to turn the decline (*Upadhyay and Mason, 2013, P. 23*).

The United States is the largest economy of the world. It had harmful impact on both the developed and developing country. Many people lost businesses due to decrease in consumption, investment and savings. U.S. is also the world's largest food supplier, exporter and importer. Therefore, when there was decline in the USA's business activity, caused a negative impact that began to percolate on the developing countries.

2.7.2 The Process of Globalization

The global economic system is the international web of individuals, business, governments, multilateral organizations and civic society groups that collectively make decisions around the production and distribution of goods and services.

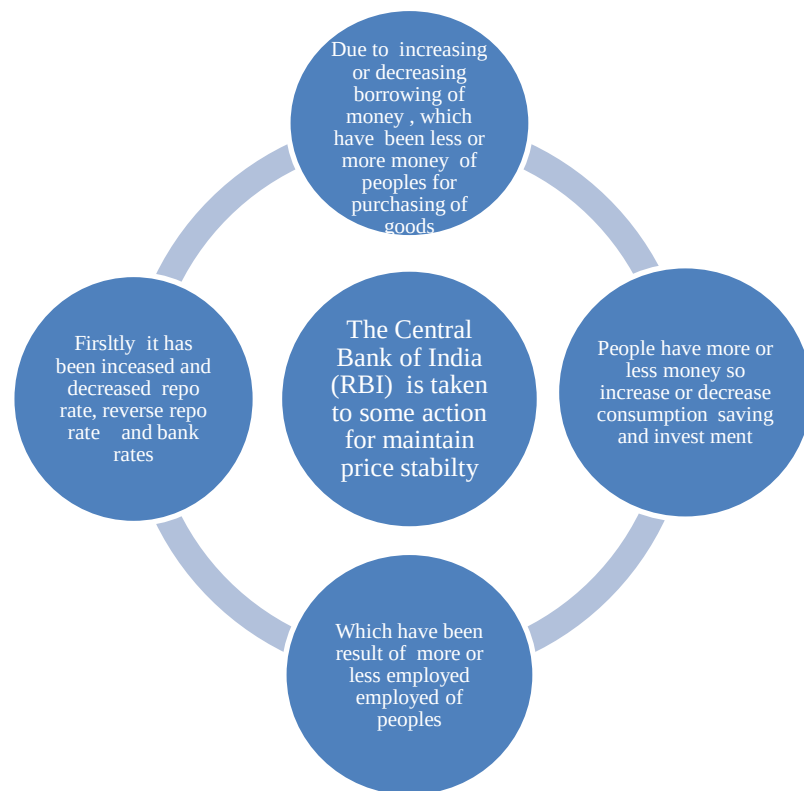
Since 1850s, the global economic isolation gave way to the globalization process which promoted economic integration. The two modern forms of globalization took place from 1850 to 1914 and from 1946 to the present. The pillars of modern economic globalization include the free cross border movements of goods and services, foreign direct investment, financial capital, labor and technology. Globalization also absorbed the economic ills that occurred from 1914 to 1945 in the wake of the two world wars. The above period in the era of globalization in the world's economy witnessed during retrenchments and a prolonged Global Depression. The big recession in the USA started in December 2007. Due to globalization, it had a noticeable impact on both the developed and developing countries (*Basanta, 2013, Pp. 233-234*). However, India was affected partially by the Global Financial crisis.

2.9 Link of the Phillips Curve Theory with the Global Financial Crisis in the Present Work

This study's main focus is on macroeconomic variables of inflation and unemployment, specifically addressing the time periods before, during and after the Recession. Many studies found that the rate of inflation and the rate of unemployment based on Phillips

curve theory did not exist in the recession period and concludes Phillips curve shape to be flat in the recession period in other countries. So this study examines the Phillips curve theory in the recession period with an intent to gauge the extent of the change in the Phillips curve shape and determine whether it was vertical, horizontal or flat in the Indian context during Global Recession. Another is to examine the output gap in the same periods.

Figure 2.7: Mechanism of the Effects of Inflation on Unemployment



Source: Authors' Compilation

The figure 2.7 presents the mechanism of the effect of the rate of inflation on the rate of unemployment. The central bank of India, the RBI, takes periodic actions for price stability in economy. The first step of central bank is to decrease the Repo rate and Bank rate. The Repo rate is a short-term instrument and the Bank rate is a long-term instrument for maintaining the price stability in the economy. If the RBI increases the repo rate, then it creates more liquidity in the economy. Due to this the people have been more money to purchase goods and services. This leads to increase in consumption, saving and

investment in the economy. These variables create of employment for people in the economy. This is a cause and effect relationship between the Rate of Inflation and Unemployment. We can write the equation like-

$$UNEM = F (In) \text{ Inflation}$$

Inflation is an independent variable that has been denoted by (I) and unemployment is a dependent variable, denoted by (U). This is a cause and effect relationship.

What causes changes in the rates of inflation and unemployment? How is the price level and degree of unemployment related? These have been key questions plaguing economists for at least forty years (*Marco et al. Pp. 1*). The Phillips curve is the most useful approach for showing the link between the unemployment rate and the inflation rate. That is why the policymakers enlist the aid of the Phillips Curve Theory.

The statement of the problem is that loss of output, increasing inflation and high unemployment are major problems of Indian economy. The present study adds to these indicators the impact of the recession on inflation, unemployment and the output gap in the wake of the 2008 Global recession. The empirical evidence in the Study would also show the short-run linkages between inflation and unemployment during the recession.

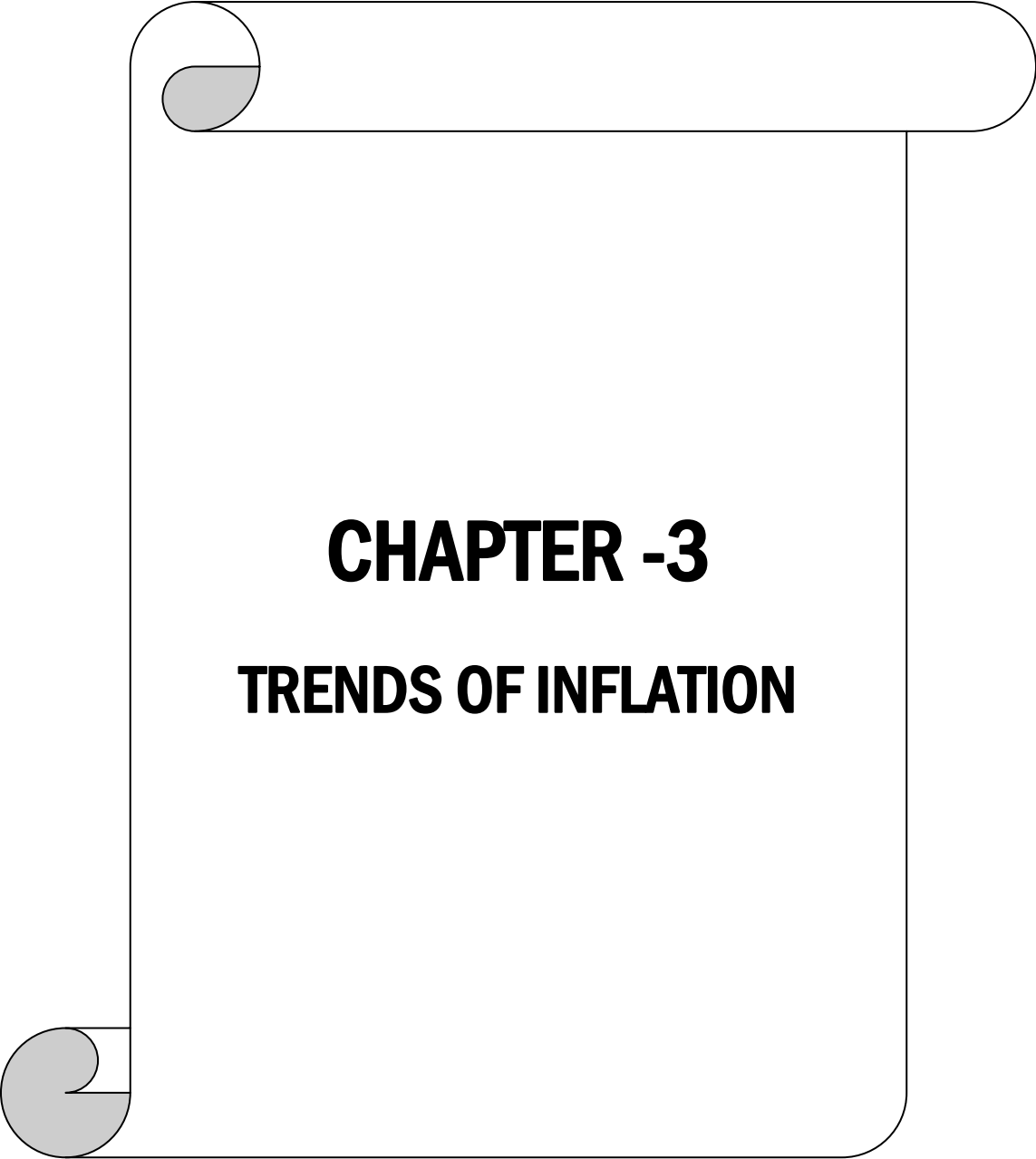
This study also seeks to fulfill the research gap wherein no study has yet been attempted to analyse the impact of Global recession on the Indian economy from the perspective of the Phillips curve theory. In macroeconomics, the short run is the period during which the economy maintains a deviation of actual from potential output, or output gap. This difference is associated either with the existence of spare capacity and unemployment, in the case of recession, or unstable output and rising prices, in the instance of a boom (Op.Cit., 2012, p. 341).

In the context of the reasons mentioned above, this study is linked to the Phillips curve because, this is a single theory that offers the combination of two variables (dependent and independent) between inflation and unemployment. In other words, it has provided the theoretical framework of the relationship between inflation and unemployment.

The mechanism that drives the Phillips curve theory is the demand-pull factor and wage push factor. As in, when the rate of inflation is increasing, it creates employment in the economy because creeping (moderate inflation) inflation is helpful for the growth in the economy. Hence, the present study examines the Phillips curve relationship in during, pre and post-recession moreover the output gap of recession 2008. On the other hand, the study also estimates the actual capacity of economy and the level of employment as less or optimum.

2.10 Concluding Facets

This chapter clearly establishes that inflation and unemployment are the macroeconomic variables and these variables create huge problems in any economic system. These variables cause fluctuations in the economy. This concerned chapter introduces the conceptual framework of inflation and unemployment. It demonstrates the short run linkages between inflation and unemployment by the theory of Phillips curve. First is short run period; the inverse relationship between the money wage rate and the rate of unemployment. When the money wage rate is decreasing, then the rate of unemployment is increasing. When the money wage rate is increased then the rate of unemployment is decreasing. It will be there in any variance of inflation and unemployment; this is more aptly described as the *knife-edge balance or equilibrium*. Another is the long run period. In this period there is no inverse relationship between the rate of inflation and the rate of unemployment. In other words, there is direct relationship between the rate of inflation and the rate of unemployment. The Long run Phillips Curve is vertical.



CHAPTER -3

TRENDS OF INFLATION

TRENDS OF INFLATION

3.0 Overview

The chapter 3 discusses and analyse about the trends of inflation. Since 1991, with a transformation India has become into a globalized economy. India also became highly vulnerable to shocks or other calamities. Therefore, the era proves interesting to be examined the trends of inflation in the present study and gauged if there is any impact of Global Recession of 2008 on the trends of inflation in the Indian economy or not. In political economy, inflation means a continuous hike in the prices of goods and services in an economy over a point of time and thus this is measured by the various price index number and deflator. This study has selected just two criteria that are the Wholesale Price Index and the Consumer Price Index. Since these two specifics capture the true picture of the rising prices in the economy, the Government of India has also chosen them as the nodes for decisions on policy implications. This chapter shows the trends of rising prices in the context of the Indian economy for 14 years. The period of the study is from 2002M1 to 2015M12. Further, this study has been divided into three periods. The beginning period is from *month one 2002 to month twelve 2007*, it represents the Pre-Recession period. The second period is from *month one 2008 to month twelve 2009*, which corresponds to the duration of Recession period. Third period is from *month one 2010 to month twelve 2015* the Post-Recession period.

Least square method has been enlisted to determine whether, the trends of all commodities and sub-groups under the Whole sale Price Index and Consumer Price Index resulting from inflation is increasing and decreasing with respect to time.

3.1 Introduction

Inflation is the most pressing problem in Indian economy. Inflation as an issue is the purview of both the rich and the underprivileged whose lives and standard of living revolves around the prices of essential commodities that they consume or use. Whenever

the finance minister presents the budget in the Parliament, every person can predict that the increase of fiscal deficit, oil price, cost of production would increase the inflation in future.

The notion of price stability as defined in modern theory and central banking practice today is fundamentally associated with a moderate rate of price inflation (*Ansari and Sbordone*, 2014, p. 1). In case of India with a large percentage of the population which is poor (42 percent in 2005) and (*Chen and Ravallian*, 2008) based on food price, inflation can be especially significant. This is because the poor spend a big ratio of their income on food. The National Sample Survey Organisation (NSSO)'s round in 2004-05 noted that 50 percent of income was spent on food. Hence, inflation results in loss of value of money. In other words, it reduces the purchasing power of money. For instance, if the price of five kilo gram (Kg) of rice is 100 rupees on a given week at a shop, then because of inflation, after a week at the same shop, only 4 Kg rice can be bought in Rs. 100. Due to inflation, the consumers are paying more money, but receiving fewer goods.

The rate at which the prices of goods and services increase over a particular period of time normally a year are termed as inflation rate. Different school of thoughts provides different perspectives on what really causes inflation. However, there is a general agreement amongst economists that economic inflation may be caused by either an increase in the money supply or decrease in the quantity of goods being supplied. Keynes defined inflation as a phenomenon of full employment. Pointing to the Neo Keynesian economic theory, demand-pull inflation, inflation due to high demand for GDP and low unemployment also known as Phillips curves inflation. Another is cost-push inflation, nowadays termed supply shock inflation is due to an effect of a sudden increase in the cost of petroleum. The monetarist theory described that when the money supply is increased in order to produce or increase production and utilization, it creates an inflationary situation within an economy, Structuralism described that the chief cause of inflation is the inelasticity in the social organization of the economy (Jain, 2015, P. 2).

The main question is that, what is the desirable rate of inflation, which is a contributing factor in developmental processes in the economy. Nevertheless, we have no clear-cut

solution to this query. It all depends upon the economic situation prevailing in a country at a particular time.

According to, International Monetary Fund (IMF), The Desirable Rate of Inflation in Developed Countries is (2.3 Percent) and Developing Countries are (4.6 Percent). As regards the desirable rate of inflation in India, According to Chakravarty Committee (1985), set up by the Reserve Bank of India to review the monetary system of a country, considered 4 percent rate of inflation in India socially desirable and conducive to economic growth⁶. According to Tarapor Committee, the Desirable Rate of Inflation in India 3.5 percent, on the other hand according to C. Rangrajan it is around 5.6 percent.

3.2 Objectives of the study

1. To examine the trends of the Wholesale Price Index in all commodities that includes primary articles, fuel & power and manufactured products.
2. To examine the trends of the Consumer Price Index in all categories that includes CPI-IW, CPI-AL and CPI-RL from 2002 to 2015.

3.3 Hypothesis of the study

1. **H₀**: WPI has increased trends in pre - recession period, decreasing in trend in duration and post-recession periods.
2. **H_a**: WPI has decreasing trends in pre - recession period, increasing in trend in duration and post-recession periods.
3. **H₀**: Consumer Price Index is decreasing trends in all categories such as CPI-IW, CPI-AL and CPI-RL in pre, duration and increasing trends in post-recession period.
4. **H_a**: Consumer Price Index is increasing in trend in all categories such as CPI-IW, CPI-A Land CPI-RL in pre, duration and shows decreasing trends in post-recession period consumer.

⁶ Shapiro, A. (1994), '*Macroeconomics Analysis*', Galgotia Publishers, New Delhi, P. 468.

3.4 The Meaning of Trend

A form of gradual modification in a condition, yield, or process, or an average or general tendency of a serial publication of data points to a move in a certain way over time and that is represented by a line or curve on a graph.

3.5. Methodology of the Study

The present study uses Least Square method to estimate the long-term trend, i.e., the secular trend. Reasons for employing this method are:

1. This is the most significant method of trend estimation.
2. It gives the best-fit line and provides the linear regression equation.

Least Square Method

Fitting the straight trend line

A straight line can be expressed by the following equation.

$$Y = \alpha + bX$$

Where, Y = trend values, X = unit of time, α is the y-intercept and b is the slope of the line.

Direct method- A straight line is defined by the equation.

$$Y = \alpha + bX$$

Two normal equations are

$$\sum y = N\alpha + b \sum X \dots\dots\dots 1$$

$$\sum XY = \alpha \sum X + b \sum X^2 \dots\dots\dots 2$$

The Second model is a Simple Linear Regression Model:-

This is a statistical tool which tells us the cause and effect relationship between two variables and summarize relationship within two continuous (quantitative) variables. One

variable represents an independent or explanatory variable while the second variable Y represents the dependent variable. This simple regression equation model is given below.

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon_t$$

Where y is termed as the dependent or study variable and X is termed as independent or explanatory variable. The terms β_0 and β_1 are the parameters of the model. The parameter β_0 is termed as intercept term and the parameter β_1 is termed as slope parameter. These parameters are usually called as regression coefficients. ε_t is observed as independent and identically distributed random variable with mean zero and constant variance 2σ . Later, we will additionally assume that ε is normally distributed.

3.6 Measurement of Inflation in the Indian Economy

The official price indices in India are calculated by using the Laspeyres's formula. The Laspeyres's price is calculated by using producers, consumers and wholesale prices. The index is determined for each of the three sets of prices for different purposes. The producer index measures the average selling prices received by domestic producers of goods and services. The Consumer Price Index (CPI) measures the average price from the consumer's perspective. Sellers' and consumers' prices may differ because of taxes levied or subsidies offered and distribution costs entailed. The Wholesale Price Index measures the average prices in the wholesale market, i.e., where goods are sold in bulk. These price indices are used to measure the average change over time in the selling prices received by producers (PPI-inflation) or prices paid by consumers (CPI- inflation) or the average price changes in the wholesale market (*Mishra & Roy, 2011, P. 5*). In the Indian economy, inflation can be measured in three ways: the Wholesale Price Index, Consumer Price Index and Gross Domestic Product (GDP) deflator. Each parameter has been explicated in the next section.

3.6.1 Wholesale Price Index in India

In the Indian context, the WPI is the basic entity for measuring the price rise. The WPI measures the cost of a collative basket of wholesale goods and details the price movement in the most comprehensive manner. It is widely practiced by the government

and the bank industry. The Department of the Industrial Policy and Promotion, Ministry of Commerce and Industry, the GOI, compiled the WPI and released it through an official publication. The Index No. of wholesale prices, with base week ending in August 19, 1939=100, for the week commencing from January 10, 1942 was the very first release of WPI. Since 1947, the Index is being issued regularly (WPI., Compilation, Manual, 2010, P. 1).

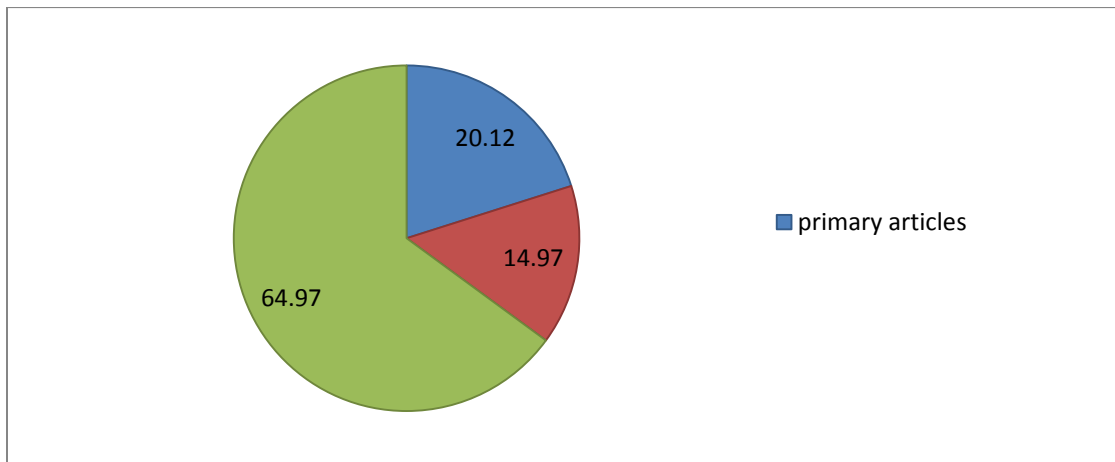
The modern version of Whole Price Index has been performed by shifting base year from 1993- 94 to 2004-05. A working group was instituted under the Chairmanship of Prof. Abhijit Sen, Member Planning Commission, for the revision of WPI services. The report presented by the committee recommended that the base year should be altered from 1993-94 to 2004-05. Technical advisory committee on statistics of prices and cost of living (TAC on SPCL) chaired by the Director General, Central Statistical Office at its meeting on 31.12.2009 gave the approval for the new base year, selection of commodity basket and derivation of weighting diagram. A committee of Secretaries (Cos) consented to the release of a new series in its meeting on 19th August, 2010. The report was finally released on 14th September 2010. The WPI of the new serial publication (with base year 2004-05) was launched on 14th September 2010 (Whole Price Index, Compilation, Manual, P. 10).

The report was estimated by the bureau of the Economic Advisor, Department of Industrial Policy and Promotion, Ministry of Commerce and Industry and it was released on the basis of three time phases of weekly, monthly and final list in every two months. Firstly, it is on the weekly basis on every Thursday for primary articles and fuel group. Second is the monthly basis on the 14th of every month for all commodities and Third, final list is released every two months (eight week). This Report provides an authentic price data for all commodities in the Indian economy⁷.

⁷Wholesale price index in all commodities is divided under three major groups namely, first is primary articles (20.12) percent of total weight) second is fuel and power (14.91) percent and third is manufactured production (64.97 percent) and these major groups are again divided into subgroups. Primary articles included in the computation of WPI include food articles, non-food articles and minerals. In the fuel, power, includes lights, lubricants; electricity, coal mining and mineral oil are included. This is represented by graphs.

Figure 3.1: Weightage of Wholesale Price in India

The figure 3.1 through the pie chart shows that the WPI has been divided into three main broad categories such as primary articles, fuel & power light and manufactured products and as well as how much are weightages of these categories.



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, Government of India

Table-3.1 Major Groups, in Wholesale Price Index in India

1. Primary Articles
I. Food articles
II. Non- food articles
III. Minerals
2. Fuel, Power, Light, Lubricants
I. Coal
II. Mineral oils
III. Electricity
3. Manufactured Products
I. Food products
II. Beverages, Tobacco and Tobacco Products
III. Textiles
IV. Leather and Leather Products
V. Wood and Wood Products
VI. Paper and Paper Products
VII. Rubber and Plastic Products
VIII. Chemicals and Chemicals Products and Several other
IX. Non- Metallic Mineral Products
X. Basic Metals, Alloys and Metal Products

XI.	Machinery and Machine Tools
XII.	Transport Equipment's and Parts
XIII.	Other Industries

Sources: Office of Economic Advisor, Ministry of Commerce and Industry, <http://industry.nic.in/>

Table 3.2: Comparative Statement of Weights, No. of Items & No. of Quotations between the Old Series & New Series.

Major Groups	Weights		No. of Items		No. of Quotations	
	2004-05	1993-94	2004-05	1993-04	2004-05	1993-94
All Commodities	100.00	100.00	676	435	5482	1918
Primary Articles	20.12	22.02	102	98	579	455
Fuel and Power	14.91	14.23	19	19	72	72
Manufactured Products	64.97	63.75	555	318	4831	1391

Source: Office of Economic Advisor, Ministry of Commerce and Industry (WPI, Compilation, Manual, 2010, pp10)

Table 3.3: The Evolution of WPI in India

Base year	Year of Introduction	No. of Items	No. of Price Quotations
The week ended 19 th August 1939	10 th January, 1942	23	23
End August 1939	1947	78	215
1952-53 (1948-49 as weight base)	1952	112	555
1961- 62	July, 1969	139	774
1970 – 71	January, 1977	360	1295
1981- 82	July, 1989	447	2371
1993-94	April, 2000	435	1918
2004-05	September, 2010	676	5482

Sources: Office of Economic Advisor, Ministry of Commerce and Industry (WPI, Compilation, Manual, Pp10).

A Basket of Commodities

The new series with 2004-05 as the base has 676 items in the commodity basket. A comparison of the number of items and price quotations in the story of the groups in the previous and the existing as well as in the revised base series is shown in table (4). There has been a significant addition in number of items and price quotations for each detail, especially in the manufacturing segment to not only better reflect the structural shifts but also to make WPI more broad based.

Table 3.4: Comparative Statement of Commodities and Price Quotations

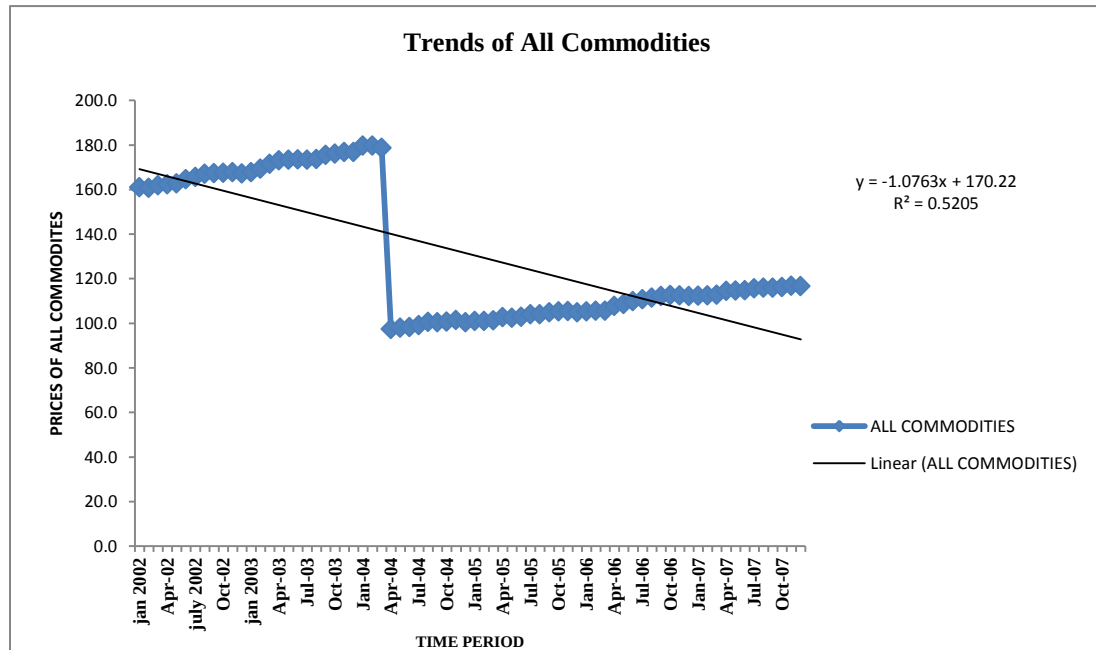
Major Groups	No. of Commodities				No. of Price Quotations			
	1970-71	1981-82	1993-94	2004-05	1970-71	1981-82	1993-94	2004-05
All Commodities	360	447	435	676	1295	2371	1981	5482
Primary Articles	80	93	98	102	411	519	455	579
Food Articles	39	44	54	55	264	320	340	431
Non-Food Articles	26	28	25	29	115	132	96	108
Minerals	15	21	19	18	32	67	19	40
Fuel and Power	10	20	19	19	30	73	72	72
Manufactured Products	270	334	318	555	854	1779	1391	4831
Food Products	37	35	41	57	117	231	168	406
Beverages Tobacco and Tobacco Products	8	7	11	15	19	39	49	102
Textiles	12	27	29	55	99	120	100	457
Wood and Wood Products	4	2	2	10	13	14	9	64
Paper and Paper Products	4	11	11	18	16	74	67	138
Leather and Leather Products	4	3	1	13	18	26	9	91
Rubber and Plastic	7	13	15	45	42	73	55	351
Chemical and Chemical Products	67	77	69	107	182	428	276	1111
Non-Metallic Mineral Products	21	22	9	26	63	125	42	225
Basic Metals, Alloys and Metal Products	42	57	53	69	125	235	203	696
Machinery and Machine Tools	35	44	56	107	104	266	312	903
Transport Equipment	21	22	21	33	39	118	101	287

Sources: Office of Economic Advisor, Ministry of Commerce and Industry, <http://eaindstry.nic.in/> (WPI, Compilation, Manual, 2010, pp.14-15)

3.7 Trends of all Commodities at Wholesale Price Index (All Groups) in India

❖ Pre-recession Period

Figure 3.7.1: Trends of Wholesale Price Index-All Commodities



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India

The line chart 3.7.1 illustrates the trends of all commodities in the (January 2002 to December 2007) pre-recession period. Y-axis indicates the prices of all commodities and X-axis indicates time. Blue color line represents the prices of all commodities and black color line indicates the trend line of all commodities. Prices of all commodities started at high 161.0 value after that it gradually increased from Feb 2004, value at 179.8. There was a sudden decrease at 97.5 value in April as well as crossed trend line due to the hardening of international oil prices as well as domestic food prices responding to a deficient monsoon in the previous year fuelled a spurt in inflation in India during the first half of 2004-05 (**Lok Sabha Secretariat, No. 6/RN/Ref./2013**). This becomes even lower in the series and crossed the trend line in May 2005 value at 102.9. After that it gradually increased and again it crossed the trend line in June, 2006 with the value of (109.0). Thereafter, it increased with the upward prices in Dec, 2007 with the 116.0 value. While the trends of all commodities declined with respect to time.

Explanation and Interpretation of Regression Model

α is intercept depicting all commodities when the explanatory variables are equal to zero.

α and β_1 are the co-efficient or parameters attached to the explanatory variables. Next line the inclusion of the stochastic term (ui or ut) in the above model is to capture the impact of other variables that are not included in the models.

3.6 Statistics Description

Evaluation based on statistical criteria

The R^2 (coefficient of determination): The R square shows the goodness of fit of the regression. It indicates how well or to what extent the explanatory variable (regress or) explains the variation (regressed). **The t- test (student-t):** The t test shows the dependent variables and its usefulness to the model. A two tailed test is concluded at the 5 % level of significance, under the n-K degree of freedom, where K is the number of samples. **The f- test:** The f test is used for the overall significance of the regression model. It will also be carried out at 5% level of significance.

Table 3.5: Interpretation of ANOVA

Source	SS	DF	MS
Model	36017.5438	1	36017.5438
Residual	33191.5775	70	474.776357
Total	69209.1214	71	974.776357

The ANOVA (analysis of variance) table splits the sum of squares into its components.

Total sum of square = residual (error term) sum of square + regression (all commodities) sum of square.

Table 3.6: Analysis of Regression Coefficient

Intercept	Coef.	Std. Err.	T stat	P >(t)	Upper	Lower
Time	-1.07195	.1234806	-8.72	0.000	-1.322469	-8299203
Allcommodites	170.2144	5.18643	32.82	0.000	159.8704	1805584

Let all commodities denote the regress and co-efficient of the regressor (time)

Column “coefficient” gives the least squares estimates of time. Column “standard error” gives the standard error (i.e. the estimated standard deviation) of the least squares estimates α . Column “t stat” gives the computed t-statistics for H_0 : decreasing trends of all commodities of (WPI) in the pre-recession period = H_0 against H_a : decreasing or not decreasing trends of all commodities of (WPI) in $\neq 0$. Column “P value” gives the P-value for the test of H_0 : decreasing trends of all commodities of (WPI) in the pre-recession period = H_0 against H_a : decreasing or not decreasing trends of all commodities of (WPI) in $\neq 0$. This equals the $\Pr \{(t) > t\text{-stat}\}$ where t is a t -distribution random variable with $n-k$ degrees of freedom and t -statistics is the computed value of the t -stat given in the previous column. Column “lower 95 percent” and “upper 95 percent” values define a 95 percent confidence interval for all commodities.

Table-3.7 Interpretation of Regression Statistics

	Value	Explanation
No of observation	72	No of observation used in regression (n)
F test	75.96	The F test compares the variance of two samples so as the two test hypothesis.
P value	0.000	To find out for significance level
R-squared	0.5204	Coefficient of determination, the overall goodness of fit- measures, i.e. R^2 (0.5204)
Adj- R- squared	0.5136	Adjusted R^2 used for more than x (dependent) variables
Root MSE	21.775	It is the best measure of goodness fit of the correlation coefficient.

Sources: Authors' Estimation from the Secondary Data

3.7 Statistical Significance of Trends of All Commodities

The regression analysis is based on secondary data which have been taken by MOSPI. There are 72 observations that have been used for analysis. Study time period is from 2002 to 2007. It has been used in monthly data on the base of wholesale price index. There are two variables used in this, analysis which is dependent variable and independent variable, time is independent variable and all commodities are the dependent variable.

The model can be written in a functional form as follows:

$$\text{ALLCOMMO} = f(T)$$

ALLCOMMO = All Commodities of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An econometric model, by including the stochastic term (u_i), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = all commodities of wholesale price index, α = intercept of y (constant coefficient),

β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{All commodities} = 2.22815 + -.0033633_{\text{time}} + \varepsilon_t$$

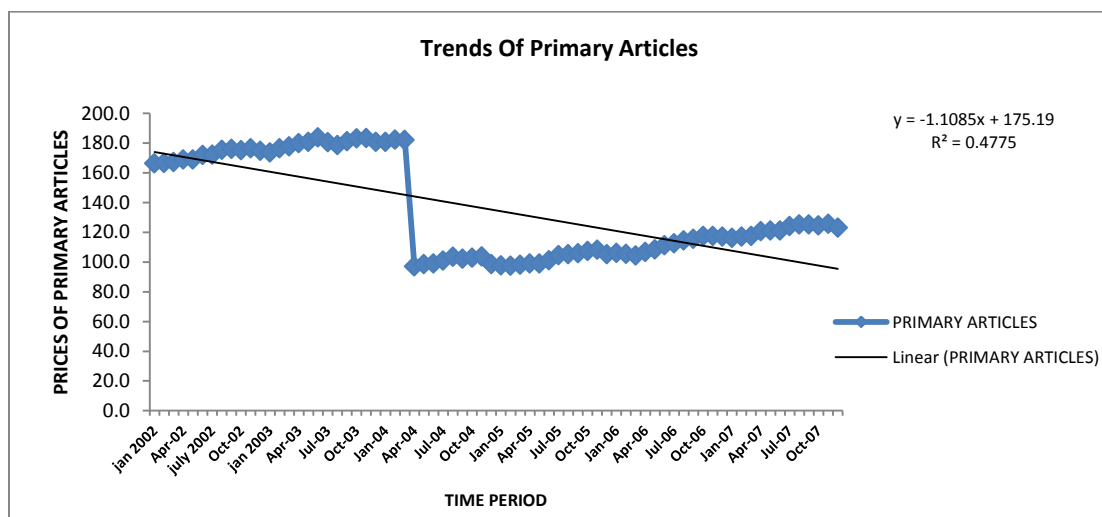
According to the statistical model, one unit change in time will affect one unit change in all commodities of (WPI) but as noted on the model, coefficient value of time is negative. Therefore, in pre-recession period, trends of all commodities of wholesale price index are

negatively associated with time. In other words trends of all commodities decreased and the prices increased.

Analysis of Regression coefficient: The coefficient value is (2.22815), Standard. Error. (.0004066). T stat (-8.27) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of all commodities in pre-recession period and $H_0 \neq 0$. While the p value is more than tstat ($0.000 > -8.27$) but it is significant at 1 percent level of significance. Therefore, null hypothesis is rejected at the 1 percent level of significance and it concludes an inverse relationship between the trends of all commodities with pre-recession time.

Figure 3.7.2: Trends of Primary Articles



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India

The line chart 3.7.2 illustrates the trends of primary articles in the (2002 -07) pre-recession period. Y-axis indicates the prices of primary articles and X-axis indicate time. Blue color line shows the prices of primary articles and black color line indicates the trend line of primary articles. Prices of primary articles starts at high value of 166.4, after which it gradually increases from Feb 2004 to 182.4 from there a sudden decrease at 97.0 value is observed April as the prices crossed trend line, due to the hardening of international oil prices as well as domestic food prices. This could be response to a deficient monsoon in the previous year that fuels a spurt in inflation in India during the first half of 2004-05 (Lok Sabha Secretariat, No. 6/RN/Ref./2013). After that, the prices

of primary articles gradually increases with continuous fluctuations occurring May 2004 with the value of 123.2 to Dec 2007 with the value of 123.2 and subsequently crossing the trend line in May 2006 with the value of 108.4. The trend of the primary articles shows decreasing trend with respect to time.

Statistical Significance of Primary Articles

The regression analysis is based on the secondary data which has been taken by MOSPI. There are 72 observations which have been used for analysis. Study time period is from 2002 to 2007. It has been used in monthly data on the basis of WPI. There are two variables used in this analysis, which are the dependent variables and the independent variables where time is independent variable and primary articles are the dependent variables.

The model can be written as a functional form as:

$$P. A. = f(T)$$

P. A. = Primary articles of wholesale price index

T = Time

f = functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = primary articles of wholesale price index, α = intercept of y (constant coefficient),

β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

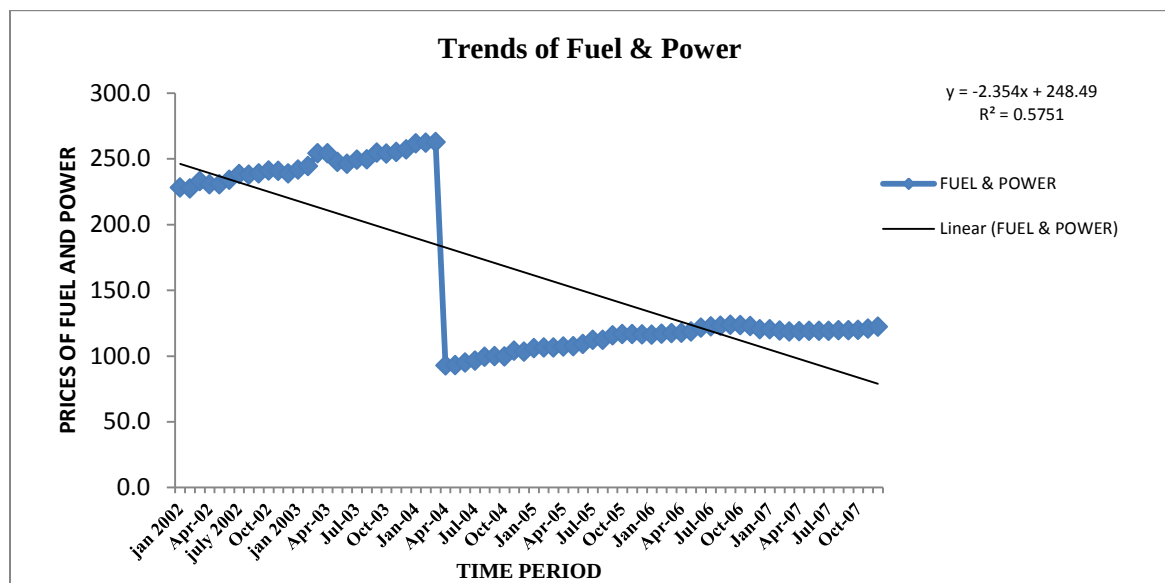
$$\text{Primary articles} = -.0033439 + 2.238436_{\text{time}} + \epsilon_t$$

According to the statistical model, one unit change in time will affect the one unit change in primary articles of (WPI) but as noted in the model, coefficient value of time is negative. Hence, in pre-recession period, trends of primary articles on wholesale price index are negatively associated with time. In other words trends of primary articles decreased and the prices increased.

Analysis of Regression coefficient: The coefficient value is (-.0033439), Standard Error. (.0004538). t stat (-7.37) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of primary articles in the pre recession period and $H_0 \neq 0$. While the p value is more than the t-stat value. But P value is significant at 1% level of significance therefore null hypothesis is rejected at the 1% level of significance (0.000 > -7.37) and it concludes an inverse relationship between the trends of primary articles with pre-recession time.

Figure: 3.7.3: Trends of Wholesale Price Index-Fuel and Power



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India.

The line chart 3.7.3 illustrates the trends of fuel and power in the pre-recession period. Y-axis indicates the prices of fuel and power and X-axis indicate time. Blue color line shows the prices of fuel & power and black color line indicates the trend line of fuel & power. Prices of fuel & power starts at high value of 228.1, after that it increases continuously from Feb 2004 and reached to 262.2. Then it shows a sudden decrease with the value of 92.8 in April as well as

crossed trend line, due to the hardening of international oil prices as well as domestic food prices. This could be in response to a deficient monsoon in the previous year that fuels a spurt in inflation in India during the first half of 2004-05 (*Lok Sabha Secretariat, No. 6/RN/Ref./2013*). After that, prices of fuel & power continuously increased from May 2004 with the value of 93.0 to Dec 2007 with the value of 122.1 and subsequently crossing trend line in March, 2006 with the value of (117.3).the trend of fuel and power shows decreasing trend with respect to time.

Statistical Significance of Trends of Fuel and Power

The regression analysis is based on the secondary data which has been taken by MOSPI. 72 observations are used for analysis. Study time period is from 2002 to 2007. The monthly data on the base of the WPI has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and fuel and power are the dependent variables.

The model can be written as a functional form as follows:

$$F. \& P. = f(T)$$

F. & P. = Fuel and Power

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = fuel and power of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

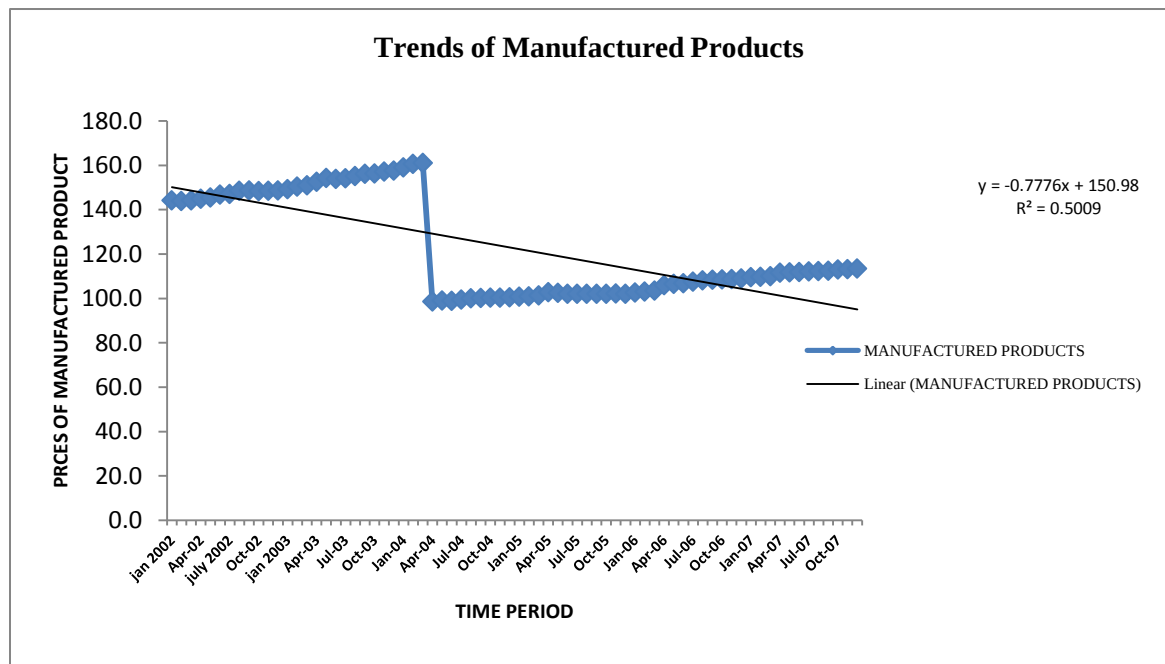
$$\text{Fuel \& power} = -.0058482 + 2.39182_{\text{time}} + \epsilon_t$$

According to the statistical model, the unit change in time will affect one unit change in fuel and power of (WPI) but as noted in the model coefficient value of time is negative. Hence, in pre-recession period, trends of fuel and power of wholesale price index are negatively associated with time. In other words trends of fuel and power decreased and the prices increased.

The coefficient value is (-.0058482), Standard. Error. (.0006476). t-stat (-9.03) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of fuel and power in the pre recession period and $H_0 \neq 0$. While the p value is more than t-stat but P value significant at 1% level of significance. Hence null hypothesis is rejected at the 1% level of significance and it concludes an inverse relationship between the trends of fuel and power with pre-recession time.

Figure 3.7.4: Trends of Wholesale Price Index-Manufactured Products



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, Government of India

The line chart 3.7.4 illustrates the trends of all manufactured products in the (January 2002 to December 2007) pre-recession period. Y-axis indicates the prices of manufactured products and X-axis indicates time. Blue color line shows the prices of all commodities and black color line indicates the trend line of manufactured products.

Prices of manufactured products starts at high value of 144.2 in Jan 2002. After that, it continuously increases from Feb 2004 to 160.4. From there a sudden decrease at 98.6 value is observed in April and it crossed trend line, due to the hardening of international oil prices as well as domestic food prices. This could be in response responding to a deficient monsoon in the previous year that fuels a spurt in inflation in India during the first half of 2004-05 (*LOK SABHA SECRETARIAT, No. 6/RN/Ref./2013*). After that, prices of manufactured products gradually increases with continuous fluctuations occurring from May, 2004 with the value of 99.0 to Dec 2007 with the value of 113.5 and subsequently crossing the trend line in May 2006 with the value of 106.5. The trend of manufactured products shows decreasing trend with respect to time.

Statistical Significance of Trends of Manufactured Product

The regression analysis is based on secondary data which have been taken by MOSPI. 72 observations have been used for analysis. Study time period is from 2002 to 2007. It is based on the monthly data for the WPI. There are two variables used in this analysis, the dependent variable and independent variable, time is independent variable and manufactured products are the dependent variable.

The model can be written as a functional form as follows:

$$M. P. = f(T)$$

M. P. = Manufactured Products of Wholesale Price Index

T = Time

f = Functional Relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (u_i), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

Y = manufactured products on wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

$$\text{Manufactured products} = 2.17696 + -.0026229_{\text{time}} + \varepsilon_t$$

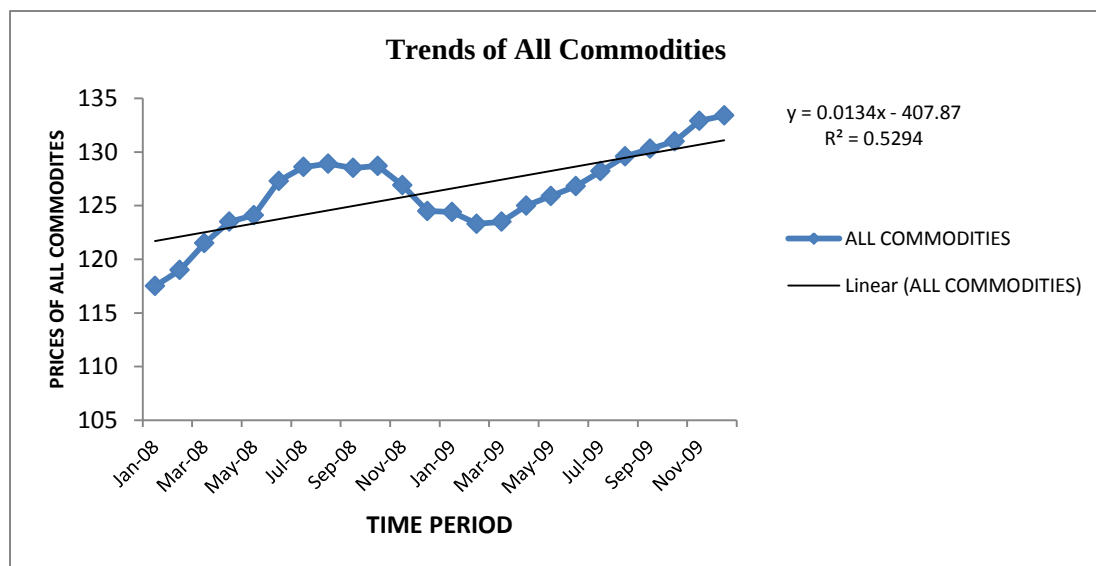
According to the statistical model, the one unit change in time will affect the one unit change in manufacturing products of (WPI) but as noted in the model, coefficient value of time is negative. Hence, in pre-recession period, trends of manufactured products on wholesale price index are negatively associated with time. In other words, trends of manufactured products were decreasing and the prices were increasing.

Analysis of Regression Coefficient: The coefficient value is (2.17696), Standard. Error. (.0003245). t-stat (-8.08) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of manufactured products in the pre-recession period and $H \neq 0$. While the p value is more than t-stat but p value significant at 1 %level of significance ($0.000 > -8.08$) Therefore, the null hypothesis is rejected at the 1% level of significance and it concludes an inverse relationship between the trends of manufactured products with pre-recession time.

Duration of Recession

Figure: 3.7.5: Trends of Wholesale Price Index-All Commodities



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India.

The line in chart 3.7.5 illustrates the trends of all commodities in the recession period (2008-09). Y-axis indicates the prices of manufactured products and X-axis indicates time. Blue color line shows the prices of all commodities and black color line indicates the trend line of all commodities. Prices of all commodities started are lowest value 117.5, January, 2008. After that, it crossed the trend line and its fluctuation was cyclical from January, 2008 to December, 2009. While the trends of all commodities increased and it showed a flatter line.

Statistical Significance of Trends of all Commodites

The regression analysis is based on secondary data taken by MOSPI. There are 24 observations in analysis. Study time period is from 2008-M,1- to 2009-M,12. Monthly data on the base of the wholesale price index has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and all commodities are dependent variables.

The model can be written as a functional form as:

$$ALLCOMMO = f(T)$$

ALLCOMMO = All Commodities of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = all commodities of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

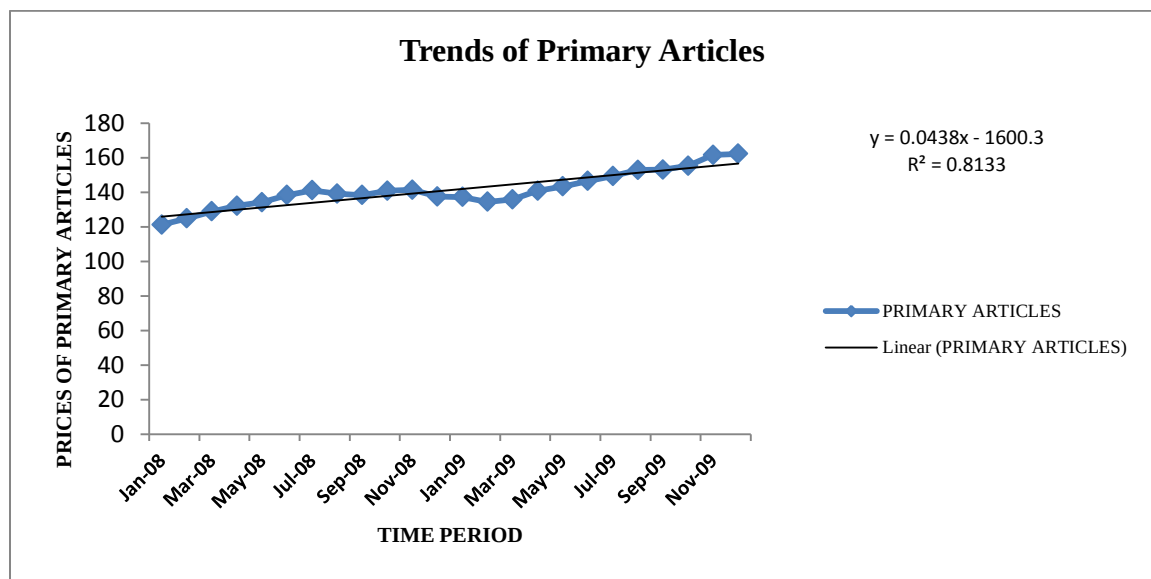
$$\text{All Commodities} = .0014103 + 2.083868_{\text{time}} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect of one unit change in all commodities of (WPI). Therefore, in duration-recession period, trends of all commodities of wholesale price index are positively associated with time. In other words, trends of all commodities and prices are increased of same direction with time.

Analysis of Regression coefficient: The coefficient value is (.0014103), Standard. Error. (.0002844). t-stat (4.96) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of all commodities in duration of recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 4.96$) therefore null hypothesis is rejected at the 1% level of significance and it concludes there is a positive relationship between the trends of all commodities (WPI) with recession time.

Figure 3.7.6: Trends of Wholesale Price Index-Primary Articles



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, GOI

The line chart 3.7.6 illustrates the trends of primary in the recession period (2008-09). Y-axis indicates the prices of primary articles and X-axis indicates time. Blue color line shows the prices of primary articles and black color line indicates the trend line of all primary articles. Prices of primary articles were upward and during the entire period, it touched the trend line from January, 2008 to December, 2009. The prices of primary articles increased but the trend line became flatter.

Statistical Significance of Trends of the Primary Articles

This regression analysis is based on secondary data taken by MOSPI. There are 24 observations for analysis. Study time period is 2008 to 2009 based on the monthly data of WPI. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and primary articles are the dependent variable.

The model can be written as a functional form as follows:

$$P. A. = f(T)$$

P. A. = Primary Articles of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ui), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

Y = primary articles on wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

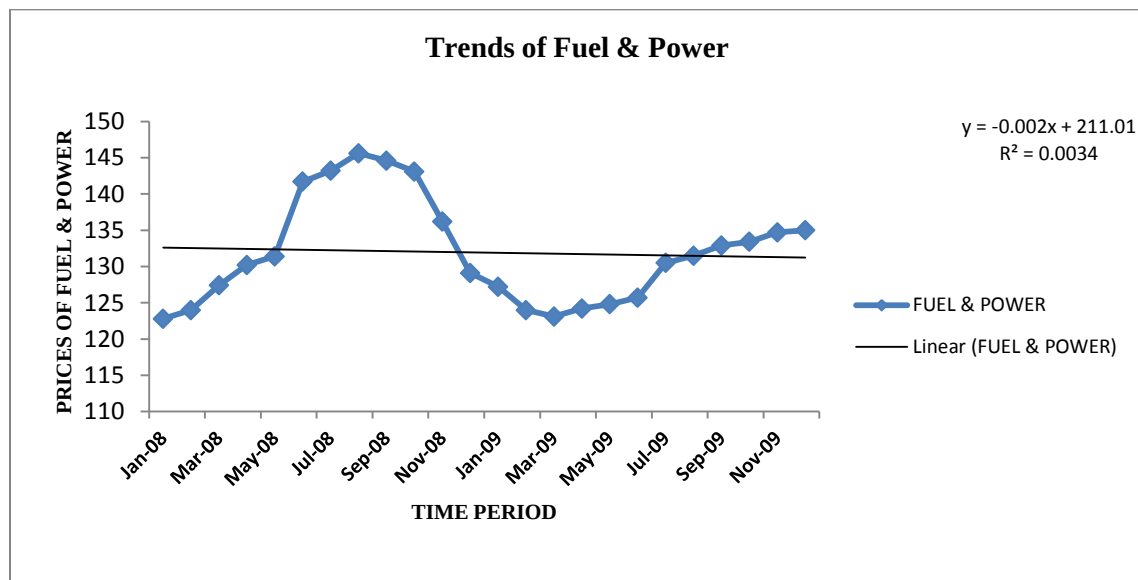
$$\text{Primary Articles} = .0040752 + 2.097934_{\text{time}} + \varepsilon_t$$

According to the statistical model, the one unit change in time will affect the one unit change in primary articles of (WPI). Therefore, in duration-recession period, trends of primary articles (wholesale Price Index) are positively associated with time. In other words, trends of primary articles and prices are increasing in the same direction with recession time.

Analysis of Regression Coefficient: The coefficient value is (.0040752), Standard. Error. (.0004146). t-stat (9.83) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are decreasing trends of all primary articles in duration of recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 9.83$) therefore null hypothesis is rejected at the 1% level of significance. There is a positive relationship between the trends of primary articles (WPI) with recession time.

Figure 3.7.7: Trends of Wholesale Price Index –Fuel and Power



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, GOI.

The line chart 3.7.7 illustrates the trends of fuel and power in the recession period (2008-09). Y-axis indicates the prices of primary articles and X-axis indicates time. Blue color line shows the prices of fuel and power and black color line indicates the trend line of all fuel and power. Prices of fuel and power starts the lowest value of 122.8 in January, 2008 and its highest peak point was in August in 2008 with the value of 145.6. After that, it crossed trend line and its fluctuation in cyclical from January, 2008 to December, 2009. While the trends of fuel and power shows side trend (horizontal line).On the other hand, the trends of fuel and power were found to be flatter.

Statistical Significance of Trends of Fuel and Power

The regression analysis is based on secondary data taken by MOSPI with 24 observations for analysis. Study time period is from 2008 to 2009 based on the monthly data of WPI. There are two variables in this analysis dependent variable and independent variable, time is independent variable and fuel and power are the dependent variable.

In the ongoing, the model can be written as a functional form as follows:

$$F. P. = f(T)$$

F. P. = Fuel and Power of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (u_i), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = fuel and power of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation.

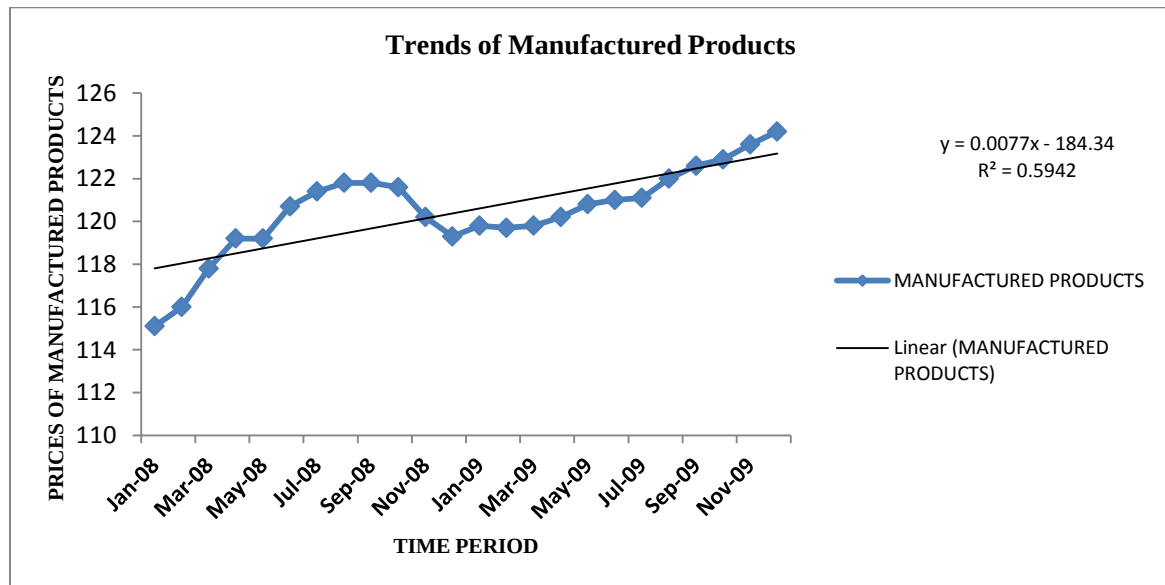
$$\text{Fuel \& Power} = 2.121729 + -.0001612_{\text{time}} + \varepsilon_t$$

According to the statistical model, one unit change in time will affect one unit change in fuel and power (WPI). Therefore, in duration-recession period, trends of fuel and power of wholesale price index are negative associated with time. In other words trends of fuel and power and prices are increasing in the opposite direction with time.

Analysis of Regression coefficient: The coefficient value is (2.121729), Standard. Error. (.0007148). t-stat (-0.23) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are increasing trends of fuel and power in duration of recession period and $H_0 \neq 0$. While the p value is more than t-stat but pvalue is significant at 1% level of significant which rejected null hypothesis at 1 percent level of significance and it concludes there is negative relationship between the trends of fuel and power (WPI) with recession time.

Figure 3.7.8: Trends of Wholesale Price Index- Manufactured Products



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, Government of India

This figure 3.7.8 shows the trends of manufactured products from 2008 to 2009 (duration recession period) in context of Indian economy. The Y axis represents the wholesale price index and x axis represents a time period. The blue line represents the prices of manufactured products and black line represents trends. This series shows the cyclical fluctuation prices of manufactured products. Lowest prices of manufactured were at 115.1 value in January, 2008 and it increased, crossed the trend line in April, 2008. It reached at peak 121.8 value in August, 2008. Then the prices of the manufactured products decreased and again crossed the trend line in November, 2008. After that the prices again increases from Jan, 2009 to December, 2009 and crossed trend line in September, 2009. On the other hand, trends of manufactured products were found to increase with an upward trend.

Statistical Significance of Trends of Manufacture Products

The regression analysis is based on secondary data taken by MOSPI. There are 24 observations for analysis. Study time period is 2008 to 2009 based on the monthly data of WPI. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and manufactured products is dependent variable.

The model can be written as a functional form as follows:

$$M. P. = f(T)$$

M. P. = Manufactured Products of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

Y = manufactured products on wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts in the equation

$$\text{Manufactured products} = .0008443 + 2.070337_{\text{time}} + \epsilon_t$$

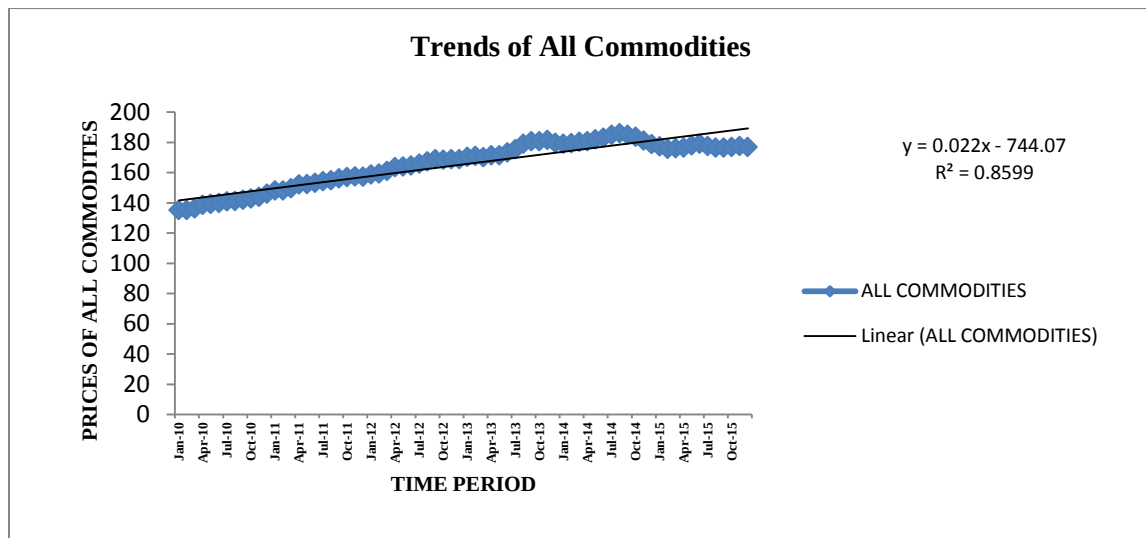
According to the statistical model, the one unit change in time will affect the one unit change in manufactured by (WPI). Therefore, in duration-recession period, trends of manufactured products (Wholesale Price Index) are positively associated with time. In other words, trends of manufactured products and prices are increasing in the same direction with recession time.

Analysis of Regression coefficient: The coefficient value is (.0008443), standard. Error (.0001494). t stat (5.65) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of manufactured in duration of recession period, and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 5.65$) therefore null hypothesis is rejected at the 1 percent level of significance. It concludes a positive relationship between the trends of manufactured products (WPI) with recession time.

❖ Post-recession Period

Figure 3.7.9: Trends of Wholesale Price Index-All Commodities



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, GOI.

The line chart 3.7.9 illustrates the trends of all commodities in the post-recession period (2008-09). Y-axis indicates the prices of all commodities and X-axis indicates time. Blue color line shows the prices of all commodities and black color line indicates the trend line of all commodities. Prices of all commodities touched the trend line from January, 2008 to June, 2015 after that it gradually decreased until December, 2015 with the value of 176.8. While the trends of all commodities increased with flatter line.

Statistical Significance of Trends of All Commodities

The regression analysis is based on secondary data which taken by MOSPI. There are 72 observations for analysis. Study time period is from 2010 to 2015. Monthly data based on

the WPI has been used. There are two variables in this analysis. Dependent variable and independent variable, time is independent variable and all commodities are dependent variable.

The model can be written as a functional form as:

$$\text{ALLCOMMO} = f(T)$$

ALLCOMMO = All Commodities of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = all commodities of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

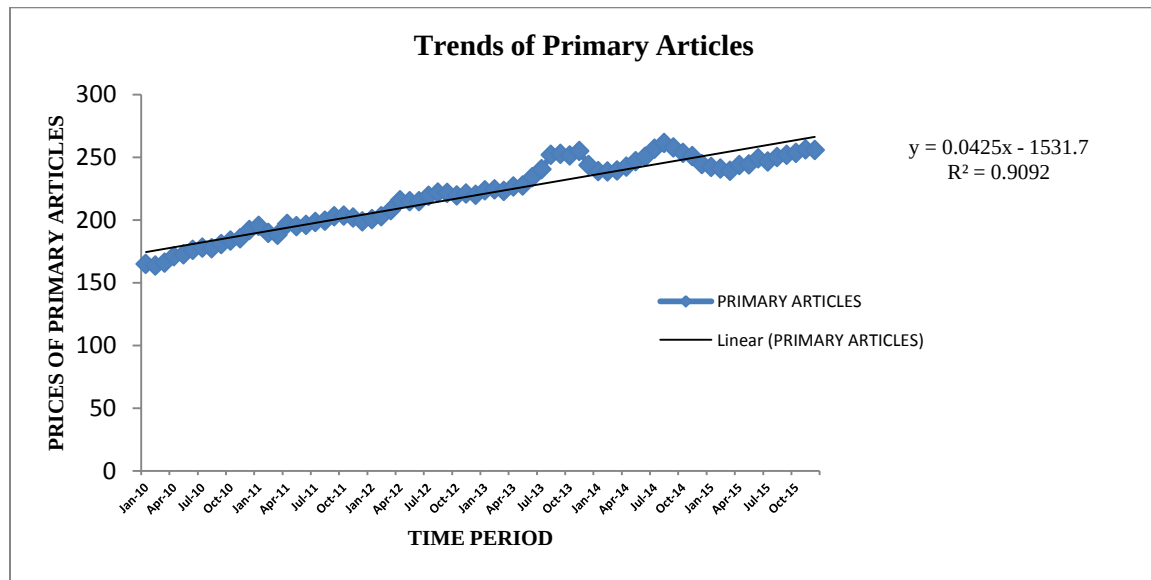
$$\text{All Commodities} = .0018114 + 2.150699 \text{ time} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect the one unit change in prices of all commodities (WPI). Therefore, in post-recession period, trends of all commodities (Wholesale Price Index) are positively associated with time. In other words trends of all commodities and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (.0018114), Standard. Error. (.0000896). t stat (20.21) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are decreasing trends of all commodities in post recession period and $H_0 \neq 0$. While the p value is less than tstat ($0.000 < 20.21$). Therefore, the null hypothesis is rejected at the 1% level of significance. it concludes there is a positive relationship between the trends of all commodities with the post-recession time.

Figure 3.7.10: Trends of Wholesale Price Index- Primary Articles



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, Government of India

The line chart 3.7.10 illustrates the trends of primary articles in the post-recession period (2008-09). Y-axis indicates the prices of primary articles and X-axis indicates time. Blue color line shows the prices of primary articles and black color line indicates the trend line of primary articles. Prices of primary articles touched and crossed the trend line from lowest value 164.9 January, 2010 to 255.6 December, 2015 but highest value (261.2) was in August, 2014. While the trends of all commodities increased with flatter line.

Statistical Significance of Trends of Primary Articles

The regression analysis is based on secondary data taken by MOSPI. 72 observations have been used for analysis. Study time period is from 2010 to 2015. It is based on monthly data on the WPI. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and primary articles are dependent variable.

The model for the above can be written as a functional form as follows:

$$P. A. = f(T)$$

P. A. = Primary Articles of Wholesale Price Index

T = Time

f = functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

Y = primary articles on wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

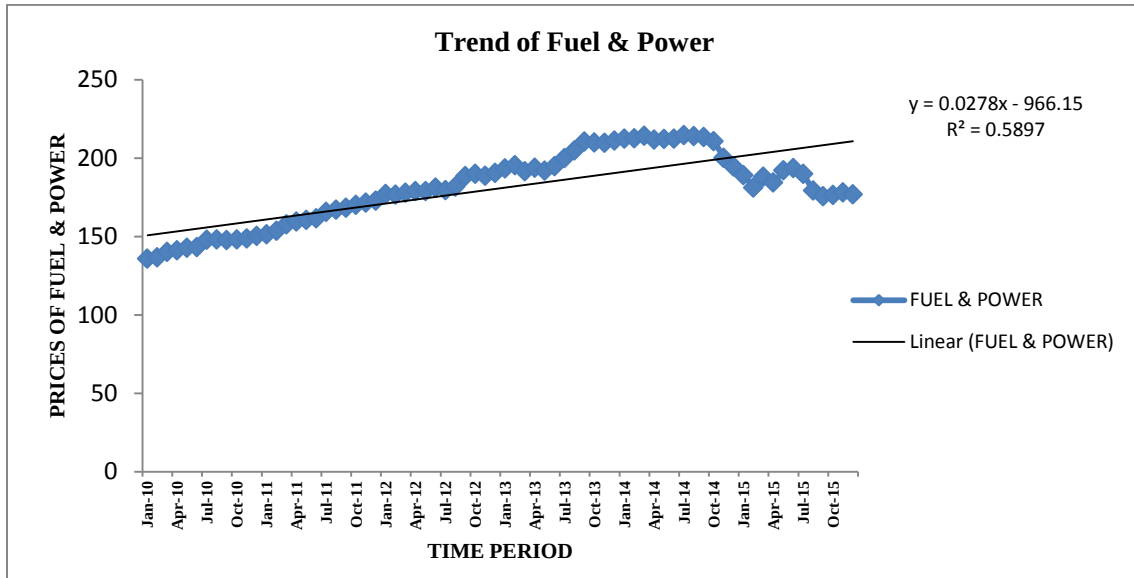
$$\text{Primary Articles} = .0026281 + 2.243395 \text{ time} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect the one unit change in primary articles of (WPI). Therefore, in post-recession period, trends of primary articles on wholesale price index are positively associated with time. In other words trends of primary articles and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (.0026281), Standard. Error. (.0001044). t stat (25.18) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of all primary articles in duration of recession period, and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 25.18$) therefore null hypothesis is rejected at the 1% level of significance. It indicates there is a positive relationship between the trends of primary articles with post-recession time.

Figure 3.7.11: Trends of Wholesale Price Index-Fuel and Power



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India

The line in chart 3.7.11 illustrates the trends of fuel and power in the post-recession period (2010-15). Y-axis indicates the prices of fuel and power and X-axis indicates time. Blue color line shows the prices of fuel and power and black color line indicates the trend line of fuel and power. Prices of fuel and power starts at the lowest value 135.8 in January, 2010. It crossed trend line in February, 2011, with the value (153.5), after that it continuously touched the trend line until March 2013, with the value 191.6. It again crossed trend line in downward way in September, 2014 with the value 213.4 and it was value 178.1 in December, 2015. While the trends of all commodities increased with flatter line.

Statistical Significance of the Trends of Fuel and Power

This regression analysis is based on secondary data taken by MOSPI. 72 observations are used for analysis. Study time period is from 2010 to 2015. It is based on monthly data of WPI. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and fuel and power is the dependent variable.

The model can be written as a functional form as follows:

$$F. P. = f(T)$$

$$F. P. = \text{Fuel and Power}$$

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = fuel and power of wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

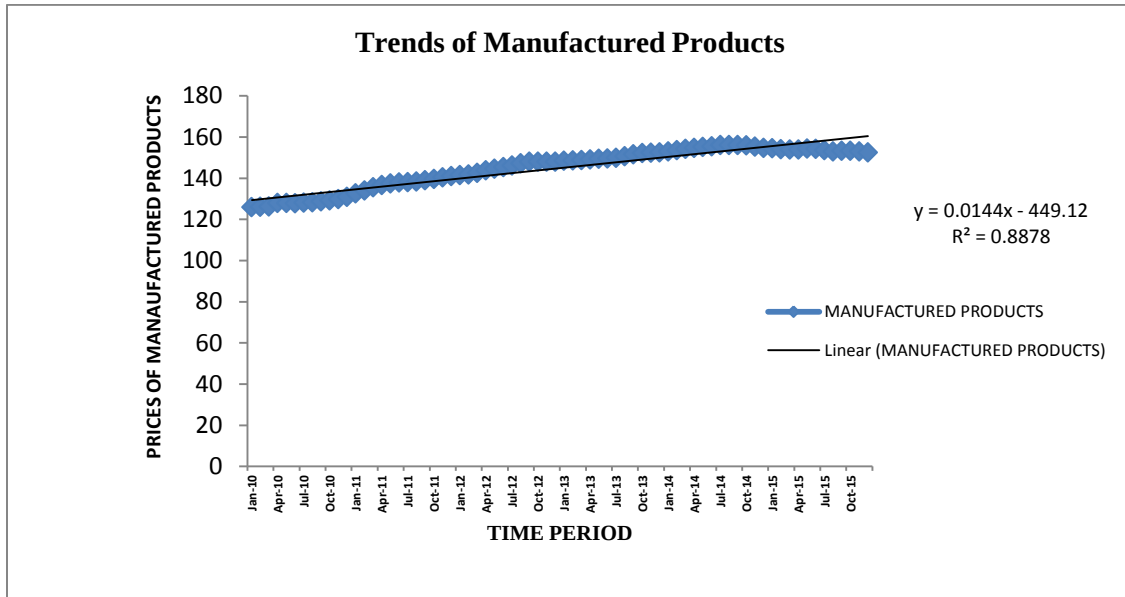
$$\text{Fuel \& Power} = .0021306 + 2.175606 \text{ time} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect the one unit change in fuel and power (WPI). Therefore, in post-recession period, trends of fuel and power (Wholesale Price Index) are positively associated with time. In other words trends of fuel and power and prices are increasing in the same direction with time

Analysis of Regression coefficient: The coefficient value is (.002306), standard. Error. (.0002036). t stat (10.46) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of fuel and power in the post recession period, and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 10.46$) therefore null hypothesis is rejected at the 1% level of significance. It concludes here is a positive relationship between the trends of fuel and power with post-recession time.

Figure 3.7.12: Trends of Wholesale Price Index- Manufactured Products



Sources: Office of Economic Advisor, Ministry of Commerce and Industry, the Government of India

The line in chart 3.7.12 illustrates the trends of manufactured products in the post-recession period (2010-15). Y-axis indicates the prices of manufactured products and X-axis indicates time. Blue color line shows the prices of manufactured products and black color line indicates the trend line of manufactured products. Prices of manufactured products start the lowest value of 125.9 in January 2010. It increased continuously with upward rate and touched the trend line from the period of January, 2010 to July 2015, with the value of 153.0 in December, 2015. The trends of manufactured products increased but with a flatter line over the same period. In this series, the interesting thing is that the prices of manufactured products and trend line moved together in the upward (slope) direction.

Statistical Significance of Trends of Manufactured Products

The regression analysis is based on secondary data take by MOSPI. There are 72 observations, used for analysis. The study time period is from 2010 to 2015. Monthly data of WPI is used. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and manufactured products is dependent variable.

The model can be written as a functional form as follows:

$$M. P. = f(T)$$

M. P. = Manufactured Products of Wholesale Price Index

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

Y = manufactured products on wholesale price index, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{Manufactured Products} = .0013397 + 2.111376 \text{ time} + \epsilon_t$$

According to the statistical model, the one unit change in time will affect one unit change in manufacturing products of (WPI). Therefore, in post-recession period, trends of manufactured products (Wholesale Price Index) are positively associated with time. In other words trends of manufactured products and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (.0013397), Standard. Error. (.0000596). t stat (22.48) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of manufactured products in the post recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 22.48$) therefore null hypothesis is rejected at the 1% level of significance. It concludes there is a positive relationship between the trends of manufactured products with post-recession time.

3.8 Problems with the Wholesale Price Index

As common people do not purchase any commodities available at the wholesale prices; therefore, this index does not capture the real situation of the amount of pressure of increasing prices on the common people. They purchase all commodities at the retail prices on a daily basis. As discussed by *Srinivasan (2008)*, according to the National Statistical Commission (NSC, 2001), “*in many cases, they refer to prices at the level of farm gate, factory gate or mine head prices; and in many other cases, they refer to prices at the level of primary markets. There is Secondary market or other wholesale and retail market*”. However, the increase in wholesale price does affect the retail price and, hence, gives only some indication of the consumer prices.

In addition to the CPI, four Consumer Price indices are also officially published and these correspond to different segments of the population viz. Industrial workers (CPI-IW, base year 2001), agriculture, labor (CPI-AL, base year 1986-67) rural labor (CPI-RL, base year 1986-67) and urban non-manual employees (CPI-UNME, base year 2001). A nationwide measurement of CPI that combines rural and urban areas became available only from January, 2011, base year, 2010). The weights used for new CPI have been derived from the 61th (2004-05) Round of the *National Sample Surveys*. The officially published CPI-IW includes only six sub-indices which are: clothing, food, fuel, light, housing, tobacco, intoxicants and miscellaneous. CPI-AL and CPI-RL are published with only five sub-indices, and exclude housing. The commodities coverage for the latest CPI measures has been broadened and now includes 23 items. In addition to housing, six sub-categories of services have been included. The most important thing is that, CPI gives a much better weight to food compared to WPI (*Mishra and Roy, 2011, Pp.5-7*).

3.9 Consumer Price Index in India

The Consumer Price Index is a measure of change in retail prices of goods and services consumed by defining population group in a given area with reference to a base year. The Consumer Price Index measures changes only in one of the factors prices.

This basket of goods and services represents the level of living or the utility derived by the consumer at given levels of their income, prices and tests. This index is an important economic indicator. It is widely considered as a barometer of inflation, a tool for monitoring price stability and as a deflector in national accounts.

The Consumer Price Index is used as a measure of inflation in around 157 countries. The dearness allowance of government employees and wage contracts between labor and employers is based on this index. The formula for calculating consumer price index is Laspeyers with base year 2010.

It is calculated by the Central Statistics Office (CSO) in the Ministry of Statistics and Program Implementation (MOSPI). It is brought out on a monthly basis for urban, rural and all India and also annually with a lag of one month. State /UTs response CPI is also released if they provide 80 percent of the required data.

CPI is calculated by collecting the retail cost of represent a time products or services from the following categories for non-manual employees.

- ❖ Food
- ❖ Fuel and light
- ❖ Clothing, bedding and footwear and
- ❖ Miscellaneous.

Table 3.9.1: All India Subgroup/group-wise of Consumer Price Index (Rural) and (Urban) and Consumer Price Index (Combined)

Group Code	Subgroup Code	Description	Rural	Urban	Combined
	1.1.01	Cereals and products	12.35	6.59	9.67
	1.1.02	Meat and fish	4.38	2.73	3.61
	1.1.03	Egg	0.49	0.36	0.43
	1.1.04	Mills' products	7.72	5.33	6.61
	1.1.05	Oils and fats	4.21	2.81	3.56
	1.1.06	Fruits	2.88	2.90	2.89
	1.1.07	Vegetables.	47.46	4.41	6.04

	1.1.08	Pulses and products	2.95	1.73	2.38
	1.1.09	. Sugar and confectionery	1.70	0.97	1.36
	1.1.10	Spices	3.11	1.79	2.50
	1.1.11	Non-alcoholic beverages	1.37	1.13	1.26
	1.1.12	Prepared meals, snacks, sweets etc.	5.56	5.54	5.55
1		Food and beverages	54.18	36.29	45.86
2		Pan, tobacco and intoxicants	3.26	1.36	2.38
	3.1.01	Clothing	6.32	4.72	
	3.1.02	Footwear	1.04	0.85	5.58
3		Clothing and footwear	7.36	5.57	0.95
4		Housing	----	26.67	10.17
5		Fuel and light	7.94	5.58	6.84
	6.1.01	Household goods and services	3.75	3.87	3.80
	6.1.02	Health	6.83	4.81	5.89
	6.1.03	Transports, communication	7.60	9.73	8.59
	6.1.04	Recreation and amusement	1.37	2.04	1.68
	6.1.05	Education	3.46	5.62	4.46
	6.1.06	Personal care s effects	4.25	3.47	3.89
6		Miscellaneous	27.26	29.53	28.32
		All Groups	100.00	100.00	100.00

Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, the GOI

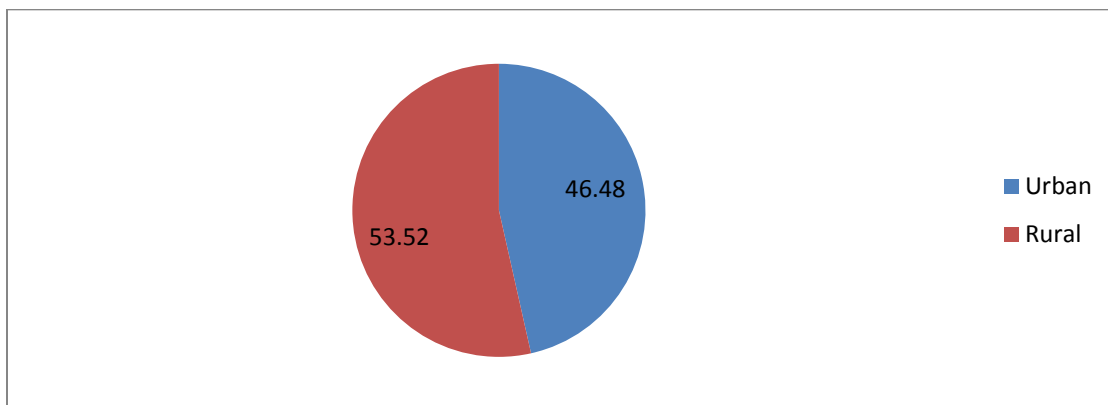
Table 3.9.2: Comparison Weighting Diagrams between of Old and Revised Series of Consumer Price Index.

Group Description	Old Series of (Weights Computed on the Basis CES (2004-05))			Revised Series of CPI Weights Computed On the Basis CES (2011-12)		
	Rural	Urban	Combined	Rural	Urban	Combined
Food and Beverages	56.59	35.81	47.58	54.18	36.29	45.86
Pan, Tobaccos Intoxicants	2.72	1.34	2.13	3.26	1.36	2.38
Clothing and Footwear	5.36	3.91	4.73	7.36	5.56	6.53
Housing	-----	22.54	9.77	----	21.67	10.07
Fuel and Light	10.42	8.40	9.49	7.94	5.58	6.84
Miscellaneous	24.91	28.00	26.31	27.26	29.53	28.32
Total	100.00	100.00	100.00	100.00	100.00	100.00

Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, GOI

The weightage of CPI has been divided in two main categories rural and urban in India. This has been represented by pie chart.

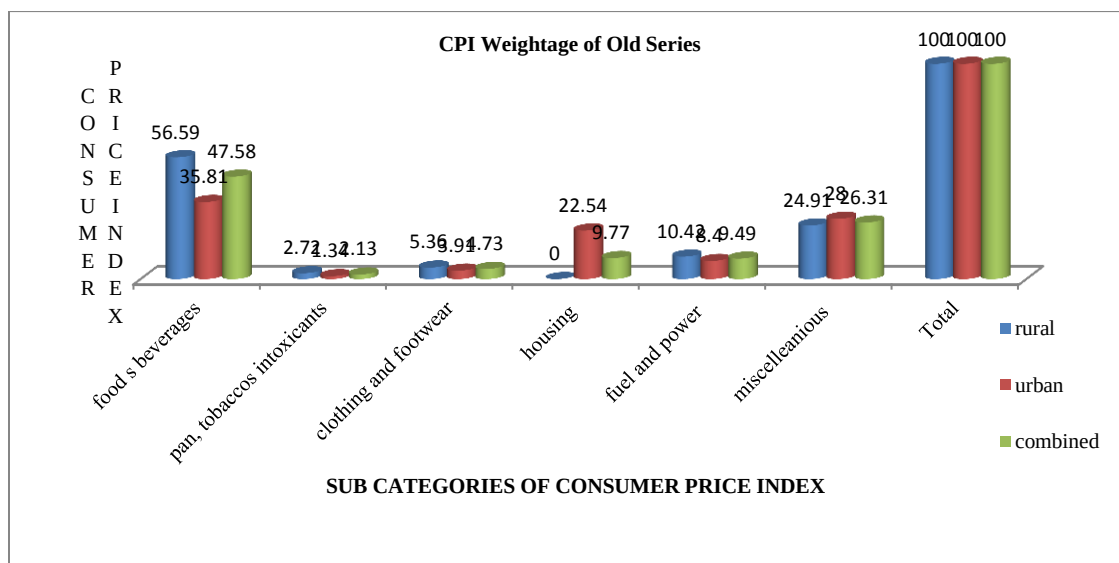
Figure 3.10: All India Weightage of CPI for Rural and Urban



Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, GOI

The figure 3.10 shows the weightage of rural area and urban area. Red color represents the rural area which has been given the weightage of (54 percent) and blue color represents the urban area, which have been given the weightage of (46 percent).

Figure 3.10.1: Consumer Price Index Weightage of Old Series



Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, the GOI.

The figure 3.10.1 shows the weightage of CPI in the old series. The consumer price index has been divided into three broad categories. According to area, population and group-wise such as rural area, urban area and combined. Then, after that all individual series have been divided into six subcategories of CPI. These categories are: Food and beverages, pan tobacco intoxicants, clothing and footwear, housing, food and light and miscellaneous.

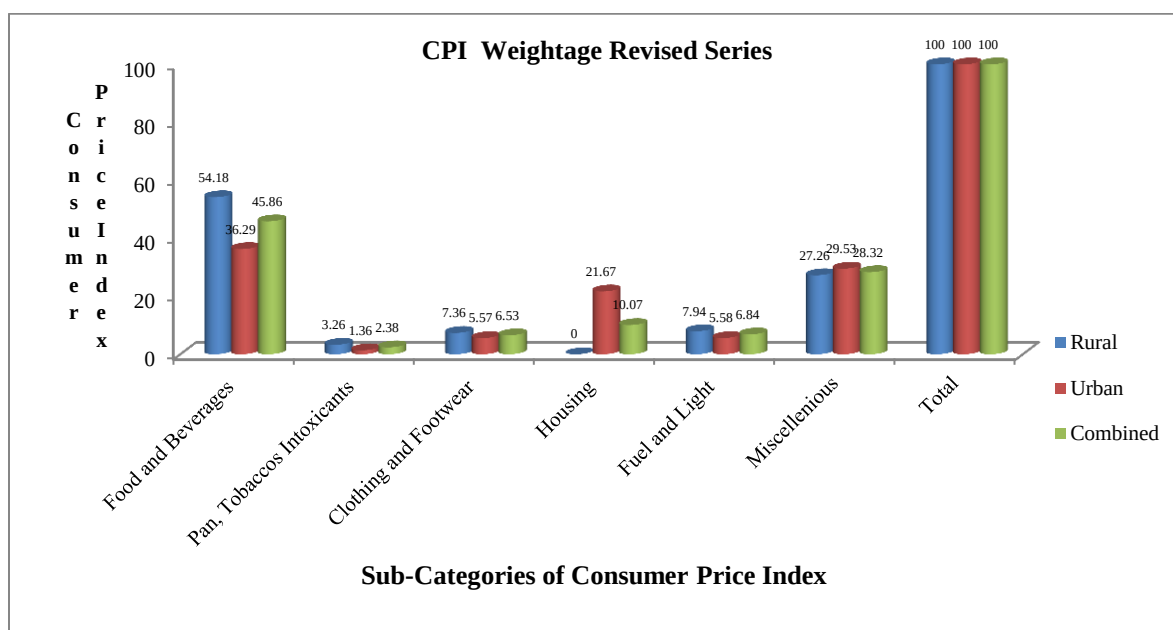
The Consumer Price Index in the rural area has been given the weightage of 100 percent. Divisions are: 56.59 percent weightage for food and beverages, 2.72 percent weighted for pan, tobacco intoxicants, and 5.36 percent weightage for clothing and footwear, 10.42 percent weightage for fuel and light, and 24.91 percent weightage for miscellaneous group. However, there is no weightage for housing in the rural area.

The Consumer Price Index in the urban area has a total weight of 100 percent. Divisions being: 35.81 percent weightage for food and beverages, 1.34 percent weighted for pan,

tobacco intoxicants, 3.97 percent weighted for clothing and footwear, 22.54 percent weightage for housing, 8.40 percent weightage for fuel and light and 28.00 percent weightage for miscellaneous group.

The Consumer Price Index of the combined zone of both rural and urban areas has the total weightage of 100 percent. Divisions are: 47.58 percent weightage for food and beverages, 2.13 percent weighted for pan, tobacco intoxicants, 4.73 percent weighted for clothing and footwear, 9.77 percent weightage for housing, 9.49 percent weightage for fuel and light, and 26.31 percent weightage for miscellaneous group.

Figure 3.10.2: Consumer Price Index Weightages for Revised Series



Sources: Central Statistics Office, Ministry of Statistics and Program Implementation, GOI

The figure 3.10.2 shows the weightage of Consumer Price Index in revised series. The consumer price index has been divided into three broad categories. According to area, population and group-wise such as rural area, urban area and combined. Thereafter, all individual series have been divided into six subcategories of consumer price index. These categories are: Food and beverages, pan tobacco intoxicants, clothing and footwear, housing, food and light and miscellaneous.

The Consumer Price Index has been given the total weightage of 100 percent in the rural area. Divisions are: 54.18 percent for food, beverages, 3.26 percent weighted for pan, tobacco intoxicants, 7.36 percent weight for clothing and footwear, 7.94 percent weightage for fuel and light and 27.26 percent weightage for miscellaneous group. There is no weightage for housing in the rural area.

The Consumer Price Index in the urban area has a total weightage of 100 percent. Divisions are: 36.29 percent for food and beverages, 1.36 percent weight for pan, tobacco intoxicants, 5.56 percent weight for clothing and footwear, 21.67 percent for housing, 5.58 percent weightage for fuel and light and 29.53 percent weightage for miscellaneous group.

The Consumer Price Index for the combined zone of rural and urban areas has a total weightage of 100 percent. Divisions being: 45.86 percent weightage for food and beverages, 2.38 percent weighted for pan, tobacco intoxicants, 6.53 percent weighted for clothing and footwear, 10.07 percent weightage for housing, 6.84 percent weightage for fuel and light and 28.32 percent weightage for miscellaneous group.

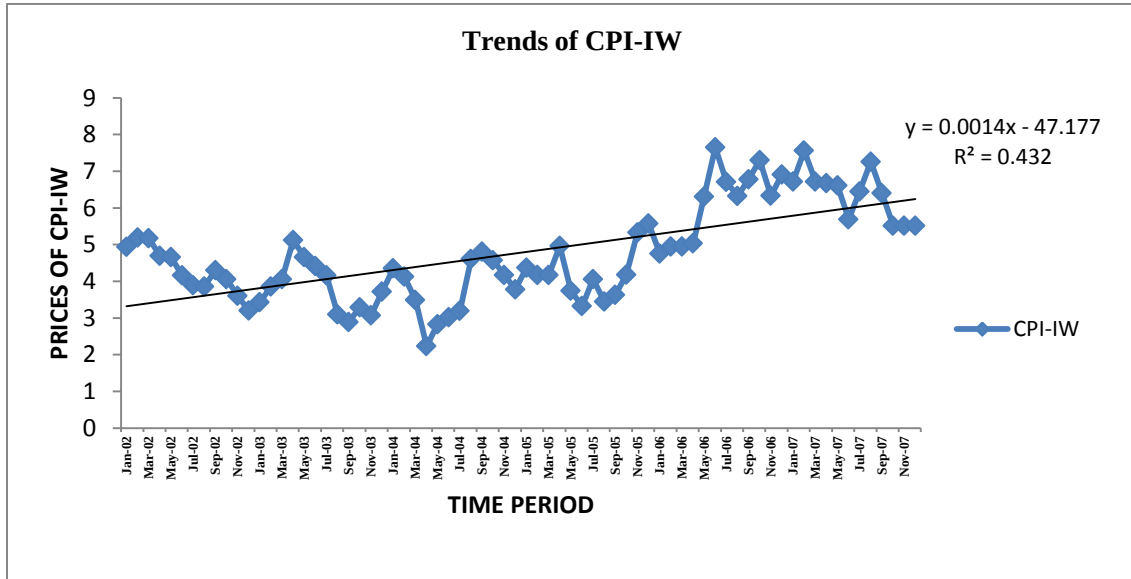
CPI is a measure of the cost of living of a person in an economy based upon the citizens' socioeconomic strata. An agricultural labor will have different requirements and weights compared to an industrial labor (http://mospi.nic.in/Mospi_New/up).

The origin of Consumer Price Index can be traced to the period after the First World War, when there was a sharp rise in prices and the cost of living. The erosion in the real wages of the workers led to demands by the workers' compensation.

3.11 Trends of Consumer Price Index in All Categories

Pre-Recession Period

Figure 3.11.1: Trends of Consumer Price Index- Industrial Worker



Sources: Labor of Statistics Bureau, Ministry of labour welfare, the Government of India

The line in chart 3.11.1 illustrates the trends of Consumer Price Index-Industrial Worker in (2002-08) pre- recession period. Y-axis represents the prices of CPI-IW and x-axis represents the time period. Blue color line shows the prices of CPI-IW and black color line shows the trend line of CPI-IW. Prices of CPI-IW starts 4.94 percent in January, 2002 and touched the trend line at 3.89 percent in July 2002. After that it continuously fluctuated and touched the trend line in Dec, 2002, with 3.2 percent till 2006. From May, at 4.95 percent, it decreased continuously. After that, it fluctuated upwards till 2006. Then in May it was 6.31 percent which remained till September, 2007 with the 6.4 percent. The trends of CPI-IW gradually increased with flatter shape in the pre-recession period. ``

Statistical Significance of the Trends of Industrial Worker (CPI)

The regression analysis is based on secondary data taken from the Labor Bureau Statistics, there are 72 observations for analysis. The study time period is from 2002 to 2007. The monthly data on CPI has been used. There are two variables in this analysis,

dependent variable and independent variable, time is independent variable and CPI-IW is a dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-IW} = f(T)$$

CPI-IW = Consumer Price Index in Industrial Worker

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-IW, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-IW} = 3.275012 + .0412554_{\text{time}} + \epsilon_t$$

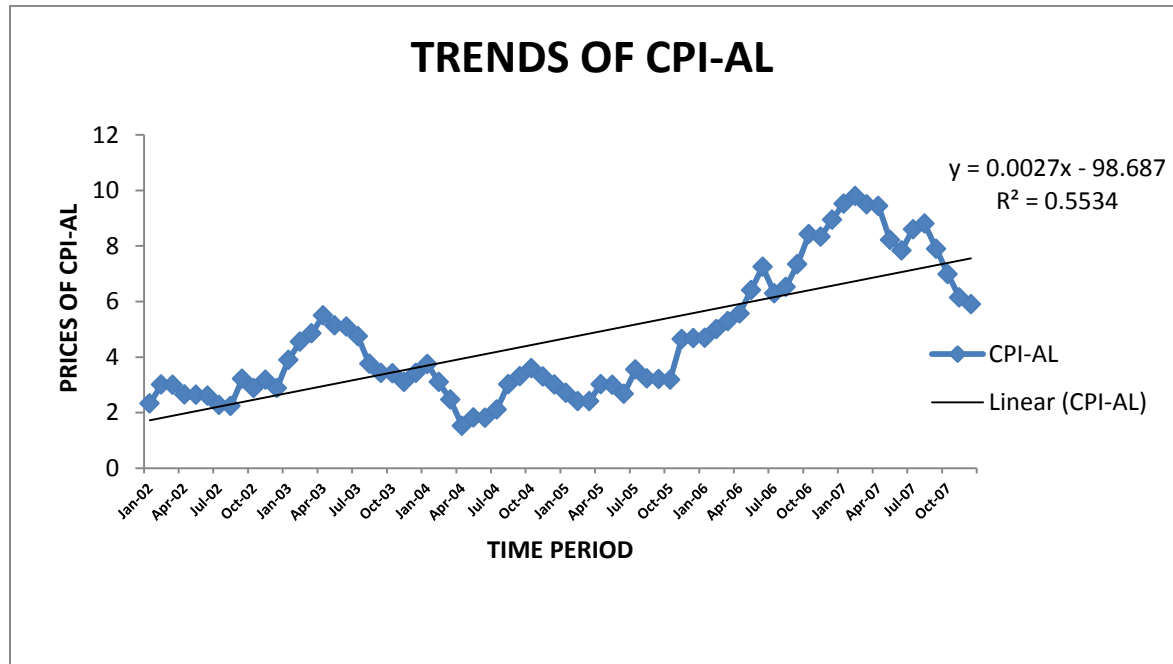
According to the statistical model, the one unit change in time will affect one unit change in the consumer price index in industrial worker of (CPI-IW). as noted in the model, the coefficient value is positive, therefore, in pre-recession period, trends of CPI-IW is positively associated with time. In other words, trends of CPI-IW decreases as the prices increase in same direction with time.

Analysis of Regression coefficient: The coefficient value is (3.275012), Standard Error (.0056526), t-stat (7.30) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-IW in Pre recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 7.30$) therefore null hypothesis is rejected at the 1% level

of significance. it concludes there are positive relationship between the trends of CPI-IW with pre-recession time.

Figure 3.11.2: Trends of Consumer Price Index-Agricultural Laborer



Sources: Labor Statistics Bureau, Ministry of labour welfare, the Government of India.

The line in chart 3.11.2 illustrates the trends of *Consumer Price Index- Agriculture Laborer* in (2002-08) pre- recession period. Y-axis represents the prices of CPI-AL and x-axis represents the time period. Blue color line shows the prices of CPI-AL and black color line shows the trend line of CPI-AL. Prices of CPI-AL starts at 2.33 percent in January, 2002 and after that it touched the trend line at 2.27 percent in August 2002, which is lowest of this series and it was highest at 9.52 percent in January, 2007. It created the cyclical fluctuations over the series or period from 2002, January to 2007, December. The trends of CPI-AL increased in the pre-recession period.

Statistical Significance of the Trends of Agriculture Laborer (CPI)

The regression analysis is based on secondary data taken from the Labor Bureau Statistics. There are 72 observations used for analysis. The study time period is from 2002 to 2007. Monthly data based on CPI has been used. There are two variables in this

analysis, dependent variable and independent variable, time is independent variable and CPI-AL is a dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-AL} = f(T)$$

CPI-AL = Consumer Price Index in Agriculture Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ui), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = CPI-AL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-AL} = 1.646483 + .0820522_{\text{time}} + \varepsilon_t$$

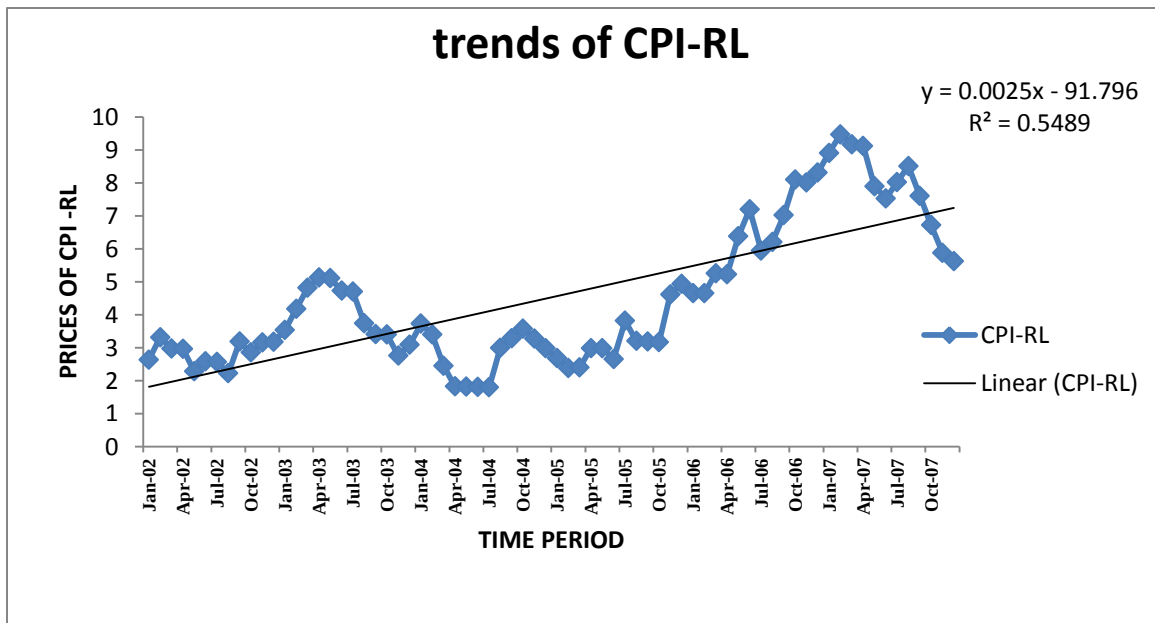
According to the statistical model, one unit change in time will affect one unit change in agricultural laborer of the consumer price index (CPI-AL). Therefore, in pre-recession period, trends of agricultural laborer in the consumer price index is positively associated with time. In other words, trends of agriculture laborer and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (1.646483), Standard Error (.0088053), t stat (9.32) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-AL in pre-recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 9.32$) therefore null hypothesis is rejected at the 1% level

of significance. it concludes there is a positive relationship between the trends of the consumer price index- agricultural laborer (CPI-AL) with pre-recession time.

Figure 3.11.3: Trends of Consumer Price Index-Rural Laborer



Source: Labor of Statistics Bureau, Ministry of labour and employment, the Government of India

The line in chart 3.11.3 illustrates the trends of **Consumer Price Index-Rural Laborer** in (2002-08) pre- recession period. Y-axis represents the prices of CPI-RL and x-axis represents the time period. Blue color line shows the prices of CPI-RL and black color line shows the trend line of CPI-RL. Prices of CPI-RL started at the value of (2.64) in January, 2002 after that it touched the trend line in May, 2002 with 2.29 percent. Further, it again crossed the trend line in September 2003 with 3.41 percent. After that it was continuously below the trend line until April, 2006. It crossed the trend line in upward way in August, 2006 with 6.21 percent. After that, it continuously increased till September, 2007 with 7.61 percent and it ended in December, 2007 with 5.63. The trends of CPI-RL increased with high rate.

Statistical Significance of Trends of Rural Labourer (CPI)

The regression analysis is based on secondary data which taken from labor bureau statistics. There are 72 observations used for analysis. The study time period is from 2002

to 2007. Monthly data on consumer price index has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and CPI-RL is dependent variable.

The model can be written as a functional form:

$$\text{CPI-RL} = f(T)$$

CPI-RL = Consumer Price Index in Rural Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-RL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-RL} = 1.73723 + .0764914_{\text{time}} + \epsilon_t$$

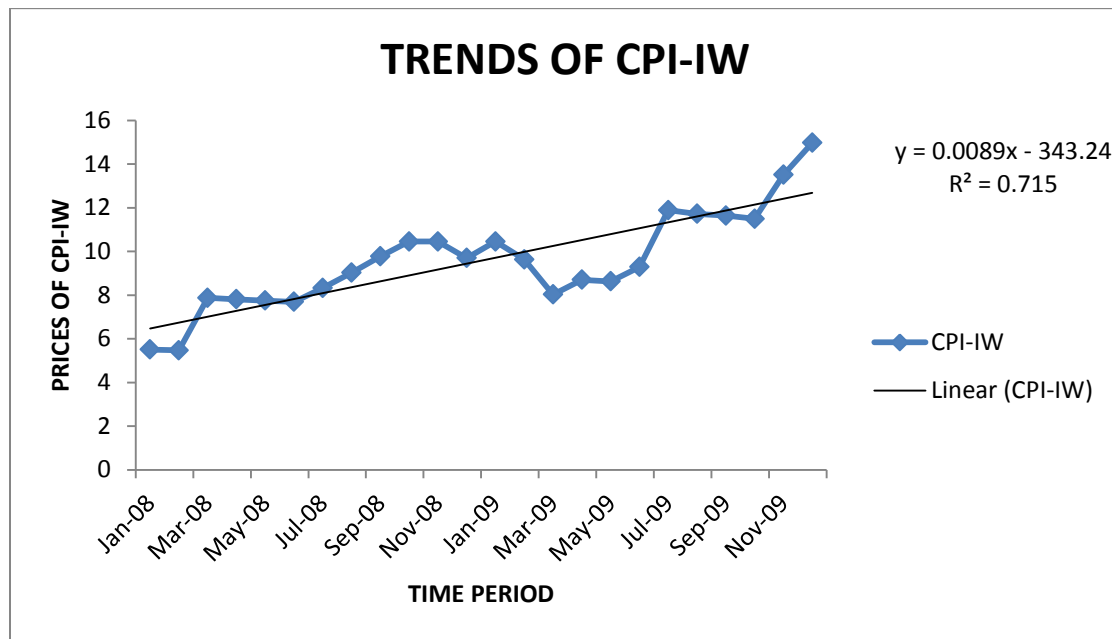
According to the statistical model, one unit change in time will affect one unit change in the consumer price index in rural laborer (CPI-RL). Therefore, in the pre-recession period, trends of manufactured products (Wholesale Price Index) are positively associated with time. In other words, trends of CPI-RL and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (1.73723), Standard Error (.0082831), t- stat (9.23) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-RL in Pre-Recession period, and $H_0 \neq 0$. In this statistical analysis the p value is less than tstat ($0.000 < 9.23$) therefore null hypothesis is rejected at the 1% level of significance. it concludes there is a positive relationship between the trends of CPI-RL with pre-recession time.

❖ Duration-recession Period

Figure 3.11.4: Trends of Consumer Price Index-Industrial Worker



Sources: Labor of Statistics Bureau, Ministry of Labor and employment, Government of India

The line in chart 3.11.4 illustrates the trends of *Consumer Price Index-Industrial Worker* in (2008-09) the recession period. Y-axis represents the prices of CPI-IW and x-axis represents the time period. Blue color line shows the prices of CPI-AL and black color line shows the trend line of CPI-IW. Prices of CPI-IW started at the lowest of 5.51 percent in January, 2008. After that, it continuously increased and touched the trend line from March, 08 with 7.89 percent to November, 2009 at 13.51 percent. It was at its highest percent of 14.97 percent in December, 2009. While the trends of CPI-IW increased but flatter shape during the recession period.

Statistical Significance of Trends of Industrial Worker (CPI

The regression analysis is based on the secondary data taken from Labor Bureau Statistics. There are 24 observations for analysis. The study time period is from 2008 to

2009. It has used the monthly data of the consumer price index. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and CPI-IW is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-IW} = f(T)$$

CPI-IW = Consumer Price Index in Industrial Worker

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots \dots \dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-IW, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

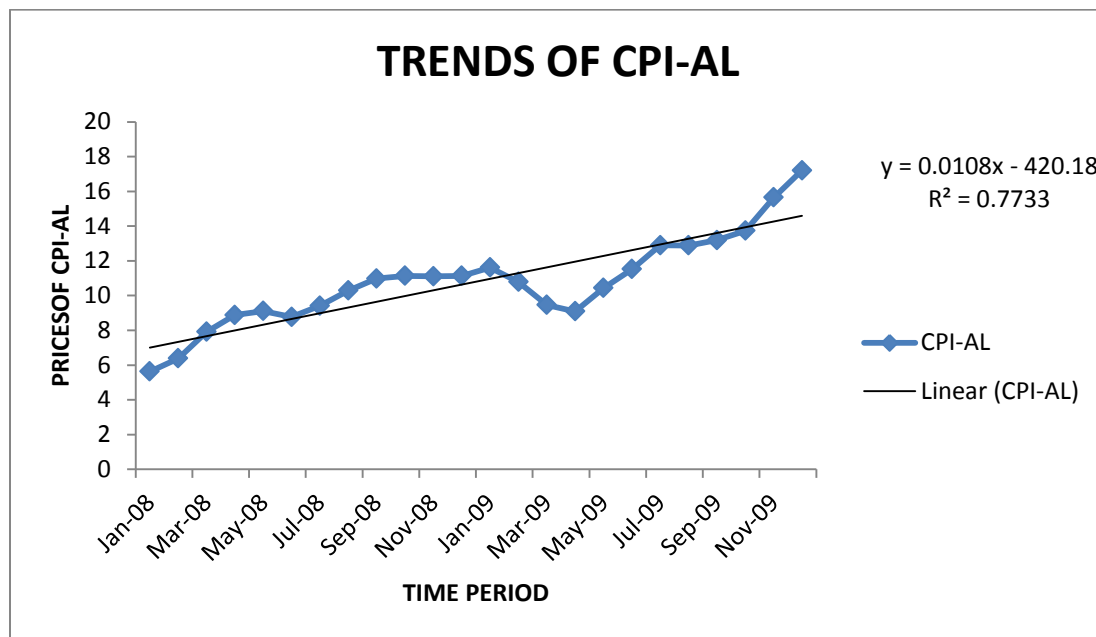
$$\text{CPI-IW} = 6.203043 + .2696565 \text{ time} + \epsilon_t$$

According to the statistical model, one unit change in time will affect of one unit change in the consumer price index in industrial worker (CPI-IW). Therefore, in duration-recession period, trends of industrial workers in the consumer price index are positively associated with time. In other words, the trends of CPI-IW and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (6.203043), Std. Err. (.0363774). t- stat (7.41) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-IW in Duration of Recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 7.41$) therefore null hypothesis is rejected at the 1% level of significance. It concludes there is a positive relationship between the trends of CPI-IW with time.

Figure 3.11.5: Trends of Consumer Price Index- Agriculture Laborer



Source: Labor of Statistics Bureau, Ministry of Labor and Employment, the Government of India.

The line in chart 3.11.5 illustrates the trends of consumer price index-agriculture laborer in (2008-09) the recession period. Y-axis represents the prices of CPI-AL and x-axis represents the time period. Blue color line shows the prices of CPI-AL and black color line shows the trend line of CPI-AL. Prices of CPI-AL starts the lowest percent of 5.63 in January, 2008. After that, the prices continuously increased and touched the trend line from March, 08 with 7.91 percent to, 2009 13.73 percent, with the highest percent of 17.21 in December, 2009. The trends of CPI-AL increased but with flatter shape during the recession period.

Statistical Significance of Trends of Agriculture Laborer (CPI)

The regression analysis is based on secondary data taken from Labor Bureau Statistics. There are 24 observations for analysis. The study time period is from 2008 to 2009 based

on monthly data of CPI. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and CPI-AL is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-AL} = f(T)$$

CPI-AL = Consumer Price Index in Agriculture Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ui), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = CPI-AL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-AL} = 6.683732 + .3294348_{\text{time}} + \varepsilon_t$$

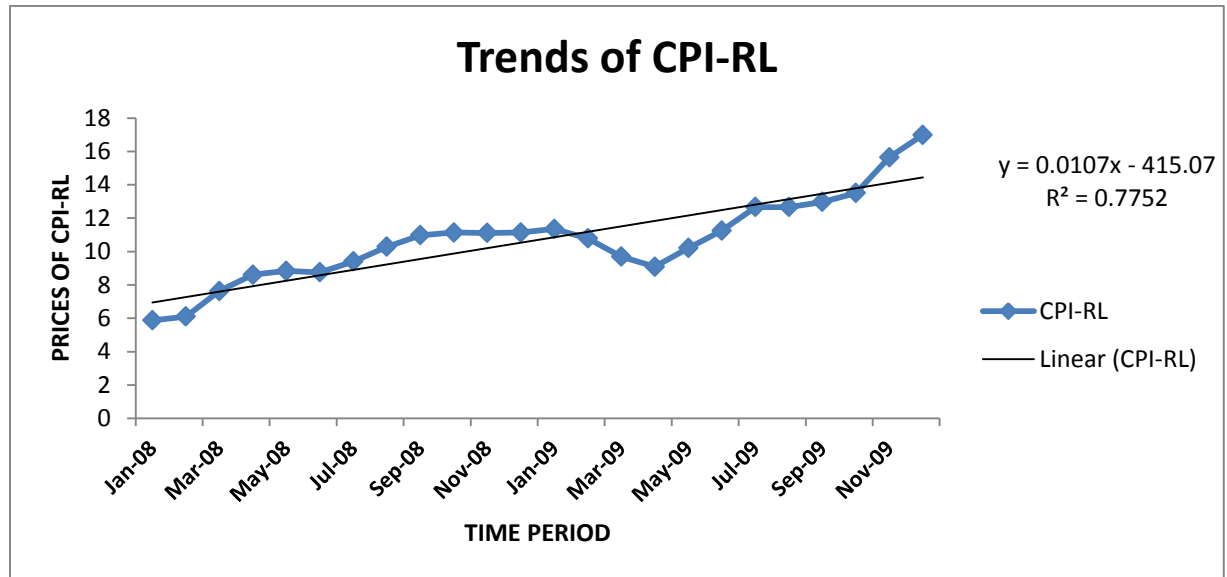
According to the statistical model, one unit change in time will affect the one unit change in the consumer price index in agriculture laborer (CPI-AL). Therefore, in duration-recession period, trends of agriculture laborer in the consumer price index are positively associated with time. In other words, trends of CPI-AL and prices are increasing in the same direction with time.

Analysis of Regression coefficient: The coefficient value is (6.683732), Standard Error (.0381137). t-stat (8.64) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are decreasing trends of CPI-AL in Pre-Recession period and $H_0 \neq 0$. While the p value is less than t-stat ($0.000 < 8.64$) therefore null hypothesis is rejected at the 1% level

of significance. It concludes there is a positive relationship between the trends of CPI-AL with recession time.

Figure 3.11.6: Trends of The Consumer Price Index- Rural Laborer



Sources: Labor of Statistics Bureau, Ministry of Labor and Employment, Government of India

The line in chart 3.11.6 illustrates the trends of *Consumer Price Index-Rural Laborer* in (2008-09) the recession period. Y-axis represents the prices of CPI-RL and x-axis represents the time period. Blue color line shows the prices of CPI-RL and black color line shows the trend line of CPI-RL. Prices of CPI-RL start the value of 5.88 percent in January, 2002. Thereafter, there was a continuous increased of prices and which touched the trend line over the time period from January, 2002 to December, 2007. However, prices of CPI-RL were below the trend line from 10.79 percent in February, 2009 to 12.67 percent in July, 2009. The highest price of CPI-RL was 16.99 percent in December 2009. While the trends of CPI-RL also increased with high rate.

Statistical Significance of Trends of Rural Laborer (CPI)

The regression analysis is based on secondary data taken from labor bureau statistics. There are 24 observations for analysis. The study time period is from 2008 to 2009. The monthly data of the CPI has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and CPI-RL is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-RL} = f(T)$$

CPI-RL = Consumer Price Index in Rural Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ui), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \varepsilon_t$$

y = CPI-RL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-RL} = 6.629457 + .3254435_{\text{time}} + \varepsilon_t$$

According to the statistical model, one unit change in time will affect one unit change in the consumer price index in rural laborer (CPI-RL). Therefore, in duration-recession period, trends of the rural laborer in the consumer price index are positively associated with time. In other words, trends of CPI-RL and prices increase in the same direction with time.

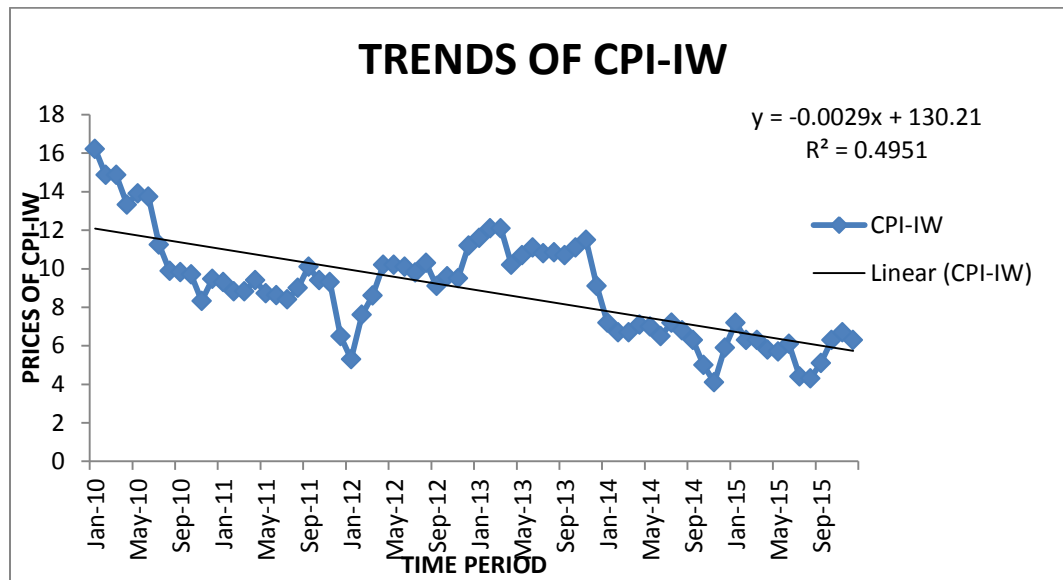
Analysis of Regression coefficient: The coefficient value is (6.629457), Standard Error (.037456), t-stat (8.69) and p value (0.000).

Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$. The null hypotheses (H_0) of this study, there are decreasing trends of CPI-RL in Duration of Recession period, and $H_0 \neq 0$. In this statistical analysis the p value is less than tstat (0.000 < 8.69) therefore null hypothesis is

rejected at the 1% level of significance. There is a positive relationship between the trends of CPI-AL with time.

❖ Post-recession Period

Figure 3.11.7: Trends of Consumer Price Index- Industrial Worker



Sources: Labor of Statistics Bureau, Ministry of Labor and Employment, Government of India

The line in chart 3.11.7 illustrates the trends of consumer price index-industrial worker in (2010 - 2015) post- recession period. Y- axis represents the prices of CPI-IW and X-axis represents the time period. Blue color line shows the prices of CPI-IW and black color line shows the trend line of CPI-IW. Prices of CPI-IW starts the highest percent of 16.22 in January 2010. It crossed the trend line with 11.25 percent in July, 2010. It further decreased till March, 2012 at 8.6 percent. After that it crossed the trend line, upwardly, from April, 2011 (10.2) percent to December, 2013 (9.1) percent. After that it once again decreased from January, 2014 with (7.2) percent to September, 2015 with (5.1) percent and then touched the trend line with (6.7) in December, 2015 in the post-recession period. In other words, it has created cyclical fluctuations over the series. While the trend of CPI-IW decreased over the period with flatter line.

Statistical Significance of Trends of Industrial Worker (CPI)

The regression analysis is based on secondary data taken from labor bureau statistics. There are 72 observations for analysis. The study time period is from 2008 to 2009. It is

based on the monthly data of the CPI. There are two variables in this analysis dependent and independent, time is independent variable and CPI-IW is a dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-IW} = f(T)$$

CPI-IW = Consumer Price Index in Industrial Worker

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-IW, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

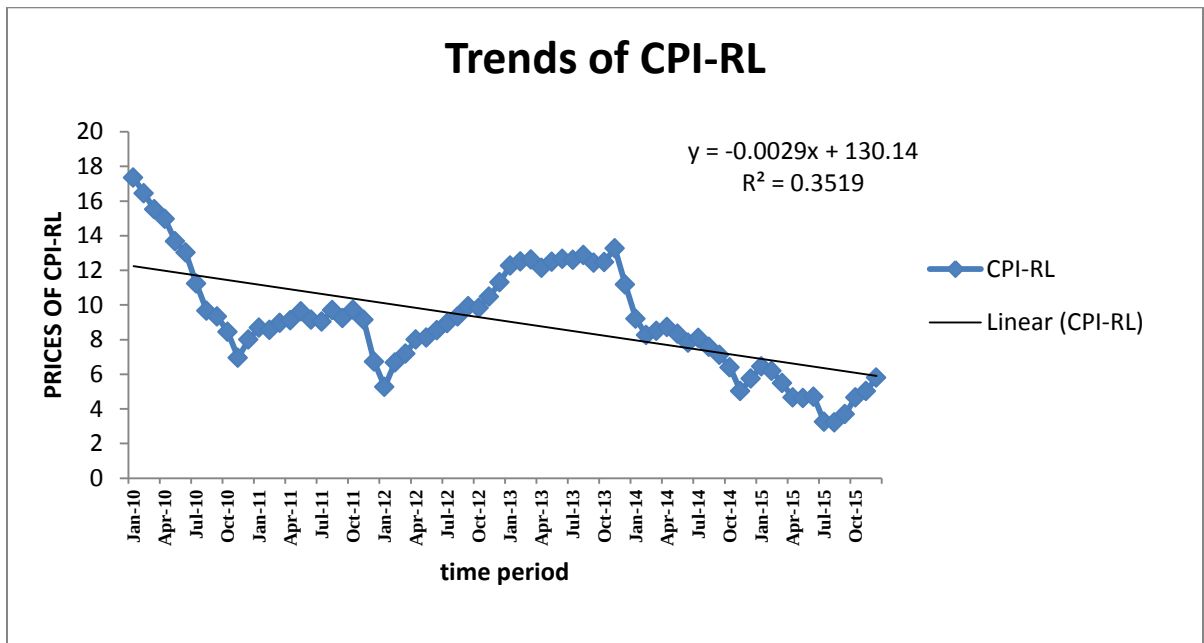
$$\text{CPI-IW} = 12.20091 + -.090166_{\text{time}} + \epsilon_t$$

According to the statistical model, the unit change in time will affect one unit change in the consumer price index in industrial worker (CPI-IW). but as noted in the model, coefficient value of time is negative. Hence, during the recession period, trends of industrial workers in the consumer price index are negatively associated with time. In other words, trends of CPI-IW and prices are increasing in the opposite direction with time.

Analysis of Regression coefficient: The coefficient value is (12.20091), Standard Error (.0110985), t-stat (-8.12) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are increasing trends of CPI-IW in Post-Recession period and $H_0 \neq 0$. While p value is more than t-stat but p value is significant at 1 % level of singificance ($0.000 > -8.12$) therefore null hypothesis is rejected at the 1% level of significance. it concludes there is a negative relationship between the trends of CPI-IW with post-recession time.

Figure 3.11.8: Trends of Consumer Price Index- Rural Laborer



Sources: Labor of Statistics Bureau, Ministry of Labor and Employment, the Government of India

The line chart 3.11.8 illustrates the trends of *Consumer Price Index-Rural Laborer* in (2010-15) post- recession period. Y-axis represents the prices of CPI-RL and X-axis represents the time period. Blue color line shows the prices of CPI-RL and black color line shows the trend line of CPI-RL. Prices of CPI-RL starts with the highest percent 17.35 in January, 2010 then it crossed the trend line in June, 2010 with 13.02 percent. After that it was below the trend line from July, 2010 with 11.24 percent until June, 2012 with 8.54 percent. Further, it again crossed trend line in upward way in September, 2012 with the 9.93 percent. Then again it crossed the trend line in March, 2014 with 8.51 percent. It was lowest in December, 2015 with 5.8 percent. While the trends of CPI-RL increased with high rate over the period.

Statistical Significance of Trends of Rural Laborer (CPI)

The regression analysis is based on secondary data taken from labor bureau statistics. There are 72 observations used for analysis. The study time period is from 2010 to 2015.

Monthly data on consumer price index has been used. There are two variables in this analysis, dependent variable and independent variable, time is independent variable and CPI-RL is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-RL} = f(T)$$

CPI-RL = Consumer Price Index in Rural Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-RL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

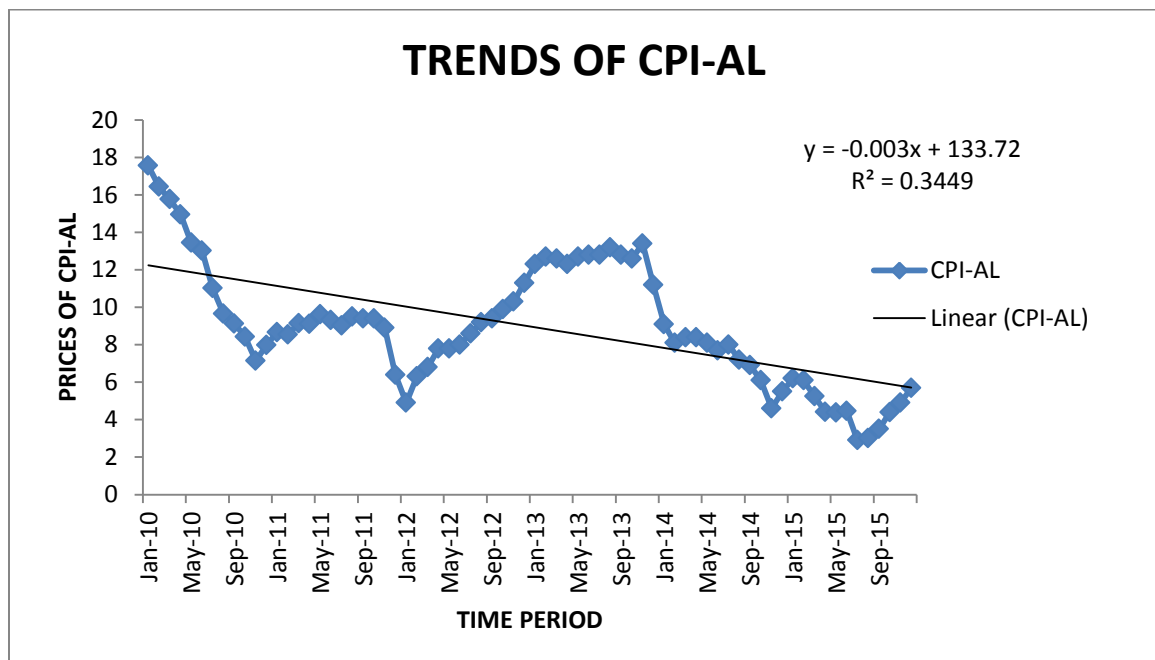
$$\text{CPI-RL} = 12.34111 + -.0891898_{\text{time}} + \epsilon_t$$

According to the statistical model, one unit change in time will affect of one unit change in the consumer price index in rural laborer (CPI-RL). Therefore, in post -recession period, trends of the rural laborer in the consumer price index is negatively associated with time. In other words, trends of CPI-RL and prices are increased opposite direction with time.

Analysis of Regression coefficient: The coefficient value is (12.34111), Standard Error (.0148973), t-stat (-5.99) and p value (0.000). Hypothesis testing: $H_0 = 0$ versus $H_0 \neq 0$.

There are increasing trends of CPI-RL in Post-Recession period and $H_0 \neq 0$. In this statistical analysis the p value is more than t-stat but p value is significant at 1 % level of significance ($0.000 > -5.99$). Therefore null hypothesis is rejected at the 1% level of significance and it concludes there is a negative relationship between the trends of CPI-RL with post-recession time.

Figure 3.11.9: Trends of Consumer Price Index- Agriculture Laborer



Sources: Labor of Statistics Bureau, Ministry of Labor and Employment, the Government of India

The line chart 3.11.9 illustrates the trends of *Consumer Price Index-Industrial Worker* in (2010-15) post- recession period. Y-axis represents the prices of CPI-AL and X-axis represents the time period. Blue color line shows the prices of CPI-AL and black color line shows the trend line of CPI-AL. Prices of CPI-AL starts the highest (17.59) percent in January, 2010. It crossed trend line in a decreasing pattern with (13.02) percent in June, 2010. The trend kept decreasing till July, 2012 when it registered (8.6) percent. After that, it crossed trend line in an upward pattern from September, 2012 at (9.4) percent till July, 2014 at (8) percent. After that, it once again decreased from Feb, 2015 with (6.1) percent to November, 2015 with (4.9) percent. It touched the trend line at (5.70) in December, 2015 in the post-recession period. While the trend of CPI-IW decreased over the period.

Statistical Significance of Trends of Agriculture Worker (CPI):

The regression analysis is based on secondary data taken from labor bureau statistics. There are 72 observations used for analysis. The study time period is from 2010 to 2015. Monthly data on the CPI has been used. There are two variables in this analysis, the dependent variable and independent variable, time is independent variable and CPI-AL is dependent variable.

The model can be written as a functional form as follows:

$$\text{CPI-AL} = f(T)$$

CPI-AL = Consumer Price Index in Agriculture Laborer

T = Time

f = Functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

In econometric model, by including the stochastic term (ϵ_t), thus our model becomes:

$$y = \alpha + \beta_1 X_i + \epsilon_t$$

y = CPI-AL, α = intercept of y (constant coefficient), β = slope for X_i (coefficient of X_i) and X_i = independent variable.

Here the output puts on the equation

$$\text{CPI-AL} = 12.34012 + -.0920262 \text{ time} + \epsilon_t$$

According to the statistical model, one unit change in time will affect one unit change in the consumer price index in agriculture laborer (CPI-AL) but as noted in the model, coefficient value of time is negative. Hence, in duration-recession period, trends of agriculture laborer in the consumer price index is negatively associated with time. In

other words, trends of CPI-AL and prices are increasing in the opposite direction with time.

Analysis of Regression Coefficient: The coefficient value is (12.34012), Standard Error (.0155868), t-stat (-5.90) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There are increasing trends of CPI-AL in Post Recession period, and $H_0 \neq 0$. While the p value is more than t-stat but p value significant at 1 % level of significance. Therefore null hypothesis is rejected at the 1% level of significance and it concludes there is a negative relationship between the trends of CPI-AL with post-recession time.

3.10 Concluding Facets

This chapter deals with only the trends of the *Wholesale Price Index* and the *Consumer Price index* with all categories in context of the Indian economy. Two hypotheses of this chapter were:

- Null hypothesis (H_0), Wholesale Price Index (WPI) has decreasing trend in the Pre - Recession period and increasing trend in the Recession and Post-Recession periods.
- **Alternative Hypothesis (H_a)**, Wholesale Price Index (WPI) has increasing trend in the Pre - Recession period and decreasing trend in the Recession & Post-Recession periods.
- **Second Null Hypothesis (H_0)**, Consumer Price Index (CPI) has increasing trend in all categories such as CPI-IW, CPI-AL, CPI-RL in Pre-Recession, duration of Recession and Post-Recession period.
- **Second Alternative Hypothesis (H_a)**, Consumer Price Index (CPI) has decreasing trend in all categories such as CPI-IW, CPI-AL and CPI-RL in Pre-Recession, during Recession and Post-Recession period.

The study's analysis showed that the *Wholesale Price Index in Pre-Recession* (2002 to 2007) period shows decreasing trend in all categories which include commodities, primary articles, fuel and power and manufactured products. On the contrary, both the *Recession period* (2008 to 2009) and in the *Post-Recession* (2010 to 2015) period WPI

shows an increasing trend. In addition, it is statistically significant by the simple regression model. Consumer Price Index of the three sub-categories namely; Consumer Price Index- Industrial Worker (CPI-IW), Consumer Price Index–Rural Laborer (CPI-RL) and Consumer Price Index Agricultural Laborer (CPI-AL) was found to be almost increasing in Pre-Recession, Recession and Post-Recession period. Only the consumer price index industrial workers (CPI-IW) has found decreasing trend in pre- recession period.

CHAPTER-4
IMPACT OF RECESSION ON
MACRO VARIABLES

IMPACT OF RECESSION ON MACRO VARIABLES

4.0 Overview

This chapter introduces yet another key factor of our study, i.e., the trends of unemployment as well as the impact of recession on Macro variables. The significance of this chapter underlines the upheavals that were faced by the Indian economy, particularly in reference to unemployment and inflation, in the wake of the Global Financial Crisis. Macroeconomic variables play a crucial role in fluctuations of economy. Fluctuations in the major variables like export, lending rate and inflation rate can creates huge problems in the economy. Hence, it is imperative to reckon how the Global Recession of 2008 in the USA affected these variables in the Indian scenario. Thus, this chapter shows the impact of financial crisis on macroeconomic variables such as export, lending rate and CPI-IW by the Vector Error Correction Model (VECM). The data has been taken for the time period from 2002-M1 to 2015-M12 in Context of Indian economy. Furthermore, this time has divided into three sub-periods, such as pre-recession, during recession and post-recession period. In addition, comparative analysis among the measurement approaches of unemployment rate such as the Usual Status, Current Weekly Status and Current Daily Status from the 61st, 66th and the 68th NSSO Rounds of the Quinquennial employment-unemployment have been drawn for empirical profiling.

4.1 Introduction

The global economic slowdown has affected the overall growth of India's economy. The impacts are spatially as well as sectorally differentiated. The influence of the global crisis has been transmitted to the Indian economy through three distinct channels, viz., the financial sector, export and exchange rate (Sahu, 2013, p).

It is essential to establish the reasons for choosing the macroeconomic variables mentioned above, hence, let's consider the integral choice of exports. *“Export plays an essential role in the international trade, whereby the goods produced in one country are*

shipped to another country for future sale or trade and this sale of such goods adds to the producing nation's gross output".

Exporting is not just an activity of large multinational conglomerates to obtain scale and location economies but it is an activity for small firms as well. Approximately all huge multinational companies today started their enlargement overseas through expansion in exports. Exporting can be a very challenging activity for many firms. More than mere shipping of goods, it is the competitive way for a brand to reach the international business ambit. Export as an investment needs minimum resources though optimum flexibility. Moreover, exports yield substantial financial, marketing, technological and other benefits to the firm. Since exporting is usually the first means of foreign entry used by many companies, exporting early usually gives companies a *first-mover advantage* (Yigang, Shaomin and David, 1999). However, exporting requires experiential knowledge that includes the foreign market knowledge (such as clients, market needs, and competitors) and institutional knowledge (such as government, institutional framework, rules, norms, and values) and adeptness in operational knowledge (Eriksson, et al. 2000). Export is predominant for the growth and development of the economy as it brings valuable foreign exchange that assists in the growth of the economy (Goyal, 2012). India, since the implementation of new economic policy in 1991, has been experiencing a high rate of economic growth along with a high rate of export growth. Though the growth slowed down to some extent during the period of the Asian currency crisis of 1997, it once again picked up from the beginning of the 21st century (Sultan, 2012).

According to International Monetary Fund *"Lending Rate is the other depository corporation rate that usually meets the short-term and medium-term financing needs of the private sector. This rate is normally differentiated according to creditworthiness of borrowers and objectives of financing".*

Reserve Bank of India is the central bank of India. It manages and controls the supply of money. Thus, the RBI and is accountable for economic growth and controlling inflation. If Reserve Bank of India makes money supply easy, then it will become very conversant for commercial banks to lend loan to public. Lending loan to public in excess will cause

increase in the supply of money in the hands of people⁸. The interest rate is charged by banks to their largest, secure, and most creditworthy customers on short-term loans. This rate is used as a guide for computing interest rates for other borrowers⁹. There are some studies supported to Consumer Price Index, such as according to Mohanty, Subbarao, Patnaik, Shah and Veronese among others discuss that Wholesale Price Index does not cover price of services. They also argued that although Wholesale Price Index is considered as measure headline inflation, it does not reflect the consumer price situation in the economy. Therefore, we considered consumer price index.

Inflation is a condition in which there is continuous and unchecked increase in the general price level of essential commodities. Inflation reduces consumption as the purchasing power of money depletes. Therefore, inflation is a situation of price rise. The reason for price increase can be due to two main factors identified as the increase in demand and decrease in supply. The Consumers buy from the retailers and not the wholesalers, so the CPI gives the accurate picture of the cost of living. In India, Consumer Price Index shows the inflation rate at retail level. There are 260 commodities enlisted in CPI. There were four Consumer Price Indices covering different socio-economic groups in the economy, namely as Consumer Price Index for Industrial Workers (CPI-IW); Consumer Price Index for Agricultural Labourers (CPI-AL); Consumer Price Index for Rural Labourers (CPI -RL) and Consumer Price Index for Urban Non-Manual Employees (CPI-UNME). However, currently, the CPI-UNME has closed. CPI is now using a new series on the base 2010=100 for all-India and States/UTs separately for rural, urban and combined. The Consumer Price Index at Industrial Workers (CPI-IW) is the measurement of general price level in India. This includes selected services and is measured on the basis of retail prices. CPI-IW is used to determine the dearness allowance of employees in both the public and private sectors. It is also an accurate indicator of general inflation¹⁰.

⁸www.quora.com/What-is-the-difference-between

⁹<http://www.businessdictionary.com/definition/prime-lending-rate.html>

¹⁰pp.1, website: <http://indiabudget.nic.in>.

4.2 Objectives and Hypothesis

1. To examines the impact of recession on export, Lending rate and inflation rate.
 2. To examines comparative analysis among the various NSSO unemployment rounds.
1. H_0 There is significant impact of recession on macro-variable in pre and post-recession period and no significant impact in the recession period.
 2. H_0 There is no significant impact of recession on macro unemployment

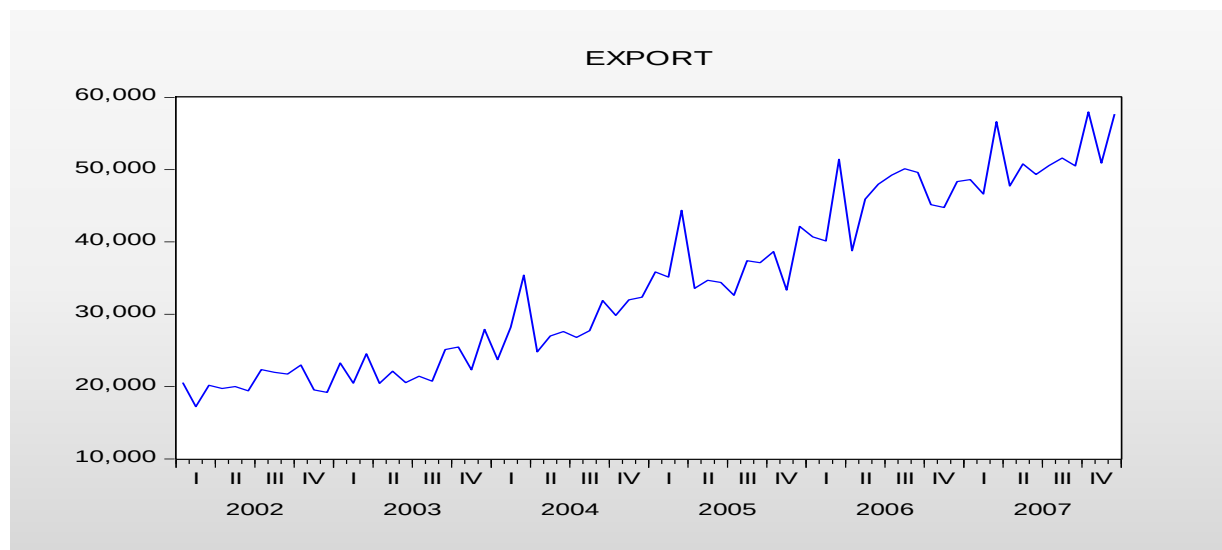
4.3 Data Source and Methodology

The present study is time series analysis and is fundamentally based on secondary data. The data has been taken from 2002 to 2015 in the context of the Indian economy. Additionally, this period has been divided into three sub-categories: Pre-Recession, Duration of Recession and Post-Recession period. We have used monthly data and collected data from various sources such as the Reserve Bank of India, Economic Political Weekly Time series Dataset and the National Sample Survey Office.

4.4: Pre-Recession Period from (2002 to 2007)

4.4.1 Pattern and Trends of Macro-Variables

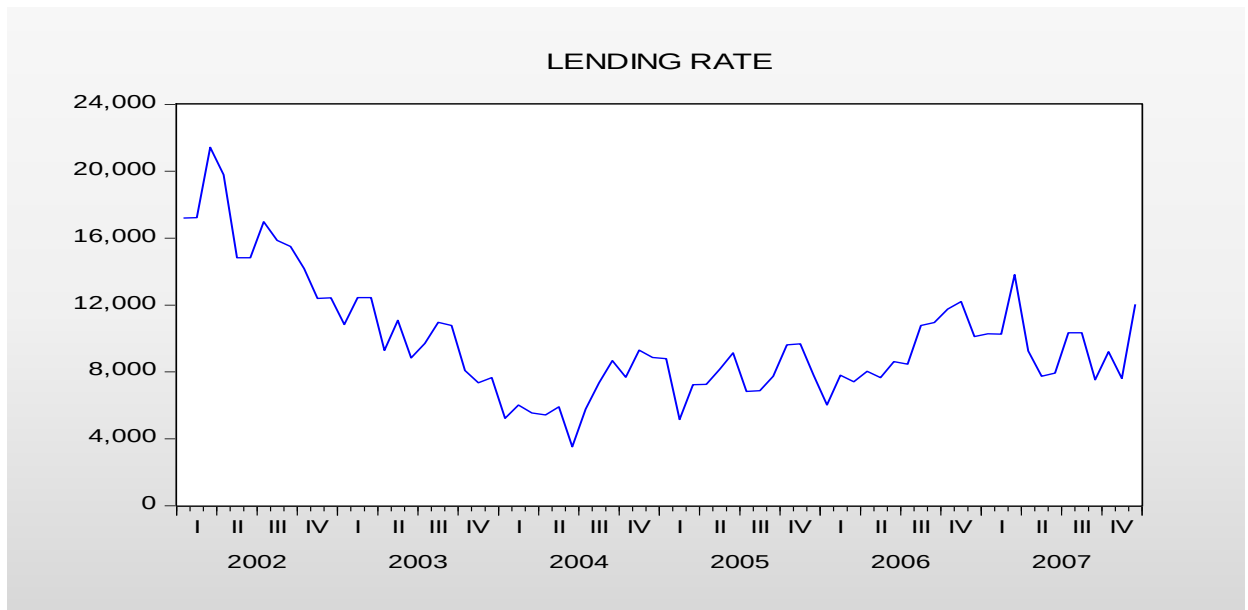
Figure 4.4.1: Trends of Export



Data Source: Reserve Bank of India & EPW Time Series

The figure 4.4.1 indicates the trends of export from 2002 to 2007 (pre recession period) in the reference of the Indian economy. The y axis occurs the quatity of export and the x axis occurs the time period. The blue line occurs the trends of export. It started with the increased rate in January 2002. Then, decreased in March 2002. It was continiously flatuating with cumulative rate in the pre-recession period. It was very high at the end of 2007.

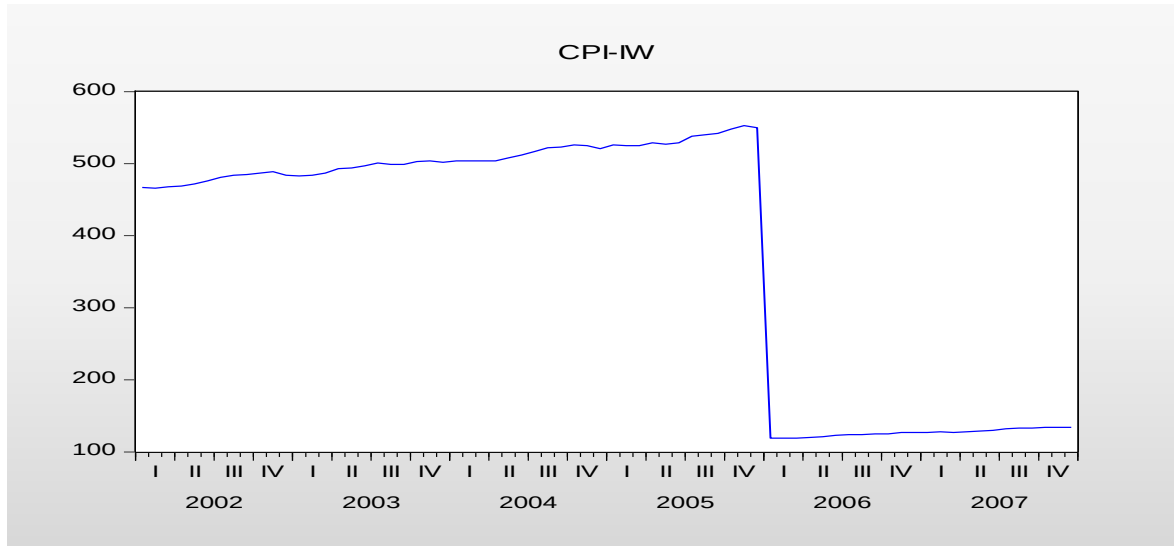
Figure 4.4.2: Trends of Lending rate



Data source: Reserve Bank of India & EPW Time Series

The figure 4.4.2 indicates the trends of lending rate from 2002 to 2007 (pre recession period) in the context of the Indian economy. The y axis occurs the quantity and amount of lending rate and the x axis occurs the time period. The blue line indicates the trends of lending rate. It started with the decline rate in the first quarter of 2002. After which, it quickly increased in the second quarter of 2002. Then came the unexpected decrease in the third quarter of 2002. After that it decresed continuously, with steep decline in the mid of the second and the third quarters of 2004. Then, it increased continiously at a slow rate from the fourth quarter of 2004 to the fourth quarter of 2007.

Figure 4.4.3: Trends of General Inflation Rate (CPI-IW)



Data source: Reserve Bank of India & EPW Time Series

The figure 4.4.3 occurs the trends of general inflation rate from 2002 to 2007 (pre recession period) in reference of the Indian economy. The y axis occurs the quantity and the amount of general inflation rate and the x axis occurs the time period. The blue line indicates the trends of general inflation rate (CPI-IW). There was a gradual increase from the first quarter of 2002 to the fourth quarter of 2005. Then came the unexpected decrease (structural break) with very low rate at the start of 2006. Though, an escalation at very slow rate started from the first quarter to the fourth quarter of 2007.

4.4.2: Augmented Dickey Fuller Test

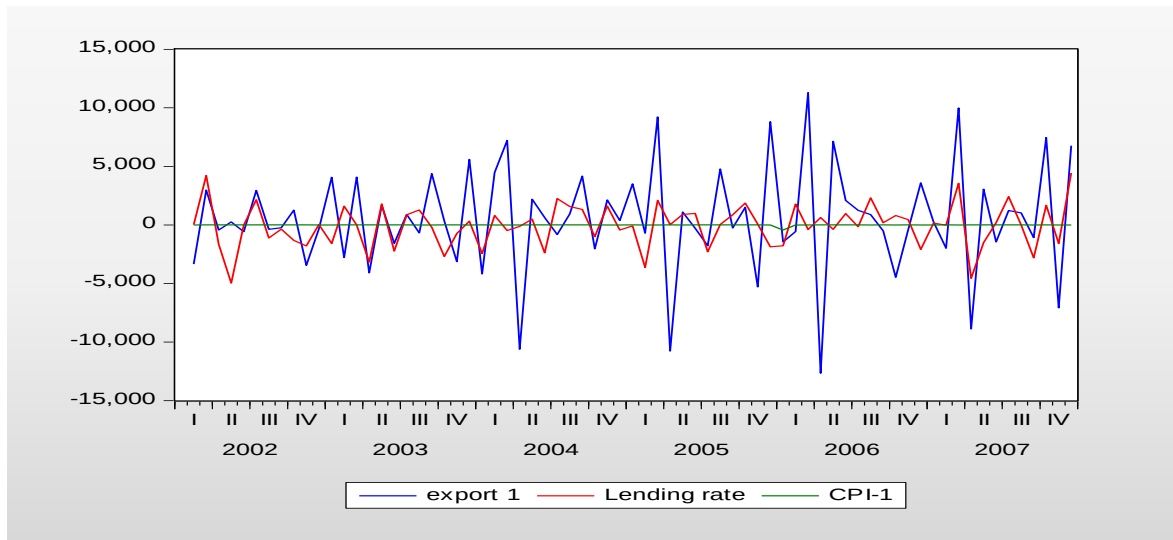
We have applied the Augmented Dickey Fuller test to avoid unauthentic regression. Testing or the unit root hypothesis has become a standard feature of applied econometric research, with the Dickey-Fuller (1979) test commonly employed. Due to the invalidity of the DF statistic in the presence of serial correlation, the test is typically applied in its augmented form. To examine the significance of the resulting Augmented Dickey-Fuller (ADF) statistic, the response surface analysis of MacKinnon (MK) (1991) can be used to calculate critical values for any sample size.

**Table 4.4.1: Augmented Dickey Fuller Test for Differences First Order Data,
(2002M1 to 2007M12)**

Variables	ADF Value DF-T Statistics	Critical value of Mackinon. In levels of significance	
		1%	5%
General Inflation rate	-8.250146 *	-3.527045	-2.903566
Export	-10.56071 *	-3.528515	-2.904198
Lending rate	-7.325386 *	-3.530030	-2.904848

Table 4.4.1 indicates the Augmented-Dickey Fuller test outcome and it depicts that variables are non-stationary at the level, but we have converted them into first differentiate on order. At the present, all variables are stationary at level one. Lending rate, Export and inflation (CPI-IW), are integrated at same order. All variables are stationary at 1 percent (*) level of significance.

Figure 4.4.4: Johanson Test for Cointegration



In Pre-Recession Period, the figure 4.4.4 shows that all variables are cointegrated with the lending rate, export and inflation rate. The lag selection criteria model has suggested that we should choose lag 2 because in this case, there are three criteria are significant such as LR, FPE and AIC.

The earlier outcomes and tests verify that we can use vector error correction (VEC) Model for assessment. According to the outcome of Johnson cointegration test, three directions are confirmed for variables of the model. The directions of variables are export lending rate and inflation (CPI-IW). Therefore, we are using Vector Error Correction Model (VECM).

We have attempted to develop the new VECM model. Common form of VECM model is as tracks:

$$\Delta y_t = a_0 + \alpha_1 + \alpha_2 ec_{t-1} + \alpha_3 \Delta y_{t-1} + \alpha_4 \Delta X_{t-1} + \epsilon_t$$

ec_{t-1} = Measures the speed of adjustment of economic growth to its equilibrium level
 ΔY = Endogenous variable, ΔX = Exogenous variable, ϵ_t = Error term or residual

$$\Delta y_t = a_{cons} + \alpha_{LR} + \alpha_{EXP} ec_{t-1} + \alpha_{INF} \Delta Y_{t-1} + \alpha_{Dum} \Delta X_{t-1} + \epsilon_t$$

Where LR = Lending rate, EXP = Export, INF = Inflation rate (CPI-IW) and DUM= dummy variable. In order to establish the joint effects of variables under Vector Error Correction Model which all variables have been taken as endogenous (ΔY) and exogenous (ΔX), to establish the long-term and short-term association between them (Andrei and Andrei, 2015, P. 573). Zero dummy = No impact of structural breakdowns on other variables and one dummy = Impact of structural Breakdowns on other variables.

We have introduced the Dummy Variable because even after having a stationary data in the series of inflation (CPI-IW) was found to have structural breakdowns(**break date**). Therefore, this study used Dummy variables for captured effect of structural breakdowns on the dependent variables.

Table 4.4.2: An Analysis of Vector Error Correction Model Estimation

Vector Error Correction model of three variables such as Export, Lending rate and CPI-IW

Vector Error Correction Eq.	Coefficient	Std. Error	t-Statistic	Prob.
Lending rate	-1.929678*	0.257572	-7.491790	0.0000
Export	-2.115526*	0.345272	-6.127133	0.0000
Inflation (CPI-IW)	0.004411	0.019704	0.223873	0.8236

First Model Lending rate: In this model, which has the dependent variable, lending rate (the speed of adjustment towards equilibrium error correction term), it is adjusting very fast at 192% towards long-run equilibrium. In other words, there is a long-run causality running from the export and consumer price index for industrial worker to lending rate and there is no short-run causality running from the export and CPI-IW to lending rate. Implication being that, this model has been affected by permanent shocks (supply shock). The overall model is a good fit because R^2 is high and F statistics or P-value is significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
Lending rate	0.696353	0.649236	14.77906	0.000000	1.832213

Overall, this model is a good fit because there is no statistical error. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

Second Model Export: In this model, the dependent variable is export, the speed of adjustment towards equilibrium error correction term; it is adjusting very fast at 2.11% towards the long-run equilibrium. In another way, there is long-run causality running from the lending rate and inflation (CPI-IW) to export and only short-run causality

running from inflation (CPI-IW) to export. There is no impact of shocks (CPI-IW) on export. Meaning that, export has affected by supply shocks as well as demand shocks. The overall model is a good fit because R^2 85 % and F statistics is 39 % and P-value is 0.000 (*) significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob(F-statistic)	Durbin-Watson stat
Export	0.858784	0.836871	39.19098	0.000000	1.960527

In this model is good fit because there is no statistical error. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

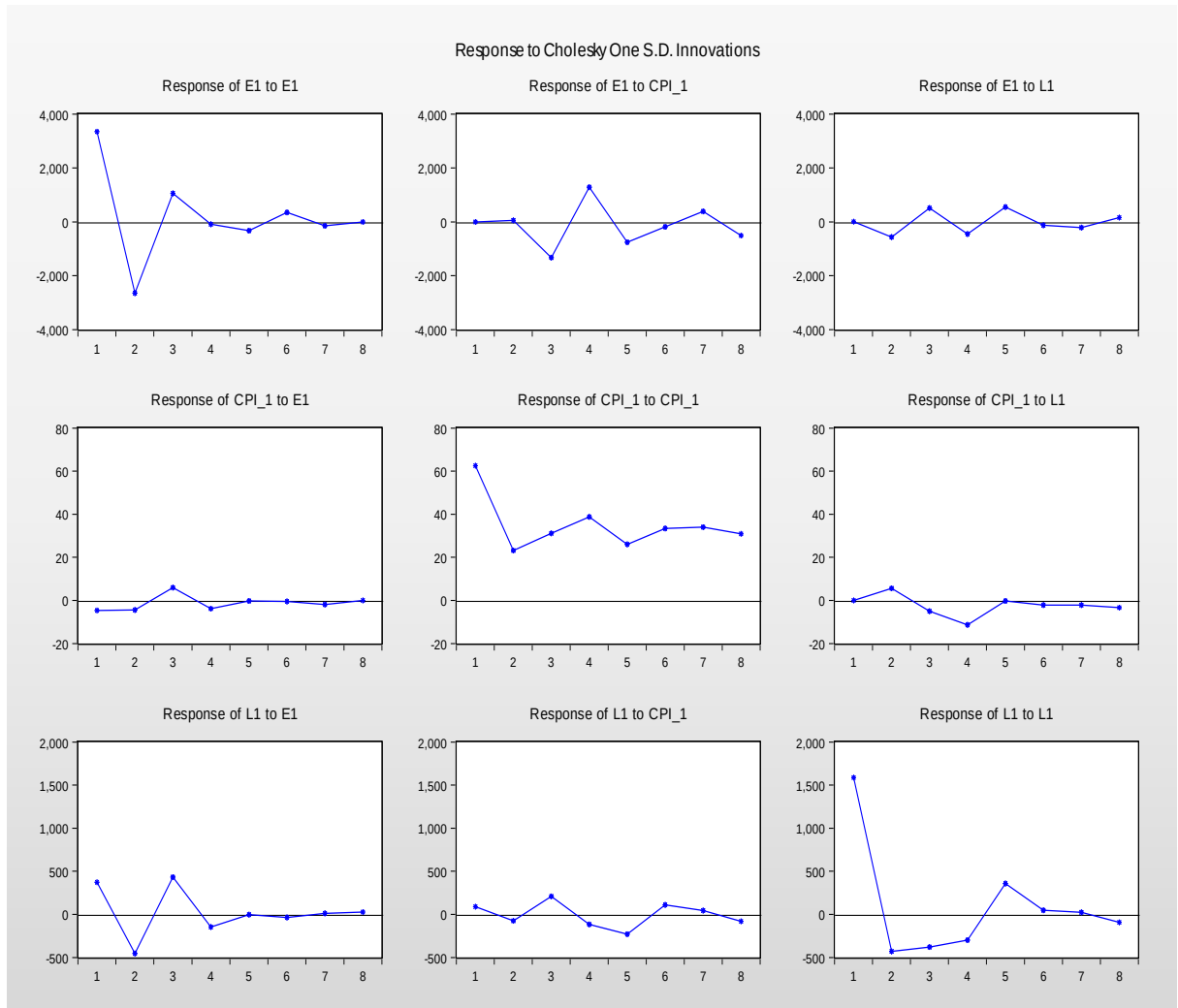
Third Model is CPI-IW: In this model, which has the dependent variable, CPI-IW, there is no long run and short run causality running from the lending rate and export to CPI-IW. It is only affected by own past values and own past shocks. The overall model is not a good fit because R^2 is 41 % low and F statistics is 4.58 % or P-value is 0.000 (*) significant, so it is acceptable.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
CPI-IW	0.415587	0.324903	4.582771	0.000138	2.181259

In this model, there is statistical error because we found the problem of serial correlation. Therefore, there is deduction of serial correlation through the lag difference order. Now, there is no serial correlation and heteroscedasticity. Another problem is that the residuals are not normally distributed and it is not desirable but acceptable because many economists and the statistician are supporting it.

4.4.3: Impulse Response Function

Figure 4.4.5: Impulse Response Function



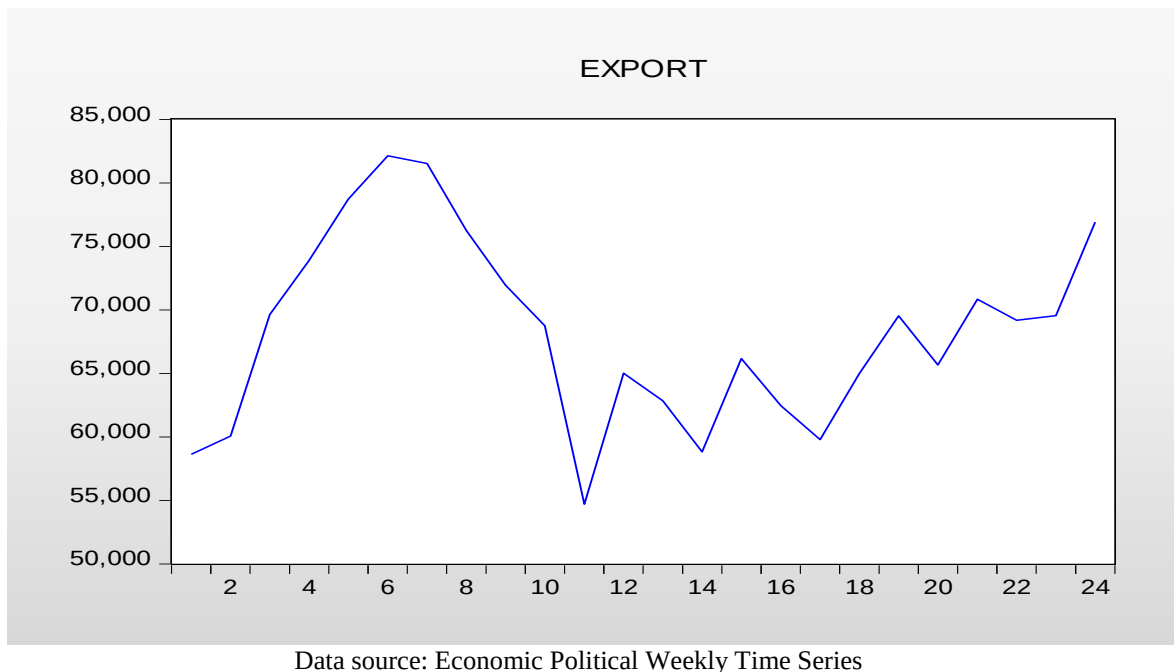
Impulse Response Functions: It determines the responsiveness of the dependent variables in Vector Error Correction Model system when a shock is put to the error term such as U_1 , U_2 and U_3 , as in the equations given above. A unit shock in U_1 will bring a change in the lending rate. It had influenced the export and inflation (CPI-IW) during the next eight months. However, before calculating the impulse response function the ordering of variables is essential. There are many methods but We have chosen the Cholesky dof adjusted, response to Cholesky one standard deviation innovation, shock or residual (error term) + 2 standard error. In the next eight months, all variables in this entire function had been affected. Hence, all the three variables had a significant

influence on each other. Nevertheless, the past values of variables more influenced. The past values of variables (lagged variables) have affected them more because they were presenting more fluctuation. Overall, this study finds that in the pre-recession period, export and lending rate had been affected more in comparison to the inflation rate (CPI-IW)

4.5. Case: 2 During the Recession Period (2008-09)

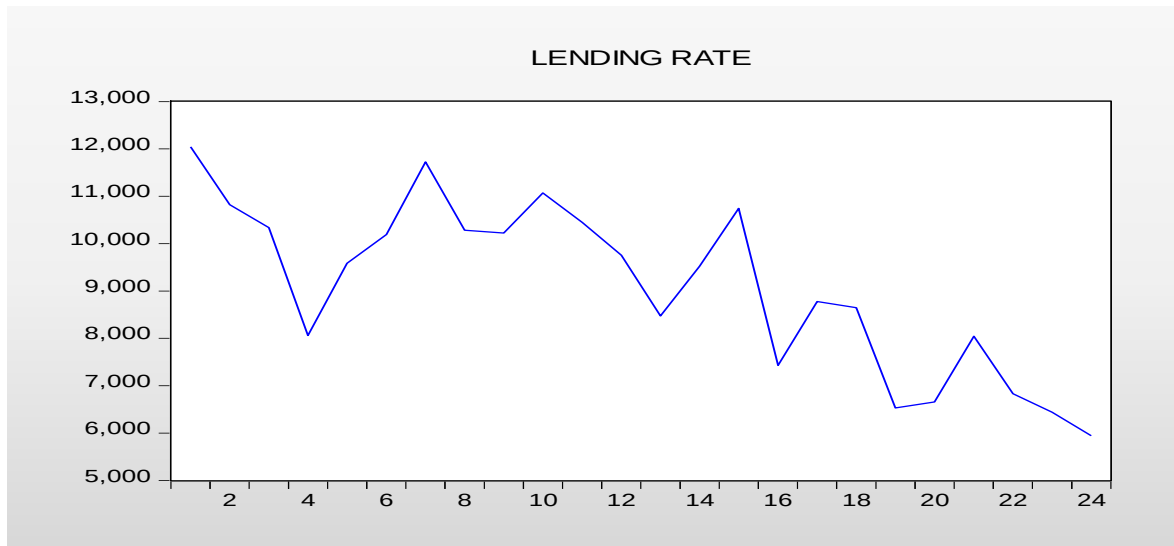
Trend of Macroeconomic Variables

Figure 4.5.1: Trends of Export



The figure 4.5.1 demonstrates the trends of export from 2008 to 2009 (during recession period) in reference of the Indian economy. The Y axis denotes the quantity of export and X axis denotes the time period. The blue line denotes the trends of export. It started decreasing in January 2008, then in February- 2008 it increased considerably, reaching the peak point in June -2008. But a steep decline is seen in the Figure in November, 2008. After that, it fluctuated and an upward trend is observed at a slow pace till December, 2009. In this series we found the structural breakdowns.

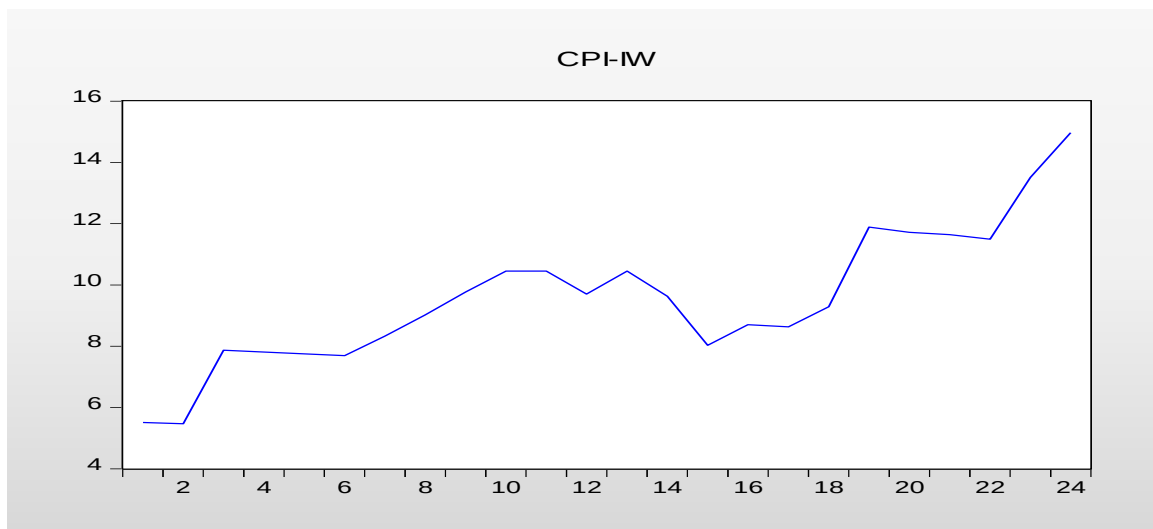
Figure 4.5.2: Trends of Lending Rate



Data source: Economic Political Weekly Time Series

This figure 4.5.2 demonstrates the trends of lending rate from 2008 to 2009 (during recession period) in reference of the Indian economy. The y axis denotes the quantity of lending rate and the Xaxis represents the time period. The blue line denotes the trends of lending rate. It starts with high and peak point of this series in January, 2008. After that, decreases in April- 2008 and then it fluctuates continuously and decreases to the hit the lowest in December- 2009. Structural breaks were also seen in this series.

Figure 4.5.3: Trends of General Inflation Rate (CPI-IW)



Data Source: Handbook, Reserve Bank of India

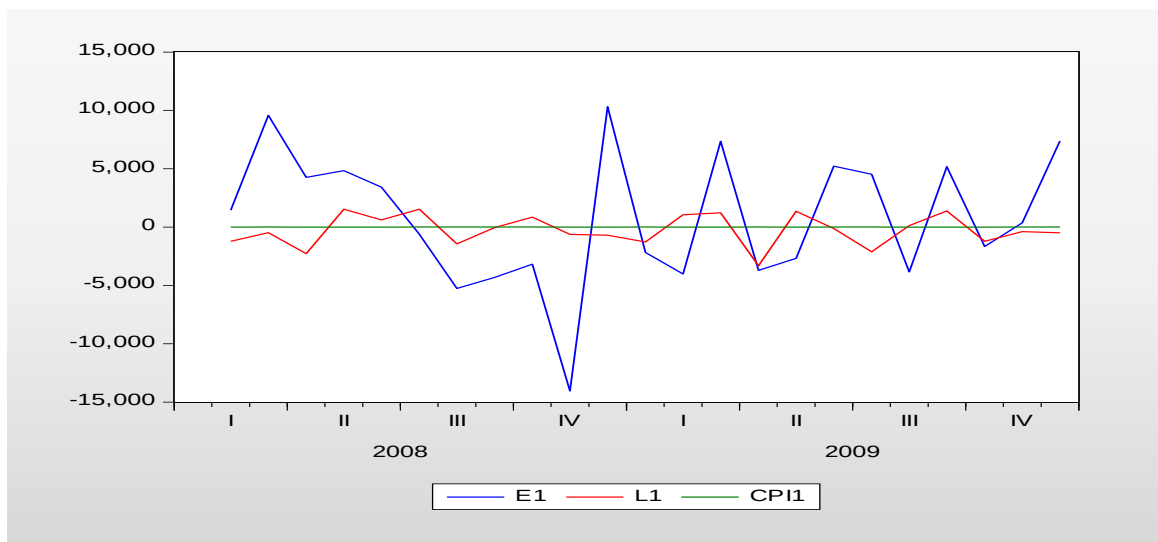
The figure 4.5.3 demonstrates the trends of general inflation (CPI-IW) from 2008 to 2009 (during recession period) in reference of the Indian economy. The **y axis** denotes the price level of general (inflation rate) and X axis denotes the time period. The blue line denotes the trends of general inflation rate. It starts with the decreasing rate in January, 2008. Then it continuously increases to reach the peak point in December, 2009.

Table 4.5.1: ADF Test for Differences First Order Data, (2008-M,1 to 2009-M,12)

Variables	ADF Value DF-T Statistics	Critical value of Mackinnon in levels of significance	
		1%	5%
Inflation (CPI)	-4.239513 **	-3.769597	-3.004861
Export	-4.826144 *	-3.769597	-3.004861
Lending rate	-5.242422 *	-3.788030	-3.012363

Table 4.5.1 described the Augmented-Dickey Fuller test result and it tells us that data are non-stationary at the level, but we have converted them into first differentiate on order. Now all variables are stationary at the level one. Lending rate, export and CPI-IW are integrated at the same order. All variables are stationary at 1% level of significance.

Figure 4.5.4: Johanson Test for Cointegration



The figure 4.5.4 indicates that only one variable (lending rate) is cointegrated in this period. Because trace statistics value is more than the critical value (TS>CV), it tells us that variables are cointegrated. If TS<CV, it tells us that variables are not cointegrated with each other. Thereby meaning that, there is no long-run association among these variables. And the lag selection criteria model has suggested that we should choose lag 2 because in this case there are three criteria is significant such as: LR, FPE and AIC.

We have attempted to develop the new VECM model. General form of Vector Error Correction Model is tracks;

$$\Delta y_t = \alpha_0 + \alpha_1 + \alpha_2 ec_{t-1} + \alpha_3 \Delta Y_{t-1} + \alpha_4 \Delta X_{t-1} + \alpha_5 \Delta X_{t-1} + \alpha_6 \Delta X_{t-1} + \epsilon_t$$

ec_{t-1} = Measures the speed of adjustment of economic growth to its equilibrium level,
 ΔY = Endogenous variable, ΔX = Exogenous variable and ϵ_t = Error term or residual term

$$\Delta y_t = \alpha_{cons} + \alpha_{LR} + \alpha_{EXP} ec_{t-1} + \alpha_{INF} \Delta Y_{t-1} + \alpha_{DLR} \Delta X_{t-1} + \alpha_{DEX} \Delta X_{t-1} + \alpha_{DINF} \Delta X_{t-1} + \epsilon_t$$

Where LR = Lending rate, EXP = Export, INF = Inflation rate (CPI-IW) and DINF= dummy variable for inflation, DEX = Dummy variable for export, DLR = dummy variable for lending rate. Zero dummy = No Impact of Structural breakdowns and one dummy = Impact of Structural Breakdowns.

During recession period, we have introduced three dummies because we found structural breakdowns in every series by the breakpoint unit root test (which is result provided in appendix). Therefore, we have used dummy variables to capture the effects of structural breakdowns on the other variables.

Table 4.5.2: An Analysis of Vector Error Correction Model Estimation

Vector Error Correction Eq.	Coefficient	Std. Error	t-Statistic	Prob.
Export	0.154309	0.141262	1.092357	0.3031
Lending rate	-2.755490 *	0.322179	-8.552663	0.0000
CPI-IW	-0.463927	0.303311	-1.529543	0.1544

First model: Export: In this model, the dependent variable is export, there is no short-run and long-run causality running from lending rate and CPI-IW to Export. Moreover, there is no impact of structural breakdown on export.

Model	R-squared	Adjusted R-squared	F-statistic	Prob(F-statistic)	Durbin-Watson stat
Export	0.680474	0.325444	1.916668	0.170992	2.061011

In this model, there is no statistical error. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

The Second Model is Lending Rate: In this model, which has the dependent variable, lending rate, the speed of adjustment towards equilibrium, it is adjusting very fast at 275% towards the long-run equilibrium. In other words, there is a long-run causality running from export and CPI-IW to lending rate and short-run running causality from CPI-IW to Lending rate. Moreover, all shocks on CPI-IW, export and lending rate in the duration of the recession are presenting a significant impact on the lending rate. It has been affected by the permanent and temporary shocks.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
Lending Rate	0.976734	0.950883	37.78286	0.000004	2.513949

There is no statistical error in this model. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

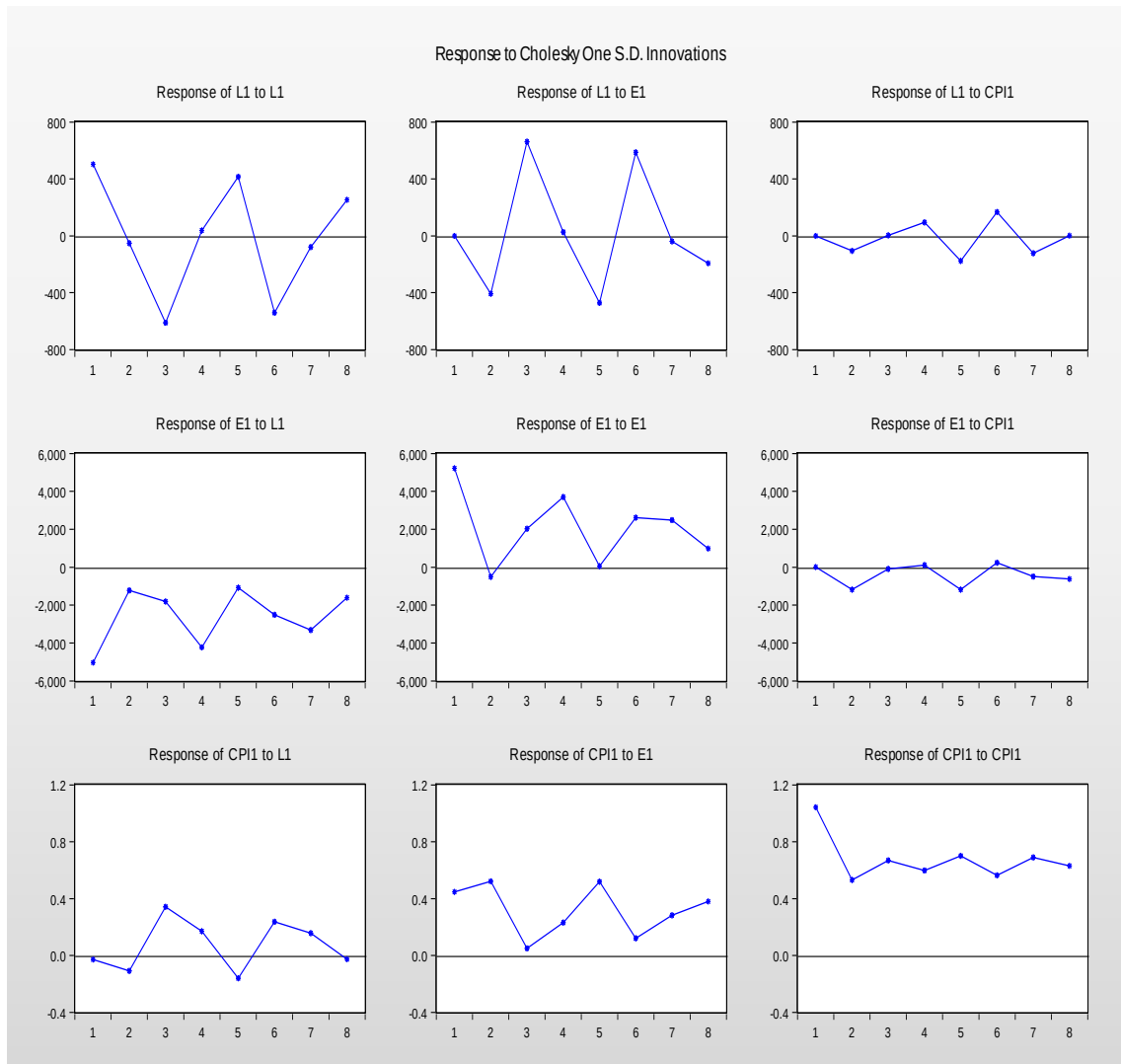
Third Model CPI-IW: In this model, which has dependent variable, CPI-IW there is no short- run and long- run causality running from export and lending rate to CPI-IW.

Model	R-squared	Adjusted R-squared	F-statistic	Prob(F-statistic)	Durbin-Watson stat
CPI-IW	0.553670	0.229066	1.705678	0.202463	2.079533

In this model, there has been the problem of multicollinearity. It has been removed but now there is no statistical error. It is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed.

4.5.5: Impulse Response Function

Figure 4.5.5: Impulse Response Function



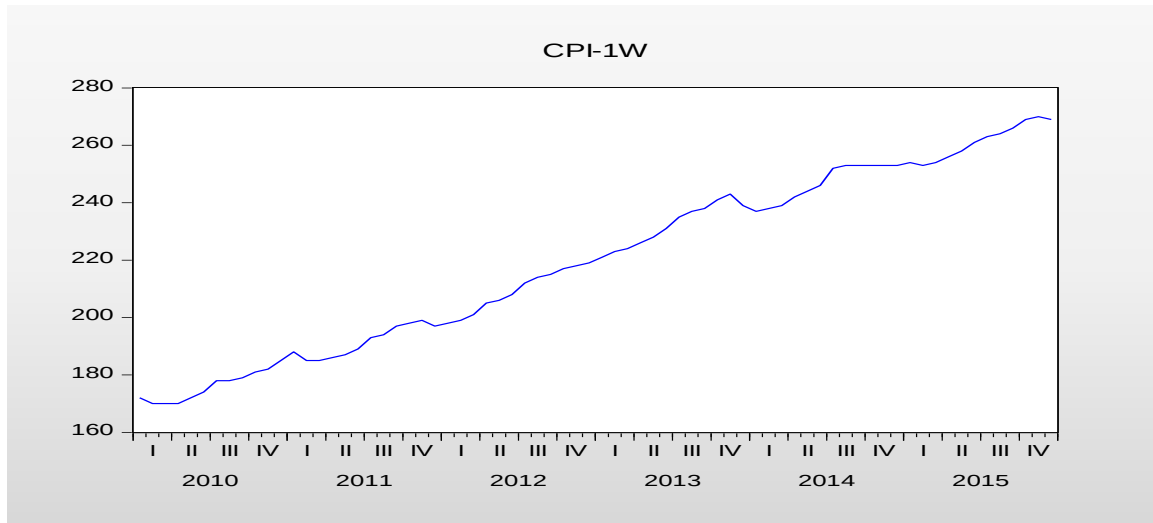
Impulse Response Functions: It identifies the responsiveness of the dependent variables in Vector Error Correction Model system, when a shock is put on error terms such as U_1 , U_2 , and U_3 , in equations given above. A unit shock in U_1 will bring a change in the lending rate. It has changed the export and inflation (CPI-IW) in next eight months. Nevertheless, before calculating the impulse response function, the ordering of the variables is essential. Many methods are given for ordering but we have chosen *Cholesky dof* adjusted, Response to Cholesky one standard deviation innovation, shock or residual (error term) + 2 standard error.

This diagram has presented the impact of the lending rate on (own lagged value) lending rate in the next eight months. It started at the high peak point and then indicated sudden decrease in the third month. After that, it increased in the fifth month, decreased in the sixth month and then increased in the eighth month. It was fluctuating due to the recession. The impact of lending rate on export started from the origin negatively and then decreased in the second month. It reached the peak point in the third month. Thereafter, came a phase of continuous highs and lows with the high rate becoming negative in the last month. In the end, there was a gradual impact of lending rate on the inflation rate for the entire period of eight months. Evidently, we can see the impact of the second error term of export on the other independent variables such as the lending rate and the inflation rate. The impact of export on the lending rate started negatively and did not touch the origin line. The affect was always negative. We can say that it has created liquidity situation in the next eight months. The impact of export on export started with high peak point and it decreased in the second month and touched the origin line. It was fluctuating continuously in the positive way and reached near the origin in the eighth month. In other words, in the last impact of export on the inflation rate, it scaled gradually up and down and touched the origin line always in the negative. Lastly, we see the impact of the third error term of inflation rate on the independent variables such as the lending rate and export. Finally, the impact of inflation rate on the lending rate started to touch the origin line negatively. It scaled up and down for the whole month. The impact of inflation rate on export started with the increasing rate and it was continuously fluctuating in the positive way. However, it did not touch the origin line. The impact of inflation rate on the inflation was gradually fluctuating with the increasing rate.

Case: 3 Post-Recession Period (2010 to 2015)

4.6. Trend of Macroeconomic Variables

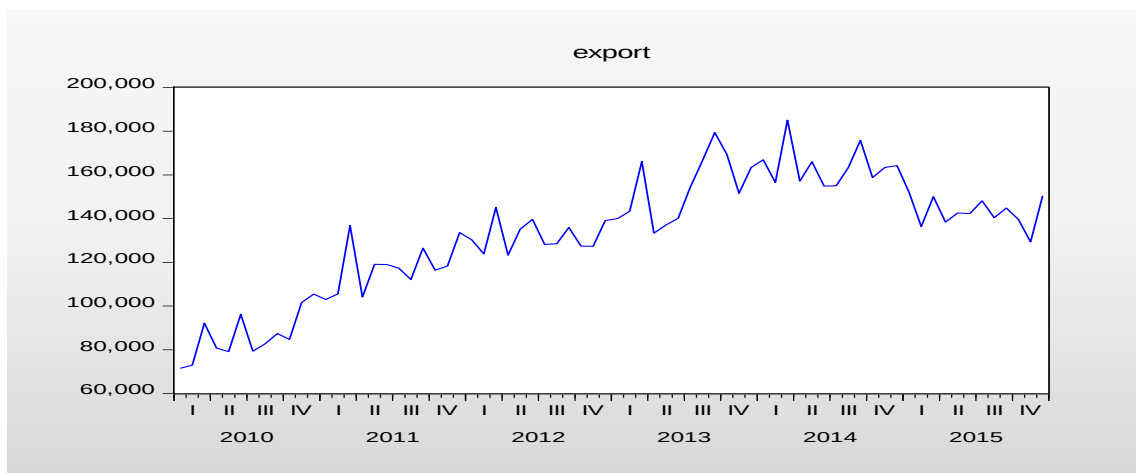
Figure 4.6.1: Trends of General Inflation Rate



Data source: Handbook, RBI

This figure 4.6.1 shows the trends of general inflation (CPI-IW) from 2010 to 2015 (post recession period) in the context of Indian economy. The y axis represents the price level of general inflation rate and the X axis represents the time period. The blue line represents the trends of general inflation rate. It started with the low rate and it increased continuously with minor fluctuations. Moreover, it reached the peak point in December, 2015.

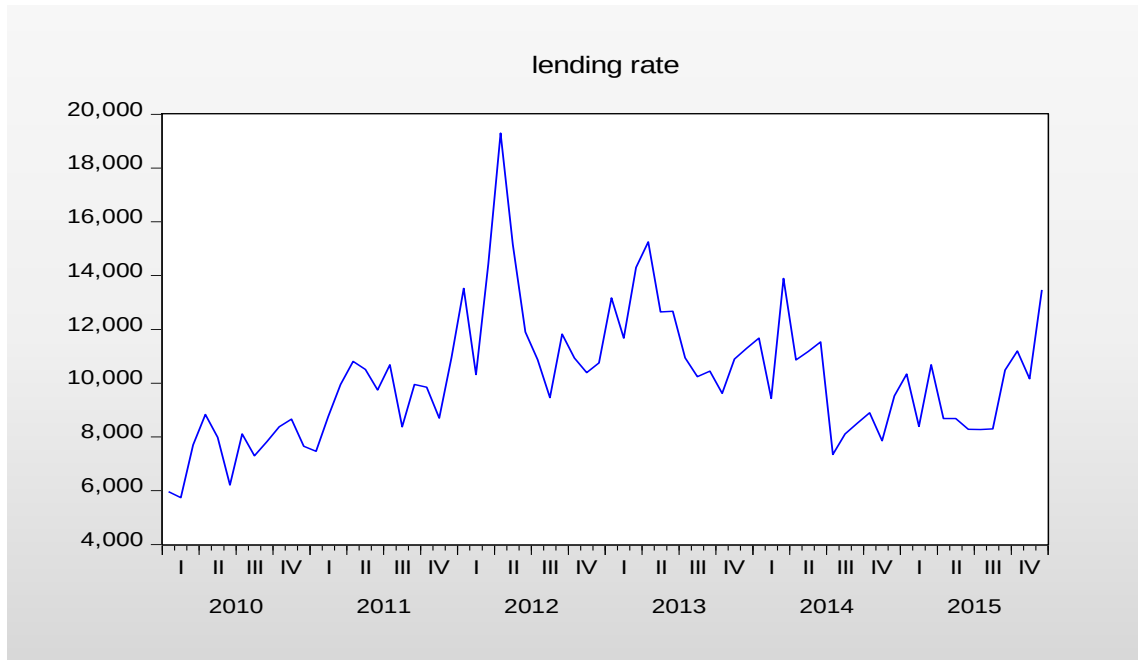
Figure 4.6.2: Trends of Export



Data source: EPW Time series

The figure 4.6.2 demonstrates the trends of export from 2010 to 2015 (the post recession period) in reference of the Indian economy. The y axis denotes quantity of export and the x axis denotes the time period. The blue line denotes the trends of export. It started with the low rate, after that it was fluctuating continuously and increased from the first quarter of 2014. Thereafter, it kept declining till December, 2015.

Figure 4.6.3: Trends of Lending Rate



Data source: Economic Political Weekly Time series

The figure 4.6.3 demonstrates the trends of lending rate from 2010 to 2015 (the post recession period) in reference of the Indian economy. The y axis denotes quantity and the amount of lending rate and the x axis denotes the time period. The blue line denotes the trends of lending rate. It started with the declining rate in January, 2010. Then, continuously increased with fluctuations. Finally, it reached the peak point in the second quarter of 2012. It was continuously fluctuating from the third quarter of 2012 to the fourth quarter of 2015.

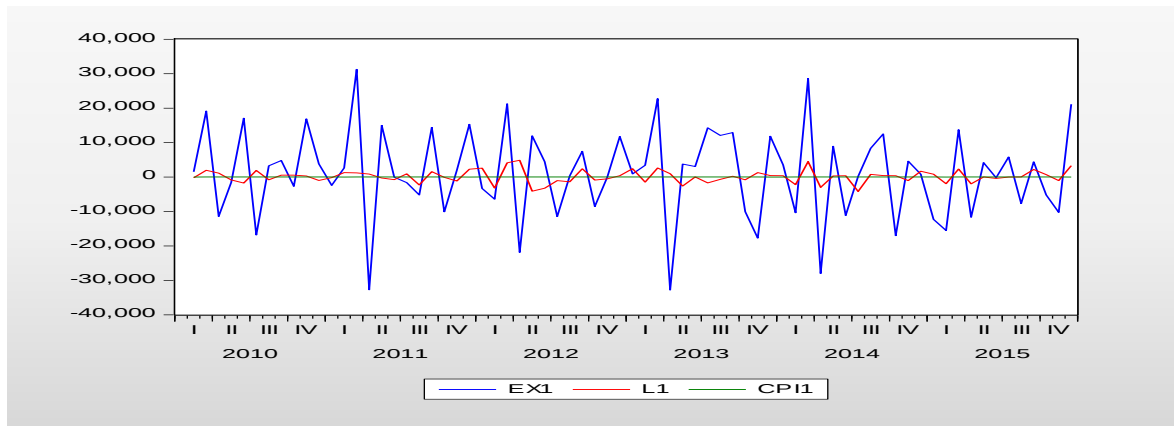
Dickey Fuller Test for Stationary

Table 4.6.1: ADF Test for Differences First Order Data, (2010-M,1 to 2015-M,12)

Variables	ADF Value DF-T Statistics	Critical value of Mackinon in levels of significance	
		1%	5%
CPI-IW	-6.569218 *	-3.527045	-2.903566
Export	-9.729711 *	-3.528515	-2.904198
Lending rate	-10.56238 *	-3.527045	-2.903566

Table 4.6.1 describes the Augmented-Dickey Fuller test result and it tells us that data are non-stationary at the level but we have converted them into first differentiate. Now, all the variables are stationary at the level one. The lending rate, export and CPI-IW have been integrated at the first order.

Figure 4.6.4: Johanson Test for Cointegration



The figure 4.6.4 indicates that all the three variables are cointegrated in this period. In other words, all variables are correlated to each other in the long-run and it influences significantly. The lag selection criteria model has suggested that we should choose lag two because in this case there are three criteria is significant. This means that there are three criteria: LR, FPE and AIC.

We have attempted to develop the new VECM model. General form of VECM model is charts:

$$\Delta y_t = \alpha_0 + \alpha_1 + \alpha_2 ec_{t-1} + \alpha_3 \Delta Y_{t-1} + \epsilon_t$$

ec_{t-1} = Measures the speed of adjustment of economic growth to its equilibrium level,
 ΔY = Endogenous variable, ΔX = Exogenous variable and ϵ_t = Error term

$$\Delta y_t = \alpha_{cons} + \alpha_{LR} + \alpha_{EXP} ec_{t-1} + \alpha_{INF} \Delta Y_{t-1} + \epsilon_t$$

Where LR = Lending rate, EXP = Export, INF = Inflation rate (CPI-IW)

Table 4.6.2: An Analysis of the Vector Error Correction Model Estimation

Vector Error Correction Eq.	Coefficient	Std. Error	T-Statistic	Prob.
Lending rate	-1.143724 *	0.271392	-4.214290	0.0001
Export	-1.220665 *	0.298319	-4.091819	0.0000
General inflation rate (CPI-IW)	-0.564972 **	0.188031	-3.004671	0.0039

First Model Lending Rate: In this model, the dependent variable is lending rate, the speed of adjustment is towards equilibrium error correction term. It is adjusting very fast at 114% towards the long-run equilibrium. In other words, there is long-run causality running from CPI-IW and export to the lending rate. Only short-run causality running from the CPI-IW to lending rate is presenting influence significantly in the short-run. In simple way, it was affected by permanent shocks and temporary shocks. The overall model is a good fit because R^2 is high and F statistics or P-value is significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
Lending rate	0.647222	0.599387	13.53048	0.000000	2.076253

In this model, there is no statistical error and it is desirable because there is no serial correlation and heteroscedasticity and residuals are normally distributed and it is a good fit.

Second Model Export: In this model, which has the dependent variable, export, the speed of adjustment towards equilibrium error correction term is adjusting very fast at 122% towards the long-run equilibrium. In other words, there is long-run causality running from the lending rate and CPI-IW to export and only short-run causality running from the CPI-IW to export. This is showing significant influence in the short-run. This means that the export has also been affected by the permanent shocks and temporary shocks in the post-recession period. The overall model is a good fit because R^2 is high and F statistics or P-value are significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (F-statistic)	Durbin-Watson stat
Export	0.796403	0.768796	28.84844	0.000000	2.036434

In this model, there is no statistical error. It is desirable because there is no ^{serial} correlation and heteroscedasticity and residuals are normally distributed and it is a good fit.

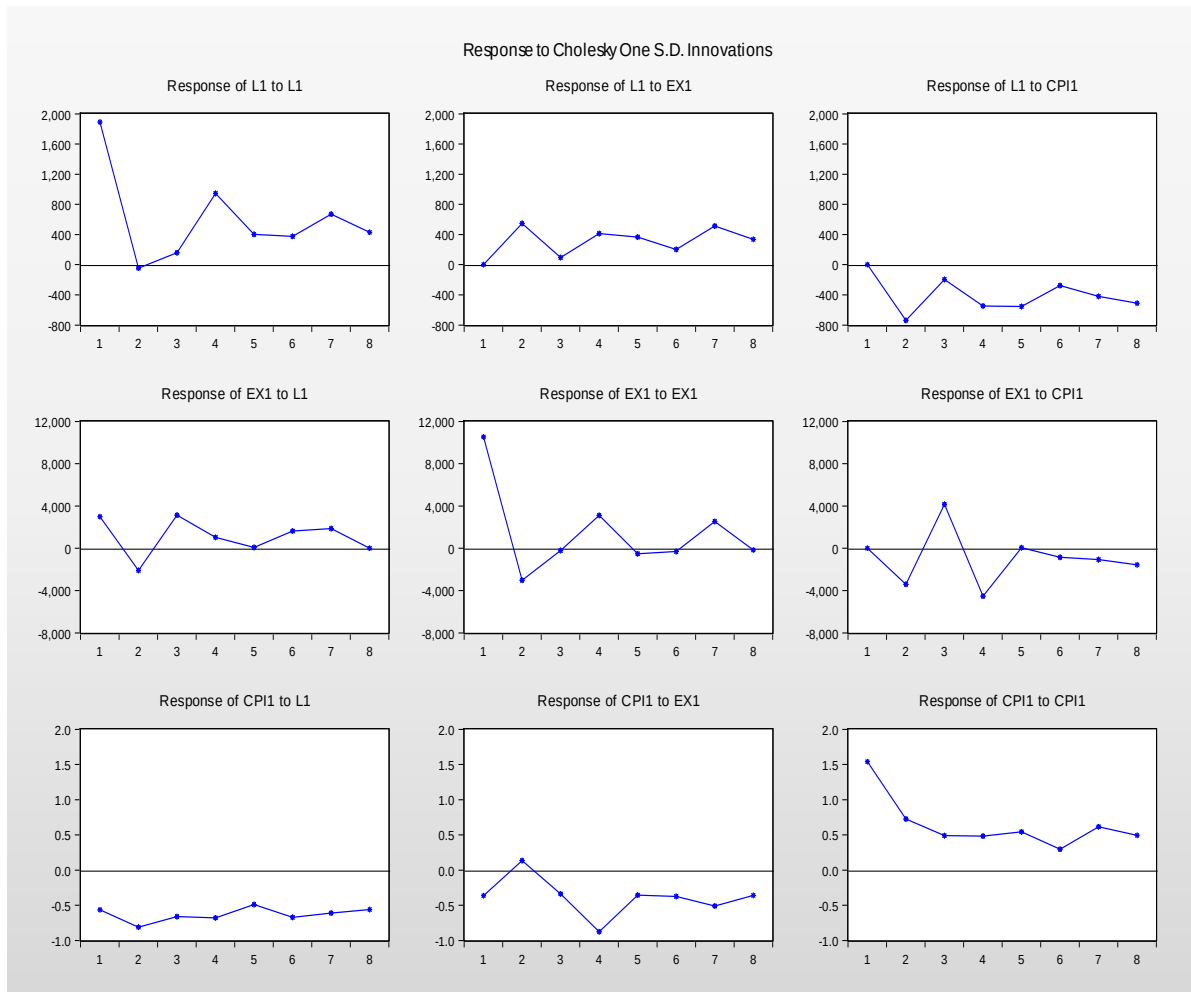
Third Model is CPI-IW: In this model which has the dependent variable, CPI-IW, the speed of adjustment towards equilibrium error correction term is adjusting very poorly at 056% towards the long-run equilibrium. In other words, there is long-run causality running from Export and lending rate to CPI-IW and short-run causality running from export and lending rate to CPI-IW. It jointly influences significantly. It has also been affected by permanent and temporary shocks. The overall model is average because R^2 is low and F statistics or P values are significant.

Model	R-squared	Adjusted R-squared	F-statistic	Prob (t-statistic)	Durbin-Watson stat
CPI-IW	0.431571	0.354496	5.599363	0.000028	1.775667

In this model the problem of serial correlation is found which has been deducted from the model. Now there is no statistical error in this model. So, it is desirable because there is no serial correlation and no heteroscedasticity and residuals are normally distributed.

4.6.5: Impulse Response Function

Figure 4.6.5: Impulse Response Function



Impulse Response Functions: It identifies the responsiveness of the dependent variables, in this Vector Error Correction Model system, when a shock has put to the error terms such as U_1 , U_2 , and U_3 , as in equations given above. A unit shock in U_1 had brought a change in the lending rate. It has changed export and inflation (CPI-IW) in next eight months. However, before calculating the impulse response function the ordering of variable is important. There are many methods for that. We have chosen the Cholesky dof adjusted. The Response to Cholesky is one standard deviation, innovation, shock or residual (error term) + 2 standard error. In the next eight months, all variables in this

entire function have been affected. We can see the impact of all dependent variables on the independent variables in the next eight months.

The Impact of the Lending Rate on Lending Rate: Started with the high peak point and touched the origin line. After that, it was fluctuating and then decreased in the last month. The impact of the lending rate on export started touching the origin line and increased in the second month. Then, it was fluctuating continuously between the decreasing and the constant rate. Impact of general inflation rate on general inflation rate started touching the origin line negatively and continuously fluctuated in the last month.

The Second Error Term is Export: The impact of export on lending rate started with the peak point and after that, it was continuously fluctuating the whole time. It touched the origin line in the last month. The impact of export on export started with the high peak point and it decreased in the second month. After that, it was continuously fluctuating and touched the origin line in the last month. The impact of export on general inflation rate started from touching the origin line. It was negative in the second month. After that, it continuously scaled up and down. In between the sixth and the eight-month, it was negative with origin line.

Third Error Term is Inflation Rate: The impact of general inflation rate on lending rate. It started negatively and while fluctuating remained negative till the end. The impact of general inflation rate on export: started negatively and touched the origin line in the second month. Moreover, it was again fluctuating with negative rate. It was negative in last month. The impact of general inflation rate on general inflation rate started with the high peak point and it kept decreasing till the last month. It generated the rectangular hyperbola curve.

4. 7 In addition to Measurement of Unemployment from Various NSSO Round

4.7.1 Unemployment Meaning, Definition and Measurement

The concept of unemployment plays a central role in the debates on economic and social policy. The difficulty of finding a definition of unemployment that captures all relevant aspect of this phenomenon should be interpreted as reflecting the great diversity of

workers without a job searching for work. This is reflected in recent labour market theoretical approaches- efficiency wages and segments labour market that devote much attention to the heterogeneous behaviour of the non-employed when they move between jobs (Centeno, et al. 2010).

Unemployment is a major problem for both the developed and developing economy. It is the most important indicator of the health of any economy. Unemployment is a situation when employable people who wish to avail of work opportunities do not get any work. Unemployment is at the core of social, political and economic problems in any country. In this context, (Diamond, 2013, P.1) study is most relevant and it states that, *“whenever unemployment stays high for an extended period, it is common to see analysis, statements, and rebuttals about extent to which the high unemployment is structural, not cyclical”*.

It is also important to consider the unemployment scenario in India and understand why the unemployment in the country is so volatile. India is a developing country where most people are employed in agriculture for their livelihood pattern. According to Mahesh Vyas (M.D. & CEO), *“a large proportion of the labour force does not have a regular job. People are mostly employed as daily wageworkers, agricultural labourers, small farmers and self-employed traders. These move in and out of jobs rapidly. ‘It is the high proportion of these workers in India that makes unemployment volatile”*.

There are two types of unemployment found in the Indian economy which are the Structural Unemployment and the Disguised Unemployment. Indian economy is beset with the problems of poverty, hunger, malnutrition that has drastically affected the developmental work of the Nation. It is pertinent to investigate the main reason of unemployment in India. When people do not work and do not have a sustainable income, their spending potential remains negligible. Spending on essentials and services also becomes unaffordable. Hence, the reduction in purchasing power creates low demand. Due to low demand and low production, the companies reduce their production cost. Many companies start downsizing and lay off employees. This creates even more unemployment and worsens the situation. With no means for economic sustenance, the employable youth often get frustrated and resort to illegal pursuits to make ends meet.

Thus, unemployment is directly linked to the increasing crime graph. As cited by many economists the main reason of unemployment in India is the Structural Framework. In the wake of the Global Recession many people lost their jobs in India also. According to the International Labour Organisation's Director General Guy Ryder, *"more than 61 million jobs have been lost since the start of the Global crisis in 2008 and our projections show that unemployment will continue to rise until the end of the decade. This means that the jobs crisis is far from over, so there is no place for complacency."*

According to the ILO, about a million of people were fired in the world due to recession. The *Global Economic Crisis* bears a profound impact on people's well-being, reaching far beyond the loss of jobs and income, and affecting citizens' satisfaction with their lives and their faith in the governments. According to the OECD report (2013 a, b) *"basically, unemployment is also a cause of recession. As output and demand falls, the firms cut the nominal wage rate on hiring new workers. This leads to a rise in unemployment, as there are reduced job vacancies. Therefore, some firms directly create unemployment by not hiring the labour. The rise of unemployment worsens the recession"*. A recent report of BBC suggests that recession has had a deep impact on jobs. According to the Chartered Institute of Personnel and Development (CIPD), the Recession caused the loss of 1.3 million jobs. This is higher than the official rise in development because many of those redundant were unable to find new jobs.

The Financial Crisis of 2007–2008, also known as the Global Financial Crisis is considered by many economists to have been the worst financial crisis since the Great Depression of the 1930s (Temin, 2010). It began in 2007 with a crisis in the subprime mortgage market in the US and developed into a full-blown international banking crisis with the collapse of the Investment Bank Lehman Brothers on September 15, 2008 (Mark, 2012). The financial crisis happened because banks were able to create too much money too quickly and used it to push up house prices and speculate on financial markets. Lending large sums of money into the property market pushed up the price of houses along with the level of personal debt. Interest had to be paid on all the loans that banks make and with the debt rising quicker than incomes, eventually some people become unable to keep up with repayments. At this point, they stopped repaying their

loans, and banks found themselves in danger of going bankrupt (<http://positivemoney.org/issues/recessions-crisis/>). U.S. is a biggest economy of the world; it is central body to exporter importer and food supplier. According to a report released by the Union Government in Aug 09, 1.71 Lakh had lost their jobs in various sectors of India. The textile industry was worst hit.

According to ILO some definitions and concept related to Unemployment.

Definition of Economic Activity: According to the International Labour Organisation (ILO), an economic activity is defined in terms of the production of goods and services as set forth by the United Nations system of national accounts (SNA). In broad way the SNA covers the production of goods and services for sale or barter in the market and the production of goods for personal consumption. All domestic or personal services provided by unpaid household members are excluded.

4.7.2 Economically Active Population: The ILO defines that the economically active population comprises all persons of either sex who furnish the supply of labour for the production of economic goods and services, as defined by the SNA, during a specified time reference period. The following set of priority rules is adopted to ensure that each person is classified into one of the three categories: employed, unemployed and economically inactive population. The first two categories make up the economically active population, which gives a measure of the number of persons furnishing the supply of labour at a given time period (Liu, E. & Wu, J., 1999). The International Labour Organisation has divided the total population of three categories, such as employed, unemployed and not in labour force. Further, all these categories have been divided into sub categories. The categories are discussed below:

4.7.2.1 The Employment Categories: According to priority rules, the first step is to identify those who are above the specified minimum age and during the specified short reference period were either at work or having formal job attachment. This group belongs to the “employed” category.

4.7.2.2 The Unemployed Category: The second step is to identify among the remaining persons those who were seeking and available for work. They belong to the “unemployed” category.

4.7.2.3 Economic Inactive Population: Those without work but they are not seeking nor are available for work, as well as those persons below the minimum age specified belong to the residual category of economically inactive population.

4.7.2.3 One Hour Criterion: The ILO recommends that, for operational purposes, the notion of some work should be interpreted as work for at least one hour during the reference period. This means that engagement in an economic activity for as short as one hour is sufficient for a person to be classified as “employed”. The main reason for the use of one hour criterion is to make the definition of employment as extensive as possible in order to cover all types of employment that exist in the economy (op. Cit,1999.).

4.7.3 According to Committees and NSSO, some Definitions and Measurements of Unemployment in India

4.7.3.1 Approaches to Measurement of Unemployment:

In early fifties, there were only two approaches to the measurement of unemployment. The first approach deals with the problems of open unemployment or idleness for want to work and the second approach is concerned with surplus labour (Raj, 1976).

Raj Krishna suggested three other criteria in addition to the production criterion time, willingness and income. According to *time criteria* a person is classified as unemployed or under employed, if he is gainfully occupied for a number of less than some normal or optional hours defined as full employment hour”(Krishna,1973). According to *willingness criterion*, a person is considered as unemployed only when he is willing to work to do more work. Dandekar and Rath (Dandekar & Rath, 1971) originally suggested the *income approach*. Sen said, “They relate to two difference categories of thought and to identify the one with the other is to weaken both the concept” (Sen, 1975). After that Sen suggested two more approaches to unemployment, first is income and second is recognition. According to income approach, a person is considered as employed if his

income is conditional on work it is immaterial whether his income is high or low. The *Recognition approach* treats a person as unemployed only when he considers himself as unemployed. He argues that “*unemployment is a state of being without fruitful work and the perception of the fruitfulness of work is to large extent, a result of social conditioning*” (Op. Cit, 1975).

4.7.4 The National Sample Survey Organisation

The National Sample Survey collected data on unemployment during many rounds though there were variations from round to rounds; the basic approach was the labour force approach with a short reference period (Visaria, P. and PP.43-144). “The employment and unemployment’ surveys were carried out in rural areas by NSSO adopting three approaches such as Usual status (US), current weekly status (CWS) and current daily status(CDS)” (NSSO, 1999, Pp.31-55).

In India, the main sources of data on employment- unemployment are the various surveys being conducted by the National Sample Survey Organisation, the Population Census, and Employment Market Information Programme of DGET that is provides information on the organised sector employment and Employment Exchange Statistics. All the data sources available and surveys conducted by the NSSO are the main data source on employment and unemployment in the country. Starting with the 27th round of survey and based on concept, definitions and procedures as recommended by the Dantwala Committee (1970). NSSO has been conducting a gap of five years (quinquennial) surveys on employment and unemployment in the country (Report, E.U.S., 2009-10).

In the employment and unemployment surveys of NSSO, information regarding the activity status of a person is collected in three different approaches viz. usual status approach, current weekly status approach and current daily approach. In the usual status approach, the broad activity status of a person viz. employed unemployment and not in labour force is decided by major time criterion. In current weekly status and current daily status approach, the broad activity status of a person is decided by priority- cum major time criterion where work activity gets priority over unemployment that in turn gets priority over ‘not in labour force activities (68th round NSSO, Pp. 6).

The National Sample Survey Organisation that provides estimates of the rate of unemployment in India bases its analysis on the *quinquennial* surveys. It has collected the data on employment and unemployment using three broad approaches. These are: The Usual Status Unemployment, Current Weekly Status Unemployment and Current Daily Status Unemployment.

4.7.4.1 The Usual Status of Unemployment: It is further categorised into two subcategories, first is usual principal status and second is usual principal and subsidiary status. Usual Status relates to the activity status of person during the reference period of last 365 days preceding the date of survey. The activity status on which, a person spent relatively longer time (major time criterion) is considered the usual principal status (UPS). To decide the usual principal activity status of a person a two stage classification is used to determine the broad activity status, viz. employed, unemployed and not in labour force within which, the detailed activity status is determined depending on the relatively longer time period spent in the activities. Apart from this the usual principal activity status, a person could have pursued some economic activity for a smaller period, not less than 30 days. The status in which such economic activity is pursued is the subsidiary economic activity status of that person. If these two are taken together, the measure of usual principal and subsidiary status (UPSS) i.e. usual status is obtained.

4.7.4.2 Current Weekly Status (CWS): A person's activity status is obtained for a reference period of 7 days preceding the date of survey. According to this, a person is considered as a worker if he/ she has performed any economic activity at least for one hour or any day of the reference week, and is obtained on the basis of daily activities performed on each day of the reference period.

4.7.4.3 Current Daily Status (CDS): A person is determined by his/her activity status on each day of the reference using a priority-cum- major time criterion (day to day labour time disposition). A person is considered working (employed) for the full day if he/she has worked for 4 hours or more during day.

The National Sample Survey Organisation has collected the data of unemployment in every five years and unemployment has released it twice in the year in India. The NSSO

has divided the entire population into three categories of the employed, unemployed and not for labour. Furthermore, these categories are divided into sub categories.

The Labour Force: *“Labour force indicates the supply of labour in the country and is an important input for production of goods and services in the country. The reliable estimates of labour force are important for policy and planning purposes. The labour force participation rate derived shows the proportion of a countries working –age population that engages actively in the labour market, either by working or searching for work”* (EUS., Report, 2015). The breakdown of labour force has been in various categories such as sex, sector, social group, and age group wise. It gives a better profile of the economically population within the country to formulate policies and plans for various target population.

4.7.5 Concept and Measurement of Labour Force

Labour Force Participation Rate- labour force participation rate is defined as the number of persons in the labour force per 1000 persons.

$$\text{LFPR} = \frac{\text{No. of Employed Persons} + \text{No. of Unemployed persons} \times 1000}{\text{Total Population}}$$

Working Population Ratio- worker population ratio is defined as the number of persons employed per 1000 persons.

$$\text{WPR} = \frac{\text{No. of Employed/Persons} \times 1000}{\text{Total Population}}$$

Proportion Unemployed: -proportion unemployed is defined as the number of persons unemployed per 1000 persons.

$$\text{PU} = \frac{\text{No. of Unemployed persons} \times 1000}{\text{Total Population ages 15+}}$$

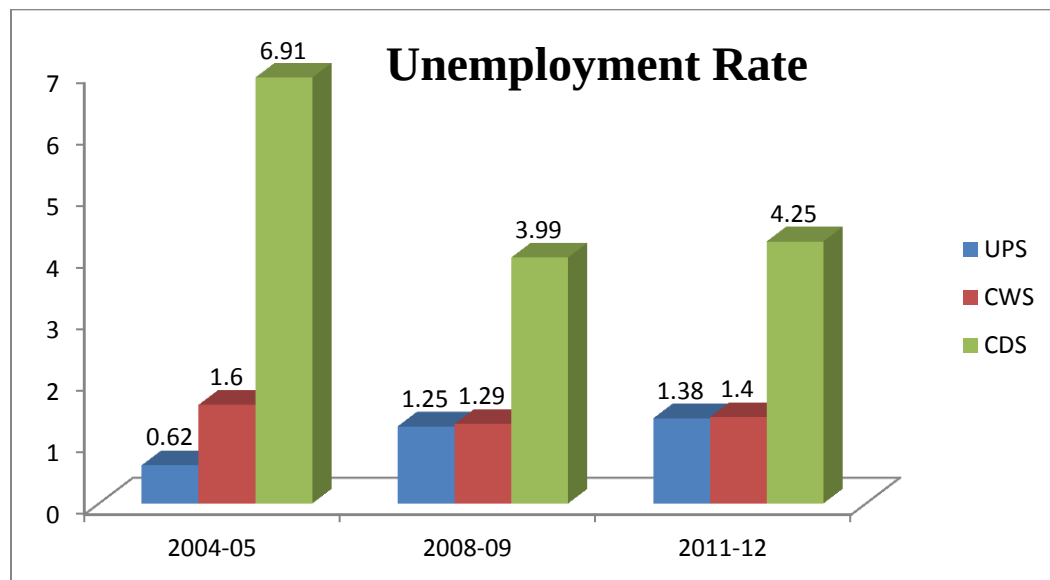
Unemployment Rate: - unemployment rate is defined as the number of persons unemployed per 1000 persons in the labour force (employed and unemployed)

$$\text{UR} = \frac{\text{No. of Unemployed persons} \times 1000}{\text{Labour force}}$$

In India there are various sources of collection of unemployment data but the National Sample Survey Organisation (NSSO) has more comprehensive strategy to collect the data of the employed and unemployed person.

4.7. The Graphic Presentation of the Percentage of Unemployed Persons in Indian Economy from Various NSS Rounds

Figure 4.7.1: Percentage of Unemployment Rate from Various NSS Round



Data Source: Unit Level Data at National Level from various NSS Rounds

The figure 4.7.1 shows the percentage change of the 5th year on 5th year rate of unemployment in namely the three quinquennial National Sample Survey (NSS) of the 61st, 64th and 68th rounds. The bar chart shows the percentage of unemployed persons in various NSS rounds.

The *Red colour* bar diagram denotes the percentage of unemployed persons in the Usual Principal Status. The *blue* bar diagram belongs to the percentage of unemployed persons in the Current Weekly Status. The *green* bar diagram depicts the Current Daily Status.

Tabulated results depict the following:

- I. In the *Pre-Recession Period* (61st NSS Round), basis of Usual Principle Status & unemployed person is at 0.62 percent. 1.60 percent persons are unemployed

in the Current Weekly Status. Moreover, 6.91percent people are unemployed in the Current Daily Status basis.

- II. During the *Recession Period* (66th NSS Round), the basis of Usual Principle Status & the unemployed person is at 1.25 percent. 1.29 percent persons are unemployed in Current Weekly Status. Moreover, 3.99 percent of the people are unemployed in Current Daily Status basis.
- III. In the *Post-Recession Period* (68th NSS Round), basis of Usual Principle Status &unemployed person is at 1.38 percent and 1.40 percent persons are unemployed in Current Weekly Status. 4.25 percent of the people are unemployed in Current Daily Status basis.

This clearly describes that in the pre- recession National Sample Survey Organisation round, the Current Weekly Status and Current Daily Status is at the highest but the Usual Principle Status is lowest than in the other National Sample Survey Organisation rounds. Further, the National Sample Survey Organisation round data also reveals that during the recession the Usual Principle Status increased but the Current Weekly Status and Current Daily Status reduced. In the post-recession phase, as per the National Sample Survey Organisation round, the Usual Principle Status, Current Weekly Status and Current Daily Status all increased in comparison to the National Sample Survey Organisation round on (P & Verma, 2019). Thus the analysis establishes that there is significant reduction of people's employment during the recession phase and the global crisis has had an impact in the Indian economy as well.

4.8 Concluding Facets

Chapter 4 summation clearly indicates that in the Pre-Recession period all variables such as export lending rate and (CPI-IW) general inflation are non-stationary at level but after the first differentiate all the variables are stationary at level one by the Augmented-Dickey Fuller test. Moreover, structural breaks were found in the CPI-IW series so we had to generate one dummy variable as an exogenous variable for removing the breaks in CPI-IW series. After that we have applied the Johnson cointegration for cointegration among the variables and all variables are cointegration, meaning that all variables are among the long run relationship and it is significant. These two tests were confirmed by

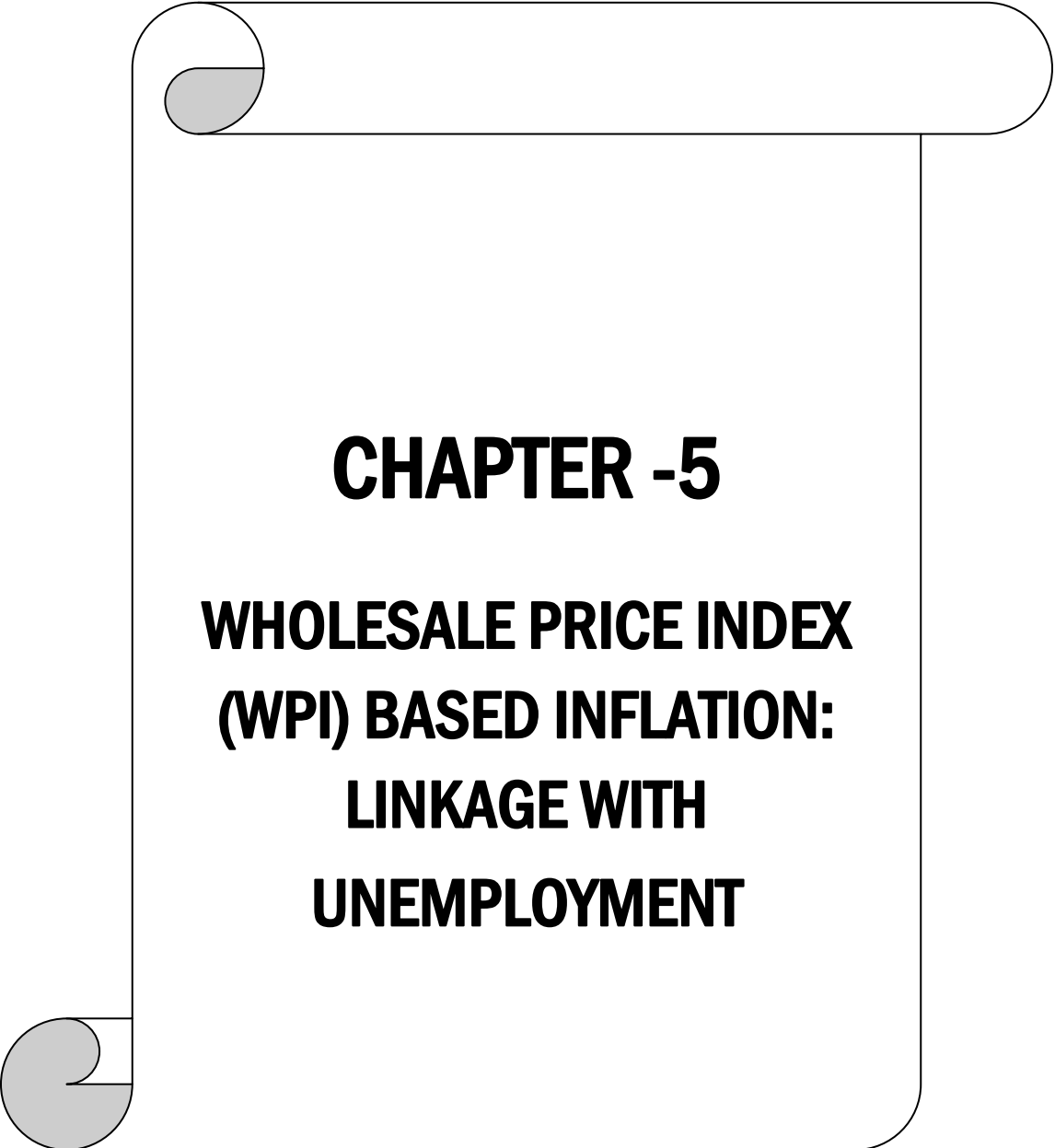
applying the VECM model. Further, the lag selection criterion has suggested that we should choose two lags. In the lending rate, there is long-run causality running from export CPI-IW to Lending rate and there is no any short-run causality running from export CPI-IW to Lending rate. In the export, there is long-run causality running from lending rate and CPI-IW, and short-run causality running from CPI-IW to export and no impact of structural breaks on export and lending rate. In the (CPI-IW) inflation rate there is no short-run or long-run causality running from lending rate and export to (CPI-IW) inflation rate.

During the Duration of Recession Period: All variables such as export lending rate and (CPI-IW) general inflation are non-stationary at level but after first differentiate all the variables are stationary by the Augmented-Dickey Fuller test. Moreover, structural breaks were found in all data series so we generated three dummies variables as exogenous variables for removing the breaks in our data series. After that we have applied the Johnson cointegration for cointegration among the variables and all variables are the long-run association. These two tests were confirmed by applying the VECM model. Further the lag selection criterion has suggested that we should choose two lags. In the export and CPI-IW there are no short run or long run causality and only lending rate is a long-run causality running from export and CPI-IW to lending rate and short-run causality running from export and the lending rate, moreover the shocks of export lending rate and CPI-IW has a significant impact on the lending rate. In other words, it is affected significantly in the Recession period.

In Post-Recession Period: All variables such as export, lending rate and (CPI-IW) general inflation are non-stationary at a level but we have converted them into first differentiate where all the variables are stationary by the Augmented-Dickey Fuller test. After that we have applied the Johnson cointegration test for cointegration among the variables and all variables are cointegration, meaning that all variables are long-run association. These two tests were confirmed by applying the VECM model. Further, the lag selection criterion has suggested that we should choose two lags. In the lending rate, there is long-run causality running from export CPI-IW to Lending rate, and there is also short-run causality running from CPI-IW to the lending rate. In the export there is long-

run causality running from lending rate and CPI-IW, and short-run causality running from CPI-IW to export. In the CPI-IW there is long-run causality running from lending rate and export to CPI-IW and short-run causality running from lending rate and export to Inflation (CPI-IW).

In short, In the Pre-Recession Period, the lending rate was affected due to supply shocks (permanent effect). The export has been affected due to both supply shocks and demand shocks (permanent & temporary effect) and there was no any impact on the inflation rate. During the Recession Period there was no impact on export and inflation rate. Although the lending rate was affected by supply shocks and demand shocks as well as structural breaks were found in export, lending rate, and inflation rate. In the Post-Recession Period, during this period all variables such as export, lending rate, and inflation rate were affected by supply shocks and demand shocks and it is significant and proved (P & Verma, 2018). In addition, to sum up, in this present study we have analysed the comparative descriptive analysis among the quinquennial unemployment rates taking into account the recession period. We found that there is significant impact of global financial on recession and post-recession period in Indian economy.



CHAPTER -5

WHOLESALE PRICE INDEX (WPI) BASED INFLATION: LINKAGE WITH UNEMPLOYMENT

CHAPTER-5

WHOLESALE PRICE INDEX BASED INFLATION: LINKAGE WITH UNEMPLOYMENT

5.0 Overview

This Chapter discusses the relationship between Inflation and Unemployment which are connected through the Phillips Curve theory, specifically during the Financial Crisis, 2008. The analysis done in this chapter also reckons the time period from 2002 to 2015 to understand the relationship between unemployment and inflation in the Indian context. For deducing our empirical facts, we have divided the specified time period in two sub categories which are the Pre-Recession and Post-Recession period.

5.1 Introduction

The relationship between inflation and unemployment are very debatable and frequently used in macroeconomics. Inflation indicates continuous increase in the general price level in the economy. Less inflation is good for economy because it helps in the growth and development of economy. However, high inflation is destructive for economy's development. In Indian economy, two types of price index are mostly used for measurement of inflation, these are: the *Wholesale Price Index* and *Consumer Price Index*. Indian economy started as lowdown in 2007-08 (April-March) after accomplishment of a GDP growth of 9.8 per cent in the last quarter of 2006-07. In fact, Indian economy propagated at an annual average rate of 8.8 percent during the five years ending 2007-08. In the first half of the financial year 2008-09, the growth rate had fallen to 7.8 percent. The pre-crisis slowdown of the economy can be accredited to the tightening of monetary policy right from September 2004 in response to the fear that the inflation was increasing. The monetary contraction became harder in 2006-07 and later in early 2008-09 a huge upsurge in world commodity prices pushed India's inflation similarly high. Inflation measured in terms of wholesale price index (WPI) sickly-looking at 12.9 percent in early August 2008 and endured high for some time. From mid-September till the end of October 2008 the economy was in the control of a serious liquidity crisis and credit crunch as detailed earlier. The Reserve Bank of India (RBI)

acted violently from mid-October to ease the situation by a series of rate cutting and liquidity injecting measures till April 2009 (Joseph, 2009).

Unemployment refers to those people who are available for work at the current wage rate but they do not find the work. Issue of unemployment is a big problem in Indian economy and it creates many social, economic and political problems. There are three measurements for gauging the unemployment in Indian economy. These are: Usual Principle Status, Current Weekly Status and Current Daily Status. Industry is a large employment intensive sector. Once the industrial sector is adversely affected, it has a cascading effect on employment scenario. The services sector is affected because hotel and tourism have significant dependency on high-value foreign tourists. Real estate, construction and transport are also adversely affected. Apart from GDP, the bigger concern is the employment implications¹¹. A survey conducted by the Ministry of Labour and Employment states that in the last quarter of 2008, five Lakh workers lost jobs. The survey was based on a fairly large sample size across sectors such as Textiles, Automobiles, Gems & Jewellery, Metals, Mining, Construction, Transport and BPO/ IT sectors. Employment in these sectors went down from 16.2 million during September 2008 to 15.7 million during *December 2008*¹². We can see this relationship by the Phillips Curve theory. It is the most pertinent tool for policy makers and helps them to gauge the expansion and contraction of money in the economy according to the shape of the Phillips curve. As a result of the severe and the prolonged Global Recession that unfolded in the wake of the 2007–2008 financial crises, special attention was paid to the issue of the shape of the curve. The Global Financial Crisis of 2007-08 has cast its long shadow on the economic prosperities of various countries, resulting in what has often been called the Great Recession. According to *Glen Stevens 2008*, the Governor of the Reserve Bank of Australia, no one could predict the Global Financial Crisis and its impact thereafter, (*Verick and Islam, 2010*). The World Bank estimated that the Great Recession of 2008-09 resulted in an increase in poverty of 64 million people (*World Bank, 2010*). The United States of America is the biggest economy in the world as well as exporter, importer and

¹¹Singh, N.K., 2008, “A matter of trust”, The Hindustan Times, October 20, 2008

¹²GoI, (2009), “Report on Effect of Economic Slowdown on Employment in India”, *Ministry of Labour and Employment*, p. 10.

food supplier of the world. Therefore, any calamity in USA was bound to impact the other economies in the world. Due to Globalisation, even the Indian economy could not be isolated from the present Financial Crisis in the developed economies (*Prasad and Reddy, 2009*). With India's increasing dependence on bilateral trade with other countries and its financial relationship with the advanced economies, the economic shocks across the world also jolted the National economy. The adverse impacts on the Indian economy were reduced export earning, fall in industrial growth, difficulty in generation of foreign exchange reserves, stock market and many others indicators (*Mathew, 2012*).

The Phillips Curve is one of the best knowingly discussed and most often used macroeconomic correlations. The Phillips curve captures the correlations between inflation and unemployment as well as between inflation and the output gap (*Szentmihályi and Világi, 2015*). The policy makers widely used the Phillips curve for policy implication. New Keynesian framework, *Kuttner and Robinson (2010)* found that there has been a flattening of the Phillips curve in the Globalization period in the US. While *Razin and Binyamini (2007)*, *Borio and Filardo (2007)* cite Globalisation as the reason for it, *Roberts (2006)*, among others, argues in favour of firmer anchoring of Inflation expectations. Therefore, many economist, academicians, and researchers still debate the connection between inflation and unemployment. However, this relationship actually exists in the economy. It is important to reckon how they affect each other and is there any relationship between these two variables. To check this relationship we need to examine the Phillips Curve theory (*Maximova, 2016, p. 1*).

Regarding the above issues, the purpose of this present study is to see the impact of Global Financial Crisis on inflation and unemployment in the Indian context. At that time (slowdown period), many were people fired from their jobs and this created more unemployment, while the Inflation was low. Moreover, it had negative impact on the economies for a long time. This study examines if the Phillips curve theory existed in the Pre-Recession (2002-08), Post-Recession (2009-15) and during the period from 2002-2015 in the Indian economy. Further, the study would also analyse the extent of changes in the Phillips curve shape in the Pre, Post-Recession. Whether, the shape is vertical, horizontal, flatter, downward, from pre, and post-recession. Moreover, the study also

examines if there is any affect of structural change such as the economic reform in 1991 and Global Financial crisis in the Phillips Curve relationship or not. For this purpose, the study draws reference from the data taken during the phase of 1991 to 2015.

5.1.1 Theory of Phillips Curve

The enunciation and origin of this theory came from the famous economist Alban William Housego Phillips (**A. W. Phillips**). He was the first economist who discovered and presented with convincing evidence the connection between the rate of inflation and the rate of unemployment in the UK economy. His empirical paper was published in the Economics Journal titled “*The Relation between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861-1957.*” Phillips theory was based on 100 years of data. He found an inverse relationship between the rate of inflation and rate of unemployment.

When the rate of inflation increases, then the rate of unemployment decrease and vice versa. Phillips curve slope is downward. After that, many economists found a stable relationship between the rate of inflation and the rate of unemployment and used it for policymaking. Economists like *Lipsay (1960)*, *Phelps (1967)*, *Leijonhufvud (1968)*, *Samuelson & Solow (1970)* and *Gordon (1971)* supported the Phillips Curve theory. But Phillips curve failed to explain the economic crises of the 1970s. Thus, some economists cited the delimits of the Phillips Curve theory, in particular, *Phelps (1967)*, *Friedman (1968)*, *Lucas (1976)* and *Okun (1975)* argued against the hypothesis.

There were many debates among the researchers and economists on the Phillips curve shape in the economy. Some economists re-examined this relationship and many economists supported it while on the other side, few economists criticized by Phillips curve. There are three ideologies on the Phillips curve which are: the *Classical (Keynesian)*, *Monetarist* and the *Neo-Classical*.

5.1.2 According to the Keynesian Approach: Some of the traditional Keynesians followers like Lipsay, Samuelson, and Solow tried to give theoretical justification for the described connection. Their belief was based on the concept of Static expectations.

According to them, there is some alternative between inflation and unemployment, i.e., the Phillips curve is interpreted as a certain law, a certain dogma. For example, if aggregate demand will increase, respectively the same will trend in the demand for a factor of production. They have assumed the static expectation or no change in people's expectation.

5.1.3 According to the Monetarists Approach: Monetarist economists such as Almond Phelps and Milton Friedman criticized Keynesian visions through the adaptive expectations. According to them, people's expectations are not fixed, because it is changeable and people are not money illusion. Their opinions are changeable according to their adaptive expectations based on past experience. In the long run, actual inflation and expected inflation is equal, therefore, there is no inverse relationship between the rate of inflation and rate of unemployment.

5.1.4 According to the Neo-Classical Approach: Which was supervised by Lucas, the Neo-classical approach used the term of rational expectations for criticizing the monetarist economists. They believed that inflation is based on present and future and information is available to the consumers. Hence, there is no short run or long run relationship that exists between the rate of inflation and the rate of unemployment.

Hence, it is evident that there are three different tangents to address and interpret the Phillips curve theory. The Phillips curve theory propounds an inverse relationship between the rate of Inflation and the rate of Unemployment in the economy. Phillips found a stable and inverse relationship between inflation and unemployment, though he did not talk about the short term or long term phases. According to Milton Friedman, two studies have described the possibility of Phillips curve; first is the short run and the second is the long run relationship between the rate of inflation and rate of unemployment.

5.1.5 Short Run Period: Phillips curve theory described that there is an inverse relationship between the rate of inflation and rate of unemployment. If the money wage rate is increasing then the rate of unemployment decreases whereas if the money wage

rate is decreasing, then the rate of unemployment increases. This is the downward and negative slope.

5.1.6 Expectations and the Long Run Phillips Curve: The phenomenon of stagflation and the break down in the Phillips curve led the economists to lay more emphasis on the role of expectations in the relationship between unemployment and inflation. Economists opined that the workers and consumers tend to adapt and alter their expectations for future inflation rates based on the present rates of inflation and unemployment. Hence, the inverse relationship between inflation and unemployment could only hold over the short run.

When the central bank increases inflation with the intent to contain and reduce unemployment, there may be an initial shift along the short run Phillips curve. However, as workers and consumers' expectations about inflation adapt to the new environment, in the long run the Phillips curve itself can shift outward. This is more prevalent around the Natural Rate of Unemployment or NAIRU (Non Accelerating Inflation Rate of Unemployment). Thus, it becomes evident that in the long run as expectations are tempered to adapt to the possibilities of changes in the inflation rates, then the Phillips curve resembles the vertical line at the NAIRU.

During stagflation, as soon as the workers and consumers become aware of the fact that there is likely to be a revision or expansion of monetary policy, there is a growing tendency to expect higher inflation rates. This rationale can cause an outward shift in the short run Phillips curve even before the expansionary monetary policy has been implemented. In such a situation, any policy would become ineffectual in lowering the unemployment. And, in effect, the short run Phillips curve also becomes a vertical line. In the Long run period there is a direct relationship between the rate of inflation and rate of unemployment. If money wage rate increases then the wage rate of unemployment also increases. Due to the adaptive expectations, the Actual Rate of Inflation and Potential Rate of Inflation is equal in the long run, therefore Phillips curve slope is vertical in the long run.

5.2 Objective and Hypothesis of the Study

The key intent of the study is to check whether the original Phillips curve relationship exists or not in the Pre-Recession (2002-2008), Post-Recession (2009-2015) and over the period from 2002 to 2015 in the context of the Indian economy.

Hypothesis

H_0 = There is direct relationship between the rate of inflation and the rate of unemployment in the Pre and Post-Recession period, as well as whole study period in the context of the Indian economy.

H_a = There is inverse relationship between the rate of inflation and rate of unemployment in pre and Post-Recession period, as well as in the whole study period in context of India.

5.3 Period of Time and Data Source

This chapter is essentially based on secondary time series data. The data has been taken from the time period between 2002 to 2015, furthermore, this time period has been divided into two categories which are the Pre (2002-08) and the Post-recession (2009-15). We have taken the data of inflation rate and unemployment rate from reliable authentic database such as the World Bank database. To fulfill our objective we employed, first, the Augmented Dickey-Fuller test for unit root. After that, we used the double log model for removing variance or change of data in percentage form. Polynomial Linear Regression is used for showing the relationship between variables or in other words for curve fitting. Thereafter, the Simple Linear Regression has been used to examine the cause and effect of the relationship.

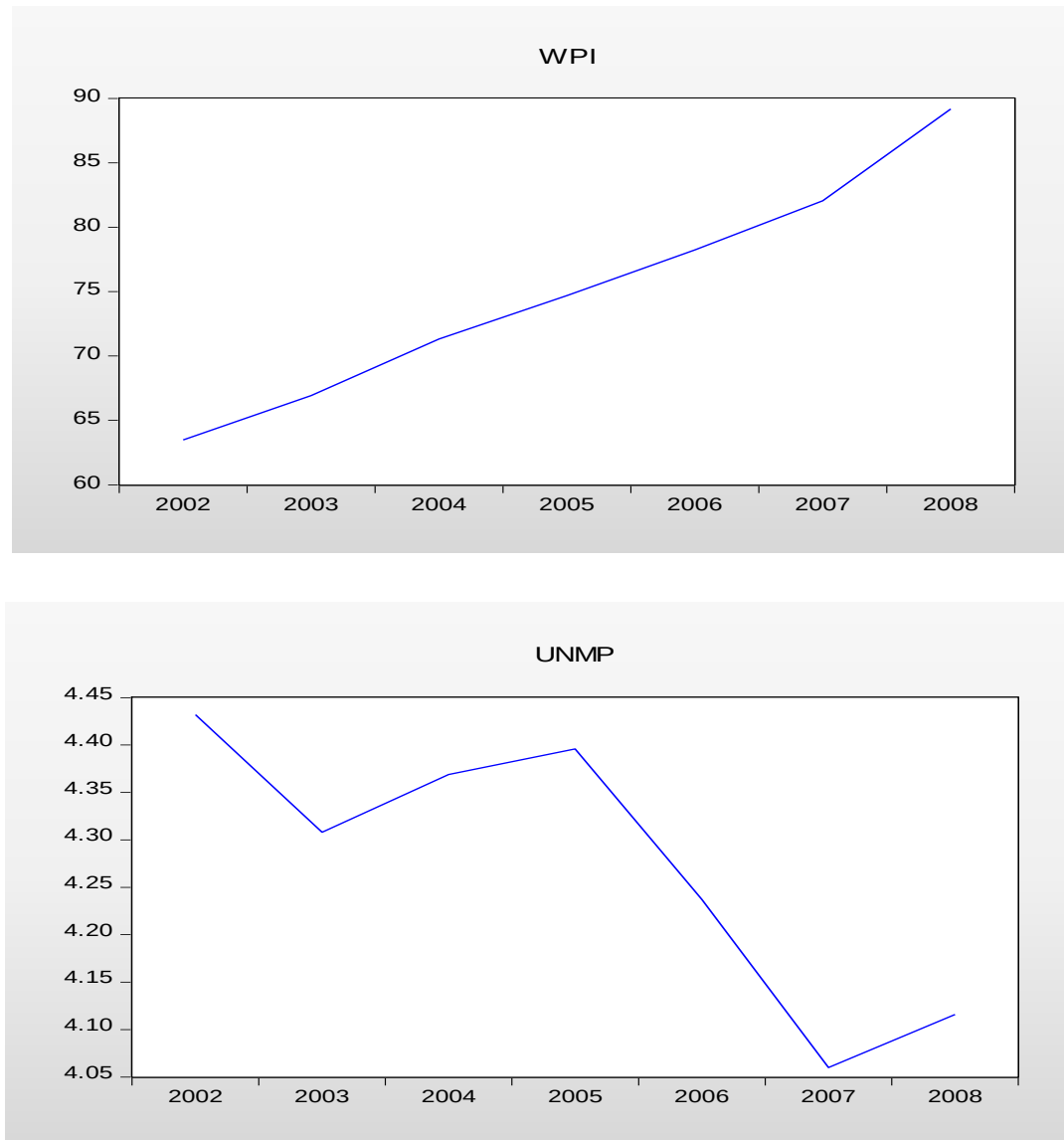
5.4 Methodology and Estimation Process

This study is based on the secondary and time series database. Before applying any test or model on data, it is important to check our variables nature and determine whether they are stationary or non-stationary. This study's data is non-stationary. Therefore, we have applied the Augmented Dickey Fuller test for stationarity. We have found that our

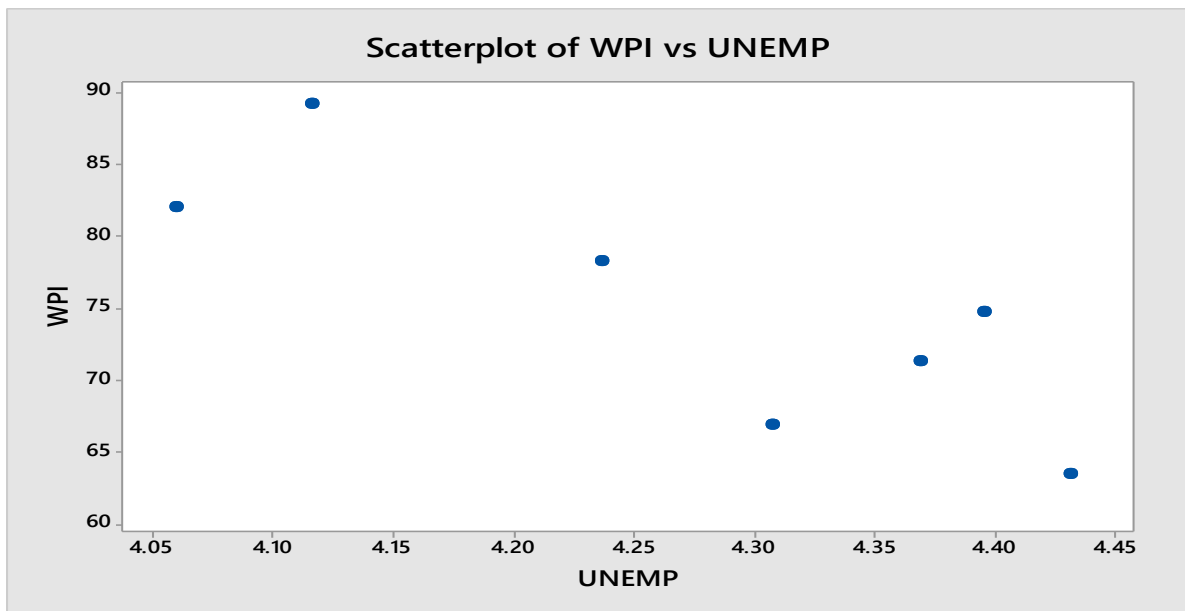
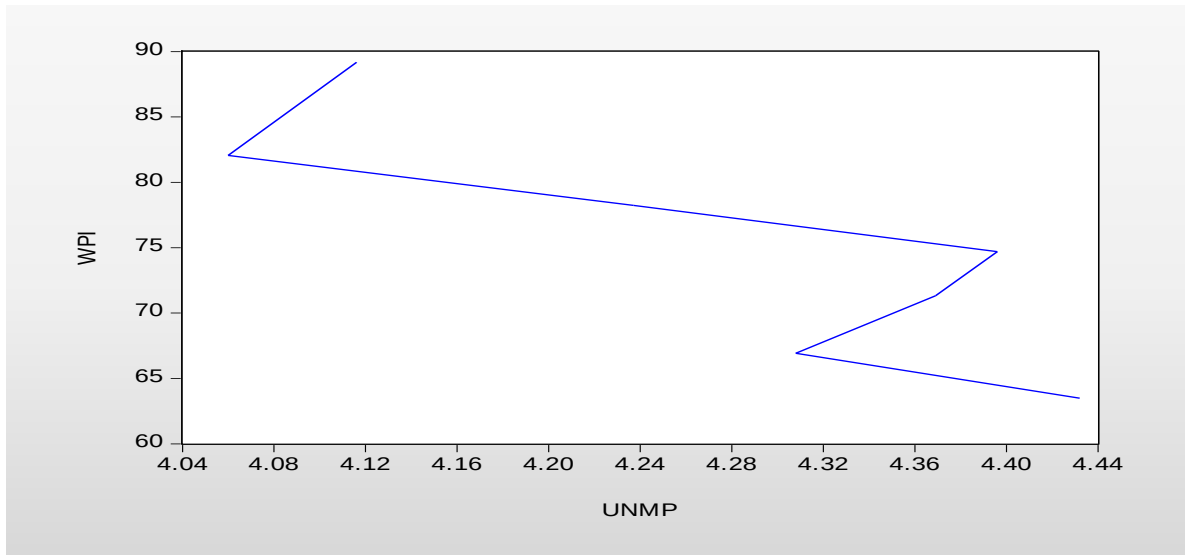
variables are non-stationary in nature. So, we transformed the data from non-stationary to linear by the linear log model $(\log_{10})^{13}$. We have taken both sides log in the dependent and independent variable.

5.5 Pre-Recession Period (2002 -2008)

Figure 5.5.1: Trends of Rate of Inflation and Rate of Unemployment



¹³If you use natural log values for your independent variables (X) and keep your dependent variable (Y) in its original scale, the econometric specification is called a *linear-log model* (basically the mirror image of the log-linear model). These models are typically used when the impact of your independent variable on your dependent variable decreases as the value of your independent variable increases.



Data Source: World Bank

The above graphs show the trends in inflation and unemployment during the pre-recession period. The pre-recession period is showing an increased trend of inflation and decreased trend of unemployment, furthermore, its combination shows a downward slope. Y-axis represents the inflation rate (WPI) and the Y-axis represents the unemployment rate. In addition, scatter Plot also plotted.

5.5.1 Unit root Test for Stationary: Augmented Dickey Fuller

Named after the American statisticians David Dickey and Wayne Fuller, who developed the test in 1979, the Dickey-Fuller test is used to determine whether a unit root (a feature that can cause issues in statistical inference) is present in an Autoregressive Model. The formula is appropriate for trending time series like asset prices. It is the simplest approach to test for a unit root, but most economic and financial times series have a more complicated and dynamic structure than what can be captured by a simple autoregressive model, which is where the augmented Dickey-Fuller test comes into play¹⁴.

Earlier testing whether any cointegration exists between inflation and unemployment the standard augmented dickey fuller test is applied to check for the order of cointegration of variables in table 5.5.1 below.

Table 5.5.1: ADF Test for Difference First Order Data, (2002 to 2008)

Variables	ADF value DF-T Statistics	Critical value of Mackinnon in levels of significance		Result of Test	Stationary or not Stationary
		1%	5%		
Inflation	-0.490701	-5.604618	-3.694851	H ₀ is accepted	Not stationary
Unemployment	-1.823522	-5.604618	-3.694851	H ₀ is accepted	Not stationary

Table 5.5.1 describes that the data are not stationary at a level; therefore, we have to first convert the data into the first, second and third differentiate of order. However, it was not stationary in any order of differentiate. Variables are non-integrated in any order and also non-stationary.

Curve Fitting with Log Functions in Polynomial Linear Regression model

Simple Regression Functions:

$$Y = \beta_0 + \beta_1 X_1 + \varepsilon_t$$

The log transformation permits linear models to fit curves that are otherwise possible only with Nonlinear Regression

$$\text{A log form: } L_N Y = \beta_0 + \beta_1 L_N X_1 + \varepsilon_t$$

¹⁴ www.thoughtco.com

Furthermore, to apply the Simple Linear Regression model for seeing the cause and effect relationship between rate of Inflation and rate of Unemployment.

Curve Fitting by the Polynomial Regression Model

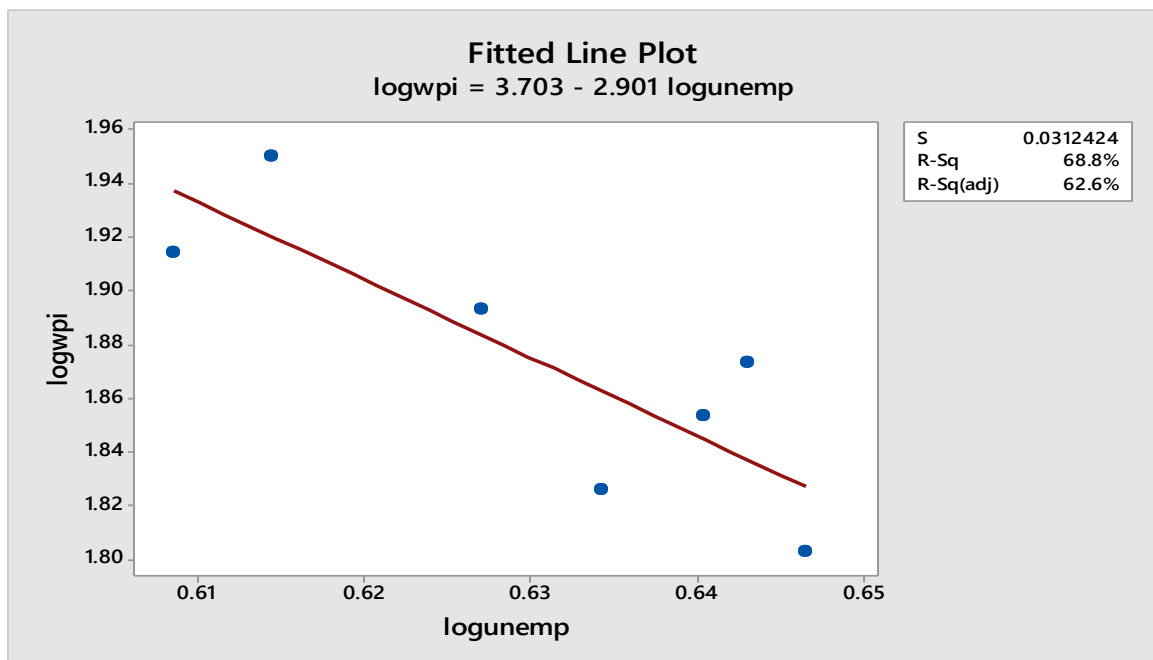
The most common approach to fit curves to the data using Linear Regression is to include Polynomial terms, such as squared or cubed¹⁵.

A polynomial term—A Quadratic (squared) or Cubic (cubed) term turns a Linear Regression Model into a curve. However, because it is X that is squared or cubed, not the Beta coefficient, it still qualifies as a linear model. This makes it a nice, straightforward way to model curves without having to model complicated non-linear models¹⁶. Linear Polynomial is any polynomial defined by an equation of the form

$$P(x) = ax + b$$

Where a and b are real numbers. A linear polynomial is the same thing as a degree 1 polynomial.

Figure: 5.5.2 Curve Fitting by the Polynomial Regression Model



¹⁵blog.minitab.com/.../curve-fi

¹⁶<https://www.theanalysisfactor>

Figure 5.5.2 shows the inverse relationship between rate of inflation and rate of unemployment in the Pre-Recession period. This Polynomial Regression Line is best fit because the standard error is 0.0312424; R-squared value is 68.8 % and Adjusted R square value is 62.6 % which tell us that the model is good and desirable.

Table-5.5.2 Interpretation of ANOVA

Source	SS	DF	MS
Model	.00088116	1	.00088116
Residual	.000399027	5	.000079805
Total	.001280187	6	.000213365

The ANOVA (analysis of variance) table splits the sum of squares into its components.

Total Sum of Square = Residual (error term) Sum of Square + Regression (unemployment) Sum of Square.

Table-5.5.3 Analysis of Regression Coefficient

Log Unemployment	Coef.	Std. Err.	t-stat	P >(t)	Upper	Lower
Log WPI	-.237226	.0713922	-3.32	0.021	-.4207455	-.0537064
Constant	1.074998	.133775	8.04	0.000	.7311187	1.418878

Sources: Authors Estimation from the Secondary Data.

The model can be written in the following functional form:

$$UNEP = f(INF)$$

UNEP = Rate of Unemployment

INF = Rate of Inflation

F = functional relationship

Increasing the model into a Linear Mathematical Relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An Econometric model, by including the stochastic term (ui), is demonstrated below:

$$Y = \alpha + \beta_1 X_1 + \varepsilon_t$$

Y = Rate of Unemployment, α = intercept of y (Constant Coefficient),

β = Slope for X_i (coefficient of X_i) and X_i = independent variable.

but we have taken log with both sides which is called the log Linear Regression Model, so our model becomes:

$$\text{A log form as: } L_N Y = \beta_0 + \beta_1 L_N X_1 + \varepsilon_t$$

Here the output puts on the equation

$$L_N \text{unemployment rate} = 1.074998 + L_{N,INF} \cdot -0.237226 + \varepsilon_t$$

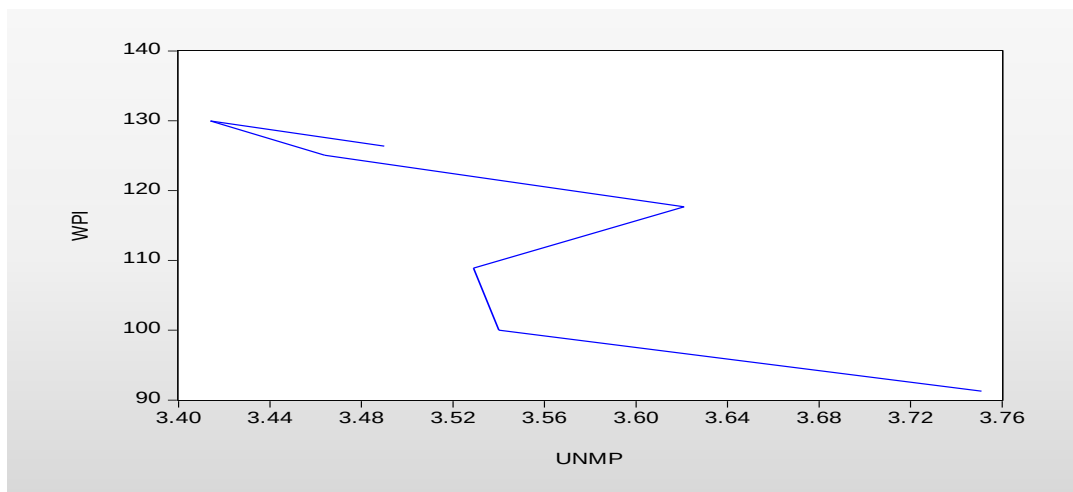
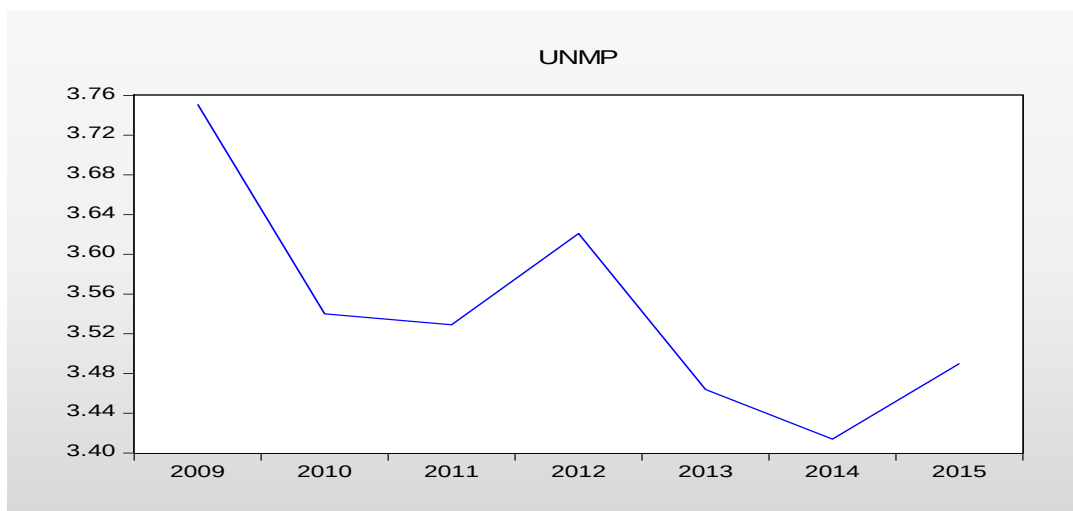
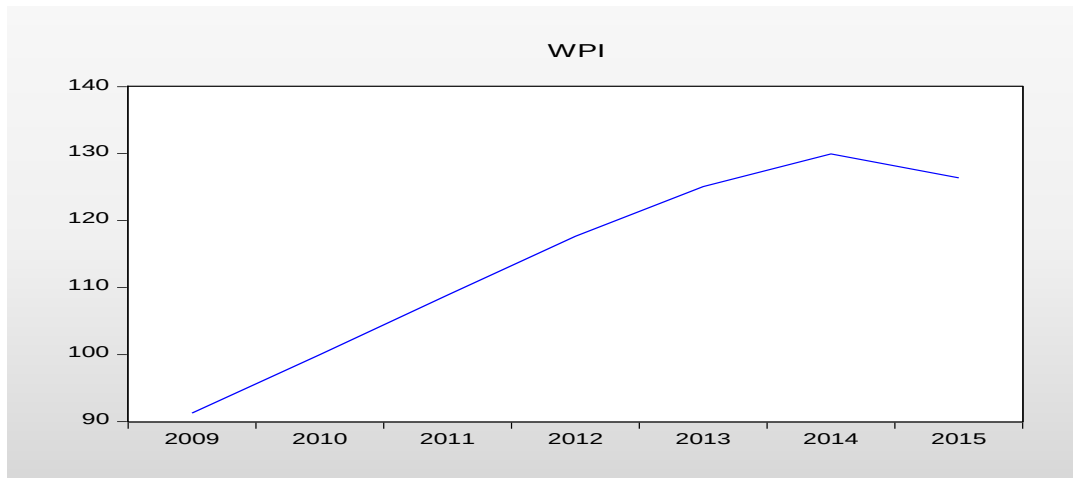
According to the statistical model, one percent change in inflation rate will affect one percent change in unemployment but as noted in the model, coefficient value of inflation is negative. Hence, there is inverse relationship between the rate of inflation and rate of unemployment in Pre-Recession period.

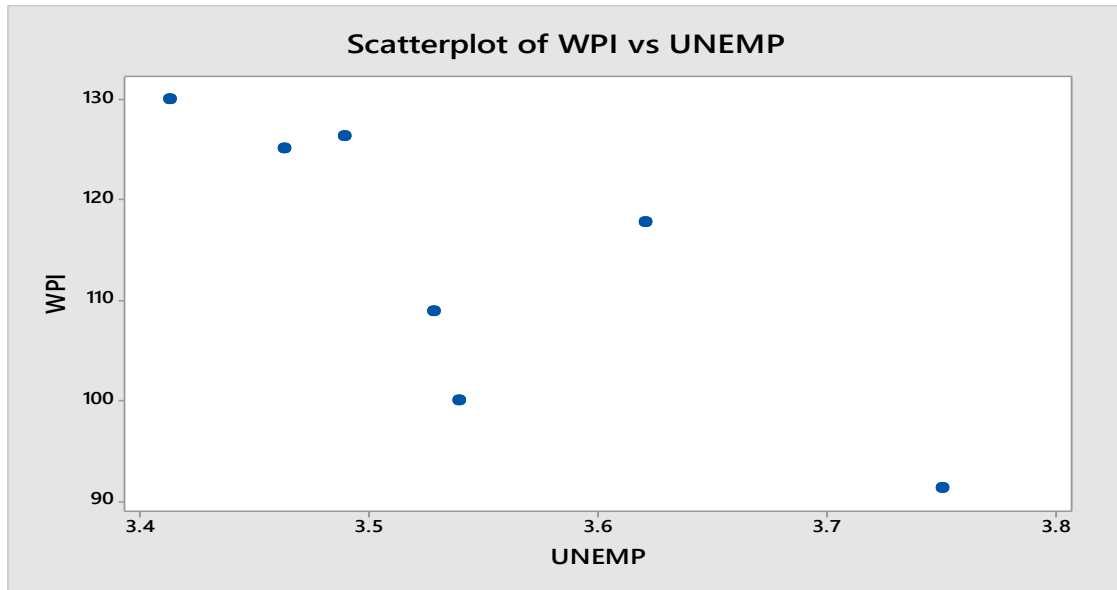
Analysis of Regression coefficient- The coefficient value is (1.074998), Standard. Error. (.0713922). t-stat (-3.32) and p value (0.021). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There is positive relationship between the rate of inflation and rate of unemployment in the Pre-recession period and $H_0 \neq 0$. While the p value is more than t-stat ($0.021 > -3.32$) but p value significant at 5 % level of significant. Hence, the null hypothesis is rejected at the 5% level of significance and it concludes an inverse relationship between the rate of inflation and rate of unemployment with the pre-recession time.

5.6 Post-Recession Period (2009- 2015)

Figure 5.6.1: Trends of Rate of Inflation and Rate of Unemployment





Data Source: World Bank

The above figures show the trend of inflation and unemployment during the Pre-Recession period. The pre-recession period shows an increased trend of inflation and decreased trend of unemployment. Further, its combination shows a downward shape. Wherever, Y-axis describes the inflation rate (WPI) and X-axis describes the unemployment rate. In addition, the scatter plot also plotted.

Table 5.6.1: ADF Test for Difference First Order Data, (2009 to 2015)

Variables	ADF value DF-T Statistics	Critical value of Mackinnon in levels of Significance		Result of test	Stationary or not stationary
		1%	5%		
Inflation	8.641810	-5.604618	-3.694851	H₀ is accepted	Not stationary
Unemployment	-2.582061	-5.604618	-3.694851	H₀ is accepted	Not stationary

Table 5.6.1 describes that the data is not stationary at level; therefore, we have to first convert it into the first, second and third differentiate of order. However, it was not stationary in any order of differentiate. Variables are non-integrated and non-stationary.

Figure 5.6.2 Curve Fitting by The Polynomial Regression Model

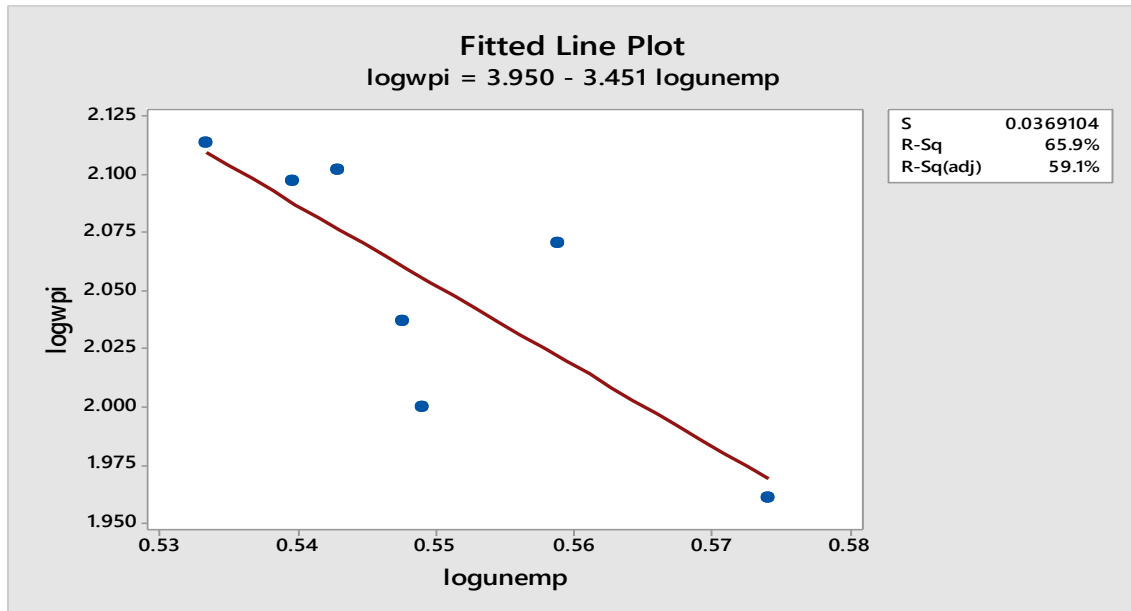


Figure 5.6.2: this figure shows the inverse relationship between rate of inflation and rate of unemployment in post-recession period. This polynomial regression line is best fit because Standard Error is 0.0369104; R-squared value is at 65.9 % and Adjusted R Square Value is 59.1 % which tell us that model is good and desirable.

5.6.1 Analysis of Regression Result

Table 5.6.2 Interpretation of ANOVA

Source	SS	DF	MS
Model	.000727725	1	.000727725
Residual	.000376852	5	.00007537
Total	.001104577	6	.000184096

The ANOVA (analysis of variance) table splits the Sum of Squares into its components.

Total sum of square = Residual (error term) sum of square + regression (unemployment) sum of square.

Table 5.6.3 Analysis of Regression Coefficient

Log Unemployment	Coef.	Std. Err.	t-stat	P >(t)	Upper	Lower
Log WPI	-.1909133	.0614403	-3.11	0.027	-.3488505	-.032976
Constant	.9415353	.1262639	7.46	0.001	.6169637	1.266107

Sources: Authors Estimation from the Secondary Data.

The model can be written in the functional form as follows:

$$UNEP = f(INF)$$

UNEP = Rate of Unemployment

INF = Rate of Inflation

f = functional relationship

Increasing the model into a Linear Mathematical Relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An econometric model, by including the stochastic term (ui), thus our model becomes:

$$Y = \alpha + \beta_1 X_1 + \varepsilon_t$$

Y = Rate of inflation, α = intercept of y (constant coefficient),

β = slope for X_i (coefficient of X_i) and X_i = independent variable.

but we have taken log with both side: which is called log log linear regression model so our model becomes:

$$\text{A log form as;} \quad L_N Y = \beta_0 + \beta_1 L_N X_1 + \varepsilon_t$$

Here the output puts on the equation

$$L_N \text{unemployment rate} = \beta_0.9415353 + L_N x_{i INF} -.1909133 + \varepsilon_t$$

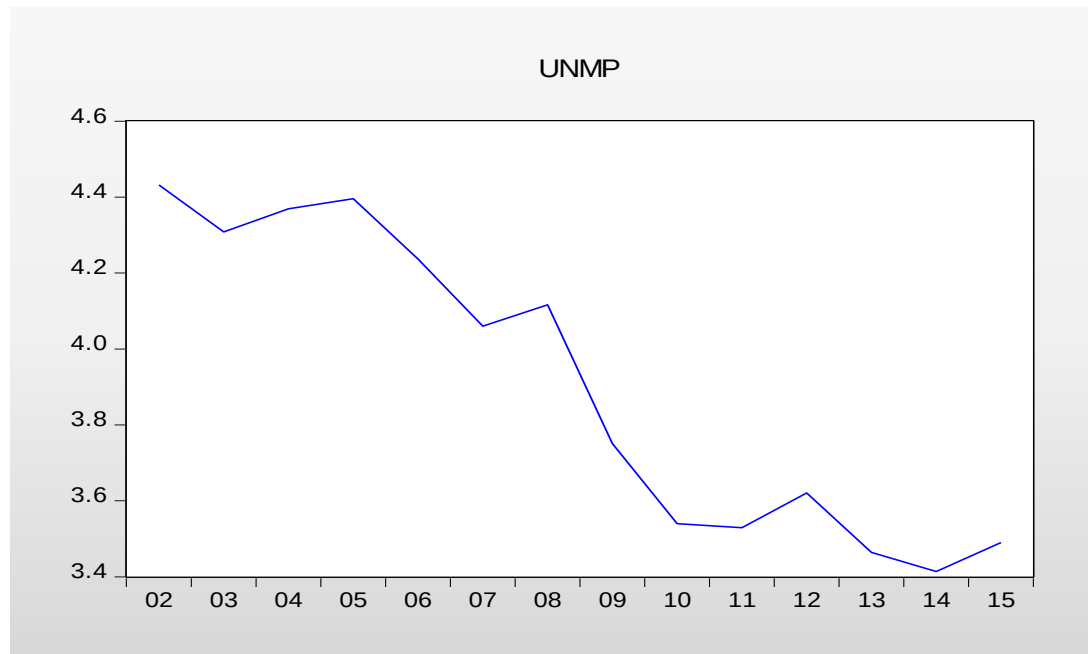
According to the statistical model, one percent change in inflation rate will affect one percent change in unemployment but as noted in the model, coefficient value of inflation is negative. Hence, there is inverse relationship between rate of inflation and rate of unemployment in the Post-Recession period.

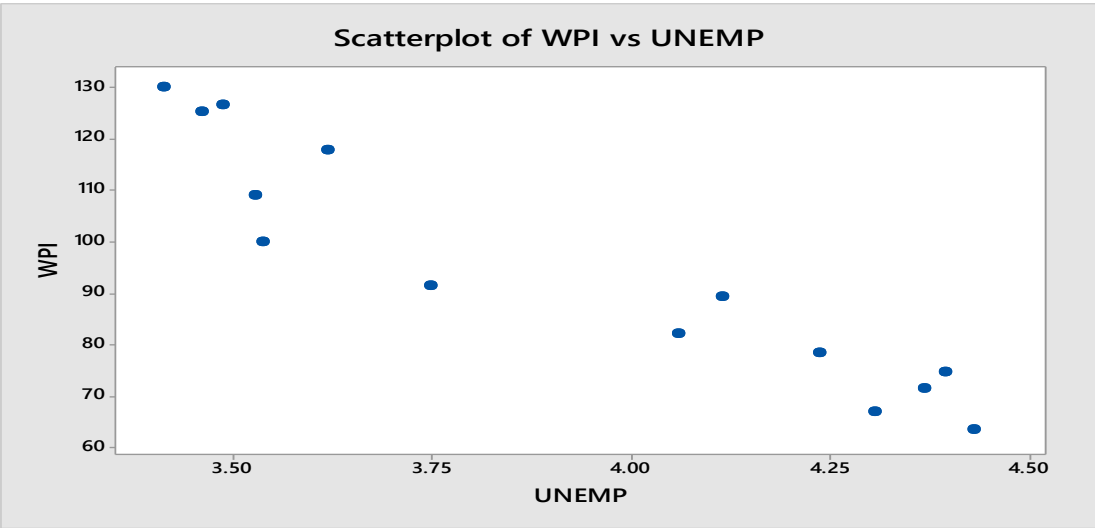
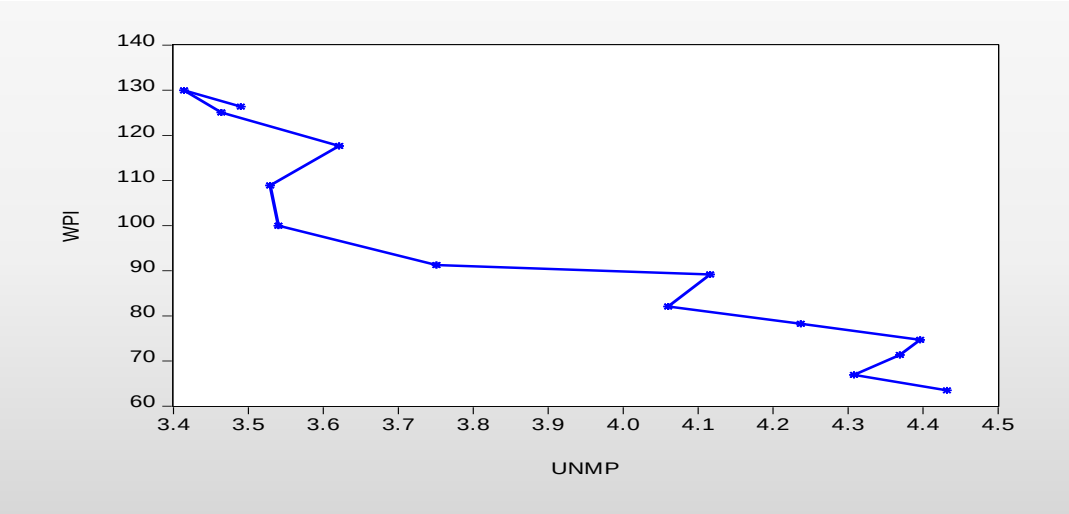
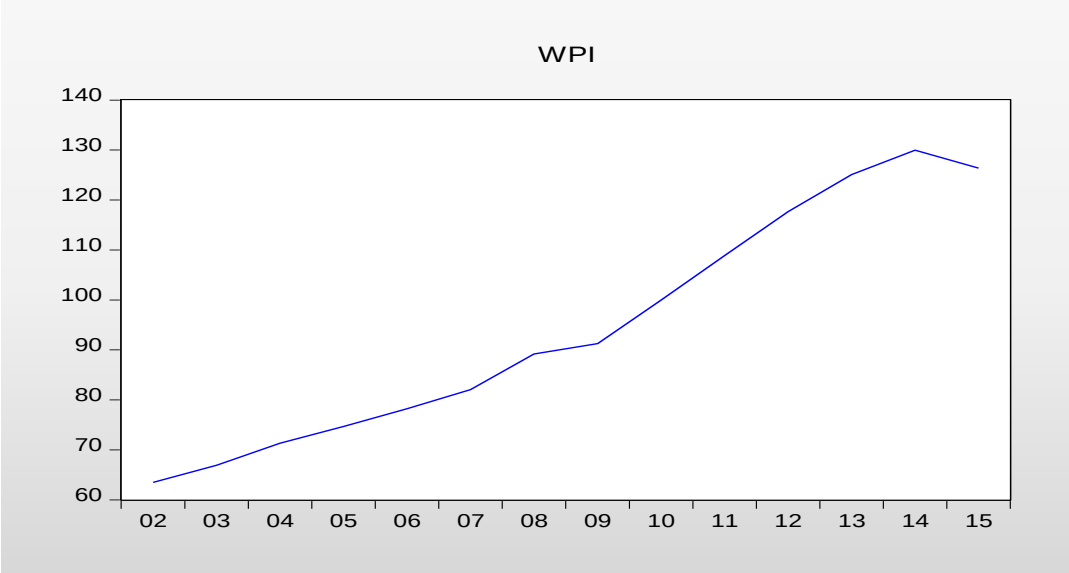
Analysis of Regression Coefficient: The coefficient value is (.9415353), Standard Error (.0614403). t-stat (-3.11) and p value (0.027). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

There is no inverse relationship between rate of inflation and rate of unemployment in the Post-Recession period and $H_0 \neq 0$. While the p value is more than t-stat ($0.027 > -3.11$) but p value significant at 5 % level of significance. Therefore null hypothesis is rejected at the 5% level of significance and it concludes an inverse relationship between the rate of inflation and rate of unemployment with post-recession period.

5.7.1 Over period of study 2002 to 2015

Figure 5.7.1: Trends of Rate of Inflation and Rate of Unemployment (2002 to 2015)





Data source: World Bank

The above graphs show the trends in inflation and unemployment from 2002 to 2015 over period. This period shows an increased trend of inflation and decreased trend of unemployment. Its combination shows a downward slope. Here, the Y-axis describes the inflation rate (WPI) and the y-axis represents unemployment rate. In addition, the scatter plot also plotted.

5.7.1 Dickey Fuller Test for Stationary

Table 5.7.1: ADF Test for Difference First Order Data, (2002 to 2015)

Variables	ADF value DF-T Statistics	Critical value of Mackinon in levels of significance 1% , 5%		Result of Test	Stationary or not stationary
Inflation	-1.395328	-4.121990	-3.144920	H ₀ is accepted	Not stationary
Unemployment	-3.221894	-4.121990	-3.144920	H ₀ is accepted	Not stationary

Table 5.7.1 describes that the data is not stationary at level; therefore, we have to first convert it into the first, second and third differentiate of order. However, it was not stationary in any order of differentiate. Variables are non-integrated and non-stationary.

Figure 5.7.2: Curve Fitting by the Polynomial Regression Model

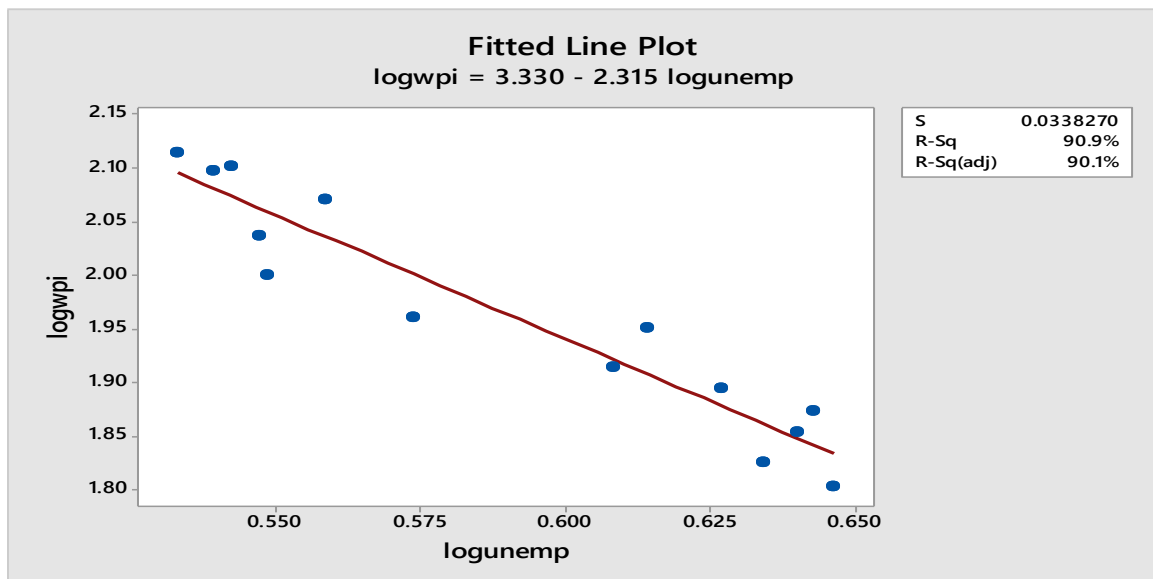


Figure 5.7.2 shows the inverse relationship between rate of inflation and rate of unemployment in this whole study time period for 14 years. Y axis is the rate of inflation (wholesale price index) and X axis is the rate of unemployment. This polynomial regression line is best fit because standard error is 0.0338270; R-squared value, 90.9 % and Adjusted R square value 90.1 % which tell us that the model is good and desirable.

5.7.2 Analysis of Regression Result

Table-5.7.2 Interpretation of ANOVA

Source	SS	DF	MS
Model	.023188761	1	.023188761
Residual	.002328112	12	.000194009
Total	.025516874	13	.001962836

The ANOVA (analysis of variance) table splits the sum of squares into its components.

Total sum of square = residual (error term) sum of square + regression (unemployment) sum of square.

Table 5.7.3 Analysis of Regression Coefficient

Log Unemployment	Coef.	Std. Err.	t-stat	P >(t)	Upper	Lower
Log WPI	-.3925299	.0359042	-10.93	0.000	-.4707584	-.3143014
Constant	1.360823	.0706065	19.27	0.000	1.206984	1.514661

Sources: Authors' Estimation from the Secondary Data.

The model can be written as a functional form as follows:

$$UNEP = f(INF)$$

$$UNEP = \text{Rate of Unemployment}$$

$$INF = \text{Rate of Inflation}$$

f = functional relationship

Increasing the model into a linear mathematical relationship

$$y = \alpha + \beta_1 X_i \dots\dots\dots \text{equation 1}$$

An econometric model, by including the stochastic term (ui), is demonstrated below:

$$Y = \alpha + \beta_1 X_1 + \varepsilon_t$$

Y = Rate of unemployment , α = intercept of y (constant coefficient),

β = slope for X_i (coefficient of X_i) and X_i = (INF) independent variable.

but we have taken log with both side which is called the log linear regression model so our model becomes:

$$\text{A log form as: } L_N Y = \beta_0 + \beta_1 L_N X_1 + \varepsilon_t$$

Here the output puts on the equation

$$L_N \text{unemployment rate} = \beta_0 1.360823 + L_N x_i INF -.3925299 + \varepsilon_t$$

According to the statistical model, one percent change in inflation rate will affect one percent change in unemployment but as noted in the model, coefficient value of inflation is negative. Hence, there is inverse relationship between the rate of inflation and rate of unemployment in this whole study period, for 14 years.

Analysis of Regression Coefficient: The coefficient value is (1.360823), Standard Error (.0359042). t stat (-10.93) and p value (0.000). Hypothesis testing: $H_0=0$ versus $H_0 \neq 0$.

there is no inverse relationship between rate of inflation and rate of unemployment in this whole study period and $H_0 \neq 0$. While p value is more than t-stat ($0.000 > -10.93$) but p value is significant at 1 percent level, which indicate negative relationship between inflation and unemployment. Therefore null hypothesis is rejected at the 1% level of significance and it concludes an inverse relationship between the rate of inflation and rate of unemployment in pre, post and over the time period of this study.

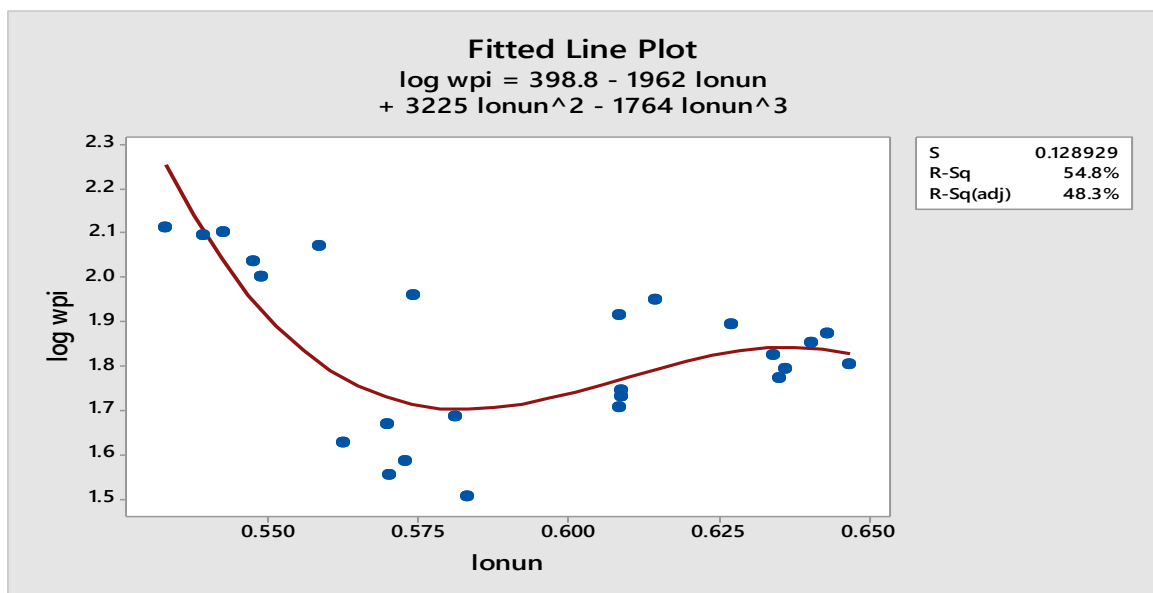
In addition, we have estimated the Phillips curve shape from 1991 to 2015. As well as to check the validity of shape, short run and long run existence in Indian economy by the ARDL model.

Before applying any model we have to first check the data's nature for the spurious or nonsense relationship. Since we found structural breaks, therefore, both tests such as Dickey Fuller and Phillips Perron test are used in this study. After that, the unit root checking by Augmented Dickey Fuller test and Phillips perron test found that one variable data series is stationary at level and second variable data is stationary at level one. According to the data's nature we have applied the Auto Regressive Distributive Lag (ARDL) Model.

We draw the Phillips curve using log-log model (algorithm) model to remove the variance of series so, we have taken the $\log^{10}$ after that plotted the Phillips curve shape by the polynomial regression.

5.8 Extended time period 1991 to 2015

Figure 5.8.1: Phillips Curve Shape using Polynomial Regression Model



This figure 5.8.1 shows the inverse relationship between rate of inflation and rate of unemployment for some time after that it shows the direct relationship between rate of inflation and rate of unemployment in the Indian context from 1991 to 2015, although we have found unidirectional (one-way) relationship in these variables and not bi-directional (two-way) relationship.

Table 5.8.1: The Summary of Descriptive Analysis

Variable	Inflation	Unemployment	Dummy UNEP.	Dummy INF.
Mean	73.95298	3.921160	0.320000	0.360000
Median	66.92171	3.832000	0.000000	0.000000
Maximum	129.9643	4.432000	1.000000	1.000000
Minimum	31.89419	3.414000	0.000000	0.000000
Std. Dev.	30.04892	0.332437	0.476095	0.489898
Skewness	0.513636	0.078996	0.771744	0.583333
Kurtosis	2.104017	1.613511	1.595588	1.340278
Jarque-Bera	1.935495	2.028451	4.536172	4.287280
Prob.	0.379938	0.362683	0.103510	0.117227

Data source: World Bank

Table 5.8.1 clearly demonstrates the disposition of the data series. Converging over the value of Skewness, the regress and variables have positively skewed, implying long right tail about the mean and the regressors closer to normal distribution though positive. Now if we stress over the value of kurtosis, except the independent variable all the dependent variables have an almost non normal distribution with kurtosis below to 3. The Jarque-Bera test indicates residuals are normally distributed.

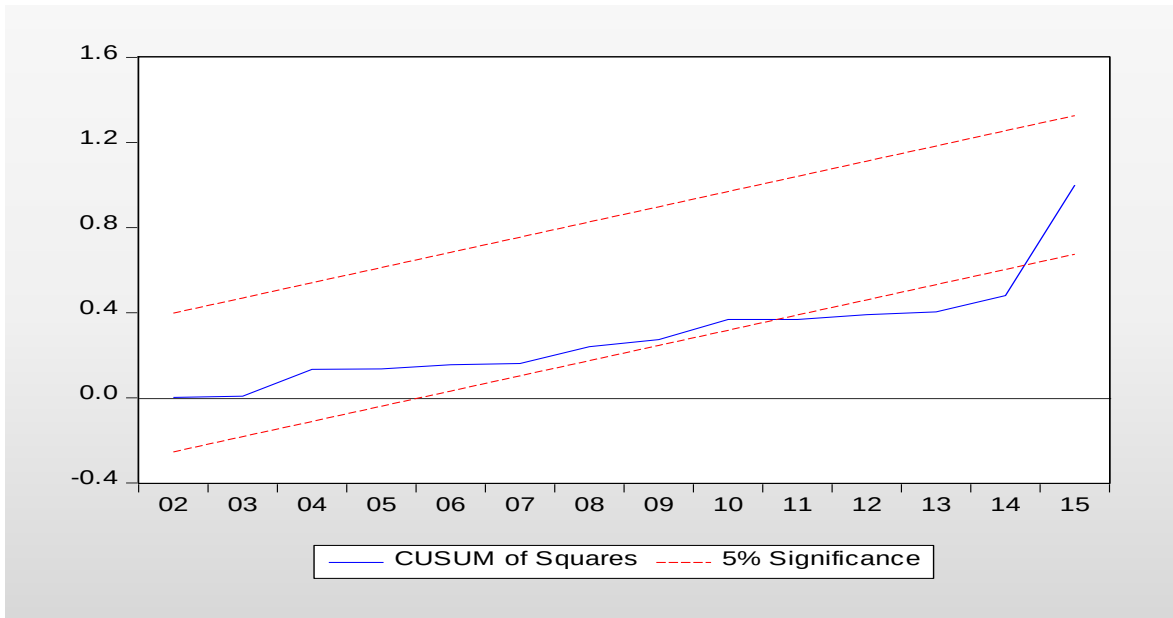
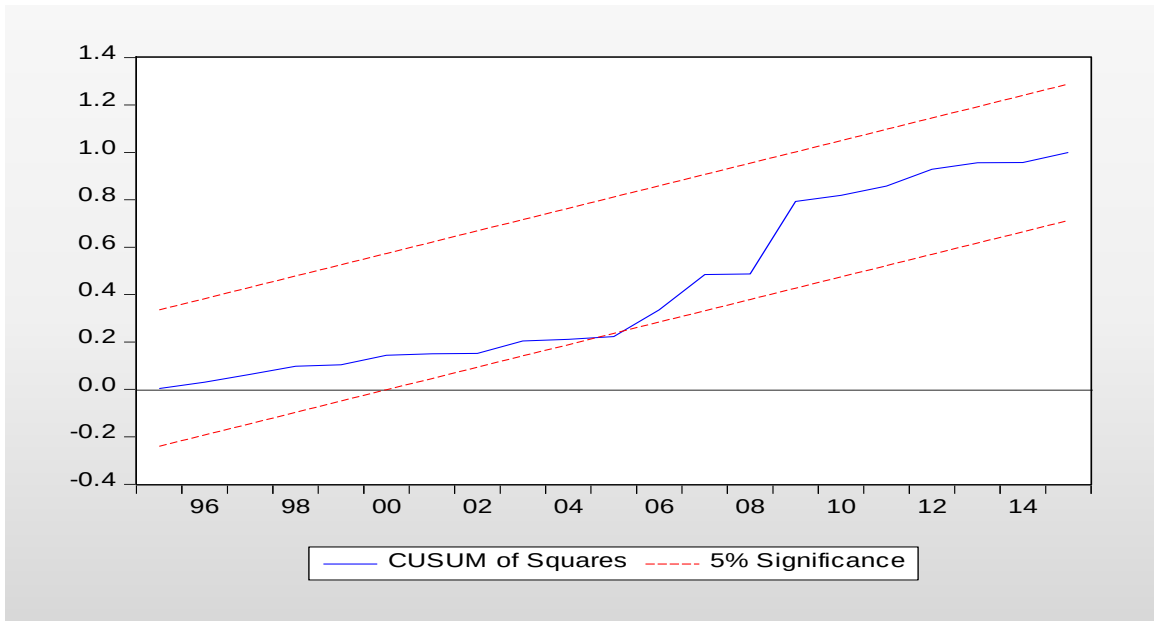
Outliers

Outliers indicates that when an event has affected the trend of a particular series or a movement in particular series is distorted or when there is a visible difference between the past and future movements in a particular series that change is considered a structural break.

5.8.1 Preliminary Test

The figure 5.8.2 is verified form of sign of some structural breakdowns in the chosen period presented through CUSUM-Square test.

Figure 5.8.2: CUSUM-Square test



5.8.2: Testing for Structural Breaks

We applied recently developed Kim and Perron (2009) single structural break unit root test to isolate single unknown structural shocks that are streaming into series.

Table 5.8.2 Kim and Perron (2009) Structural Break Unit root Test

Variable	Break Period	t-stat. level	Prob.	Decision
Unemployment	2008	-6.256629	0.000*	Stationary
Inflation	2007	-3.402898	0.4394	Non-Stationary

* shows the significance at 1 % level of significance

Table 5.8.2 presented the Kim Perron test results founds that two structural breaks date. We have worked on both break dates.

5.8.3: Checking Stationary of Data, through the Augmented Dickey Fuller Test and Phillip Perron Test

Table 5.8.3: ADF Test for Differences First Order Data (1991 to 2015)

Variables	ADF Value DF-T Statistics	Critical value of Mackinnoon in levels of significance 1% 5%		Result of Test	Stationary or no Stationary
LnInflation (WPI)	-2.135607	-3.737853	-2.991878	H0 is accepted	Non-Stationary
Ln Unemployment	-3.947424	-3.752946	-2.998064	H0 is rejected	Stationary

Table 5.8.3 describes the Augmented-Dickey Fuller Test result and it tells us that the series of inflation is non-stationary at the level, although the series of Unemployment is at a stationary at level. So in this dataset one variable is at stationary level and one series is at stationary level one. All variables are mix stationary so we have applied Auto Regressive Distributed Lag (ARDL) model. We have also used Phillips perron test for stationarity.

Table 5.8.4: Phillips Perron Test for Differences First Order Data (1991 to 2015)

Variables	Phillips Perron Value DF-T Statistics	Critical value of Mackinon in levels of significance		Result of Test	Stationary or no Stationary
		1%	5%		
LnInflation (WPI)	-1.888000	-3.737853	-2.991878	H0 is accepted	Non- Stationary
Ln Unemployment	-3.947424	-3.752946	-2.998064	H0 is rejected	Stationary

Table 5.8.4 describes the Phillips Perron test result and it tells us that the series of inflation is non-stationary at the level, although the series of Unemployment is at a stationary at level. So in this dataset one variable is at stationary level and one series is at stationary level one. All variables are mix stationary. Both tests confirmed that we should apply Auto Regressive Distributed Lag (ARDL) model.

5.8.4: Lag Length Criteria

The maximum dependent and dynamic regress or lag limit according to AIC, SC and HQ criteria for annually data is chosen one. The table 5.8.5 represents optimal lag criteria.

Table 5.8.5: Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	55.24159	NA	2.15e-05	-5.070627	-4.971149	-5.049038
1	125.5970	120.6092*	3.89e-08*	-11.39019*	-11.09175*	-11.32542*
2	129.5188	5.976184	3.98e-08	-11.38275	-10.88536	-11.27480
3	130.5551	1.381717	5.46e-08	-11.10049	-10.40414	-10.94936
4	135.5028	5.654460	5.33e-08	-11.19074	-10.29544	-10.99644

The figure 5.8.5 shows the lag length criteria and this lag selection criteria model has suggested that we should choose lag one because in this case there are three main criteria is significant such as AIC, SC and HQ.

Table 5.8.6: Short ARDL Determination (1,0) Model Dependent Variable**Short Run ARDL Model**

Dependent Variable Δ Unemployment , ARDL(1, 0, 0, 1) Model based on AIC Criteria				
Regressor or independent variable	Coefficient	Standard Error	t-Ratio	p-value
Lag 1 Unemployemnt	0.805311	0.095234	8.456135	0.0000*
Inflation	0.069475	0.033939	2.047066	0.0540***
Dummy inflation	-0.029432	0.006139	-4.794258	0.0001*
Dummy unemployment	-0.010471	0.012823	-0.816553	0.4238

The table 5.8.6 shows the clear association between the rate of unemployment and rate of inflation in short run. Although the lagged unemployment and own lagged value of inflation has a positive impact on rate of inflation, it means direct relationship between them in the short run. while The taking account of (dummy inflation) shock of Global Financial crisis has negative impact on the rate of inflation, this means that in the negative association between rate of inflation and rate of unemployment in the short run, Phillips curve theory exists.

We can write the above result in equation form:

$$unemployment = \alpha_0 + \beta_1 \Delta_{t-1} + \beta_2 \Delta + \beta_3 \Delta + \beta_4 \Delta + \varepsilon_t$$

$$unemployment = \alpha_0 + \beta_1 \Delta_{lag\ unemp} + \beta_{inf} \Delta_{inf} + \beta_{dummyinf} \Delta_{dummyinf} + \beta_{dummyunemp} \Delta_{dummyunemp} + \varepsilon_t$$

$$unemployment = \alpha_0 + \beta_1 0.805311* + \beta_2 0.069475*** + \beta_3 -0.029432* + \beta_4 -0.010471 + \varepsilon_t$$

5.8.5: ARDL Specification Results

Bound Test Approaches to Co-integration:

Table 5.8.7: Result of Bound Test

ARDL Model Model: Unemployment = f (Inflation)		
Model	F-statistics	K
Unemployment	2.641292	1
Critical Values	Upper Bound (1)	Lower Bound(0)
10% level	3.28	2.44
5% level	4.11	3.15
1% level	6.02	4.81
K represents number of independent factors		

The table 5.8.7 shows the F-statistics that suggests that in this result f statistics value is between upper bound and lower bound at 10 percent level of significance and we have no clarity about whether there is a long run relationship or not. In this ambiguous situation, we can also apply long run ARDL because the f statistics value is the upper bound of the critical values as referred by *Pesaran et al.* (2001). This declaration thereby rejects the null hypothesis of no cointegration in the model. This indicates that there is a long run relationship among the variables in the concerned model.

5.8.6 Order of Lag

Table 5.8.8: F-Statistics for Testing the Existence of Long Run Relationship

Order of lag	F-statistics
1	2.641292

5.8.6 Results and Analysis for the Estimated Long Run Coefficients

After confirming the evidence of long run relationship with the Bound Test, furthermore we carry on to settle for the Estimated Long-run results.

Table 5.8.9: ARDL Long Run Model

Dependent Variable Δ Unemployment , ARDL(1, 0) Model based on AIC Criteria				
Regressor or independent variable	Coefficient	Standard Error	t-Ratio	p-value
Ln unemployment	-0.194689	0.091111	-2.136845	0.0452**
Ln inflation	0.069475	0.031766	2.187057	0.0408**
Dummy inflation	-0.029432	0.014832	-1.984337	0.0611***
Dummy unemployment	-0.010471	0.017571	-0.595918	0.5579

****, **And *** show significance level at 1%, 5% and 10% level, respectively.***

This table 5.8.9 shows ARDL model's long run result which clearly shows association between rate of unemployment and rate of inflation. Own lagged of unemployment is negative or inverse impact on rate of unemployment at the 5% level of significance and the rate of inflation has a positive impact on rate of unemployment at 5% level of significance. Although, the shock of Global Financial Crisis is negative or has an inverse impact on the rate of unemployment in the long run. There is also a direct relationship between the two variables in the long run. The (dummy inflation) shock of Global Financial Crisis has negative impact on the rate of unemployment and the Phillips Curve theory exists in both the short run and the long run.

$$unemployment = \alpha_0 + \beta_1 \Delta unemployment_{t-1} + \beta_2 \Delta inflation_{t-1} + \beta_3 \Delta dummyinflation_{t-1} + \beta_4 \Delta dummyunemployment_{t-1} + \varepsilon_t$$

$$unemployment = \alpha_0 + \beta_1_{-0.194689**} + \beta_2_{0.069475**} + \beta_3_{-0.029432***} + \beta_4_{-0.010471} + \varepsilon_t$$

5.8.7 Error Correction Term

Error Correction Model Specification:

$$\begin{aligned} \text{rate of unemployemnt} = & a_0 + \sum_{i=1}^p a_{1i} \Delta unemployment_{t-1} + \sum_{i=1}^q a_{2i} \\ & \Delta inflation_{t-1} + \sum_{i=1}^q a_{3i} \Delta dummyunemployment_{t-1} + \sum_{i=1}^q a_{4i} \\ & \Delta dummyinflation_{t-1} + \lambda ECT_{t-1} \dots \dots \dots (5) \end{aligned}$$

Table 5.8.10: Error Correction representation of the selected ARDL model

	Coefficient	Standard Error	t-ratio	Prob.
Coint-Eq (-1)	-0.194689	0.082665	-2.355146	0.0288**

For the study period, the equilibrium correction coefficient is -0.194689 for the model. The ECT is both negative and less than one and significant at 5 percent.

As shown in the table 5.8.10: 19.46 Percent of disequilibrium from previous period converges back to the long run equilibrium in the current period.

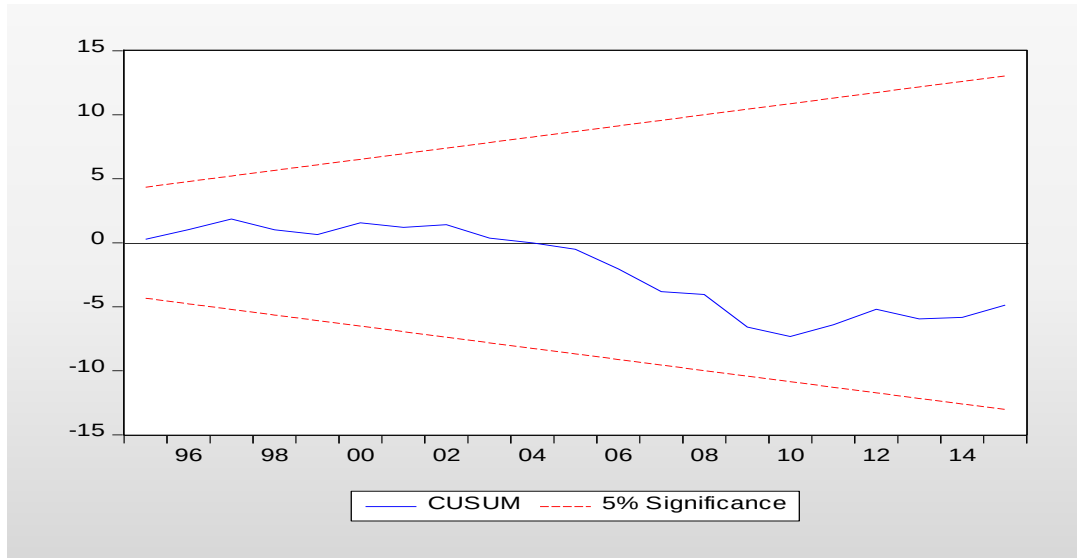
5.8.8: Diagnostic Tests

Table 5.8.11: Diagnostic Tests

Diagnostic Tests			
	Model		
Diagnostic Tests	F-stat	Prob. Value	Obs-R-square
Serial Correlation	2.120940	0.1489	4.577182
Heteroscedasticity	Breusch-Pagan-Godfrey		
	F-stat	Prob. Value	Obs-R-square
	1.484665	0.2463	5.715137
Normal distribution	Jarque-Bera	0.73854	JB 0.673854

The robustness of the estimated model has been verified by numerous diagnostic tests such as serial correlation, Heteroscedasticity test, normal distribution and CUSUM stability test. In the model there is no serial correlation, Heteroscedasticity found, as well error or residual is normally distributed therefore model is good fit. The model stands stable as shown in the CUSUM graph.

Figure 5.8.3: CUSUM Test



Second Model of Inflation

5.8.9: Short ARDL Determination (1, 0) model dependent variable

Table 5.8.12: Short Run ARDL Model

Dependent Variable Δ Inflation , ARDL (1, 0, 0, 0) Model based on AIC Criteria				
Regressor or independent variable	Coefficient	Standard Error	t-Ratio	p-value
Inflation lag one	0.941757	0.032819	28.69522	0.0000
Unemployment	0.205612	0.093795	2.192154	0.0404
Dummy inflation	0.005857	0.006298	0.930084	0.3634
Dummy unemployment	0.020496	0.009412	2.177533	0.0416

The table 5.8.12 shows the short run ARDL model's result, when the inflation is taken as the dependent variable the own lagged value of inflation and the rate of unemployment has positive impact on rate of inflation in the short run period although Global Financial

crisis also has a direct impact of on the rate of inflation. In short, the direct or positive relationship between rate of inflation and rate of unemployment exists in the short run.

5.8.10: Order of Lag

Table 5.8.13: F-Statistics for Testing the Existence of Long Run Relationship

Order of lag	F-statistics
1	30.34332

Table 5.8.14: Result of Bound Test

ARDL Model		
Model: Inflation = f (Unemployment)		
Model	F-statistics	K
Unemployment	30.34332	1
Critical Values	Upper Bound (1)	Lower Bound(0)
10% level	3.28	2.44
5% level	4.11	3.15
1% level	6.02	4.81
K represents number of independent factors		

F-statistics in the table 5.8.14 postulates for the model that the statistics crosses the upper bound of the critical values as referred by Pesaran et al. (2001). This declaration thereby rejects the null hypothesis of no co-integration in the model. This enfolds that there exists a long run relationship among the variables in the concerned model.

5.8.11: Results and Analysis for the Estimated Long run Coefficients

After confirming the evidence of long run relationship with the Bound Test, we carry on to settle for the Estimated Long-run results.

Long run Model Specification

Table 5.8.15: Long Run Model based on Bound Test

Dependent Variable Δ Inflation , ARDL (1, 0, 0, 0) Model based on AIC Criteria				
Regressor or independent variable	Coefficient	Standard Error	t-ratio	p-value
Inflation lag one	-0.058243	0.031924	-1.824464	0.0831***
Unemployment	0.205612	0.089819	2.289174	0.0331**
Dummy inflation	0.005857	0.014786	0.396144	0.6962
Dummy unemployment	0.020496	0.016349	1.253678	0.2244

** **and *** show significance level at 1%, 5% and 10% level, respectively*

The table 5.8.15 shows the long run result between the rate of inflation and rate of unemployment. This model, where the rate of inflation is dependent variable, own lagged of inflation has a negative impact on the rate of inflation at the 10% level of significance and the rate of unemployment has a positive impact on rate of inflation at 5% level of significance. According to the long run results, this model shows that both relationship such as positive and negative between lag unemployment and the inflation rate. However, there is no any impact of structural breaks (Global Financial crisis) in this model.

The long run co-integration relation can be traced in the form of the following equation:

$$inflation = \alpha_0 + \beta_1 I_{t-1} + \beta_2 + \beta_3 + \beta_4 + \varepsilon_t$$

$$inflation = \alpha_0 + \beta_1_{-0.058243***} + \beta_2_{0.205612**} + \beta_3_{0.005857} + \beta_4_{0.020496} + \varepsilon_t$$

5.8. 12: Error Correction Term

Table 5.8.16: Error Correction Representation of the Selected ARDL Model

	Coefficient	Standard Error	T-ratio	Prob.
Coint-Eq (-1)	-0.058243	0.007296	-7.982541	0.0000

For the study period, the equilibrium correction coefficient is -0.058243 for the model. The ECT is both negative and less than one and significant at 1 percent.

As shown in the table 5.8.16: 05.82 Percent of disequilibrium from previous period converges back to the long run equilibrium in the current period.

5.8.13: Diagnostic Tests

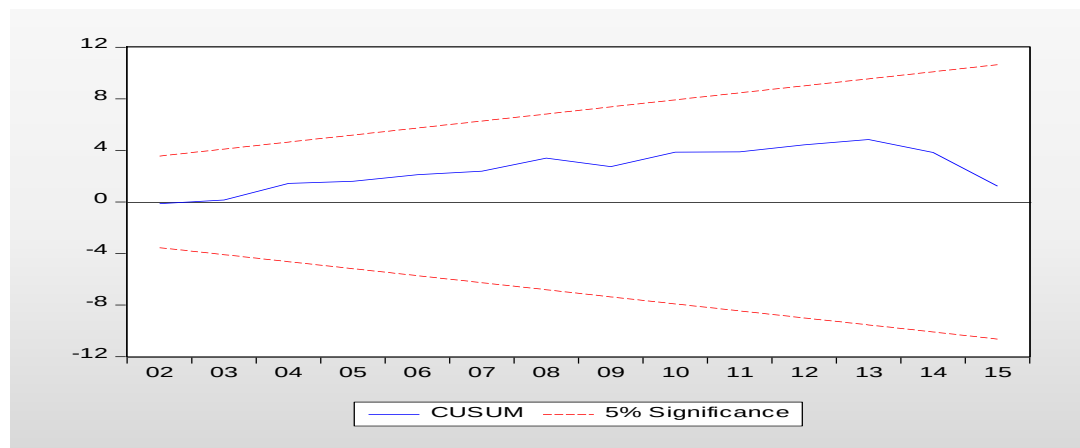
Table 5.8.17: Diagnostic Tests

Table : Diagnostic Tests			
	Model		
Diagnostic Tests	F-stat	Prob. value	Obs-R-square
Serial Correlation	0.933217	0.4115	2.254779
Heteroscedasticity	Breusch-Pagan-Godfrey		
	F-Stat	Prob. value	Obs-R-square
	1.401831	0.2713	5.468932
Normal distribution	Jarque-Bera	0.818316	JB 0.401013

The robustness of the projected model has been check by several diagnostic tests such as serial correlation, Heteroscedasticity test, normal distribution and CUSUM stability test. In the model there is no serial correlation, Heteroscedasticity as well as error or residual is normally distributed, hence the model is a good fit.

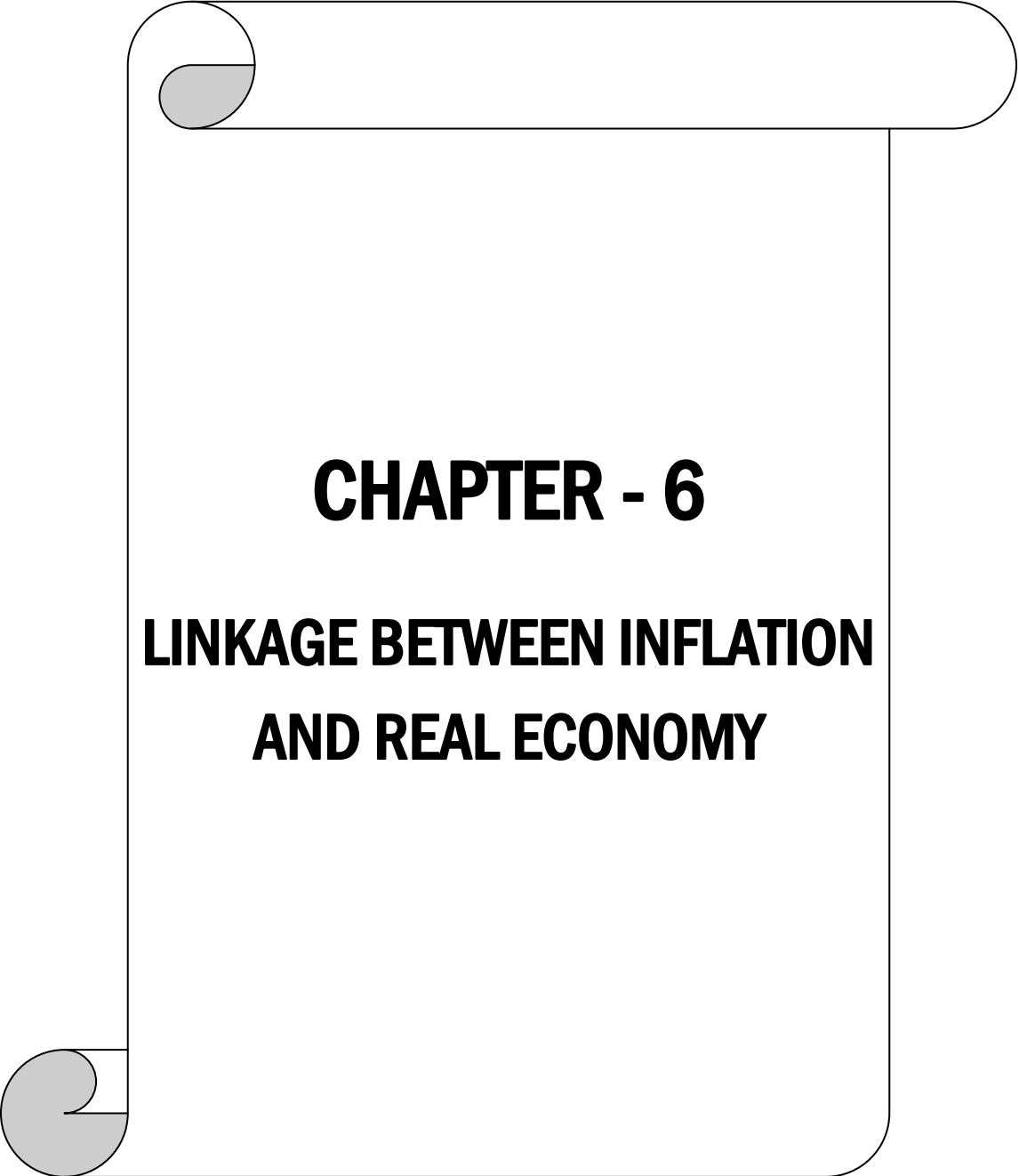
The model stands stable as shown in the CUSUM graph.

Figure 5.8.4: CUSUM Test



5.9 Concluding Facets

Chapter 5 concludes that the Phillips Curve plays an important role in policy making. According to this curve, policy authorities can create expansionary or contractionary situation of money in the economy. We concluded that during the Global Financial Crisis there was inverse relationship between the rate of inflation and the rate of unemployment in the Indian economy, in the Pre-Recession (2002-2008), Post-Recession (2009-2010) and over the period of 2002 -2015. It was noted that when rate of inflation was high, then the rate of unemployment was low and vice versa. It also mentioned few studies which are premised on the Phillips Curve, namely, *Cyril, Ogboko (2005)*, *Fumitaka and Furuoka (2007)*, *Fumitaka Furuoka, Qaiser, Munir and Hanafiah, Harvey (2013)* in other countries and *Singh, et al. (2010)*, *Kumar and Vashist, (2012)* in the Indian economy. These studies found similar results and supported that the Phillips Curve trade-off still existed in the economies. In addition, we examined the Phillips curve relationship in the extended period from 1991 to 2015. We found that the short run and long run Phillips Curve theory also existed in this period. During the phase of the Global Financial Crisis the Phillips curve theory existed for both short-run and long run in the Indian economy. We also found here the unidirectional relationship and not bidirectional relationship between them. In other words, although, the shock of Global Financial Crisis was direct or inversely associated with the rate of unemployment in the long run.



CHAPTER - 6

LINKAGE BETWEEN INFLATION AND REAL ECONOMY

LINKAGE BETWEEN INFLATION AND REAL ECONOMY

6.0 Overview

This Chapter is a follow up of Chapter Fifth and it discusses and examines the output gap concept during the Global Financial Crises from 2002 to 2015. Here we have taken the output gap concept because in Indian economy there is no quarterly or annually data on unemployment rate. Therefore, we have taken Output Gap as the proxy variable of unemployment. The general idea of excess demand or supply is not mean or constant at all times and there could be ups and downs. Moreover, the concept of Output gap has played an important role in the process of inflation and disinflation in the economies and thus this study is based on this understanding. We will first investigate the output gap as a measurement of excess supply or demand and, in addition examine the relationship between the output gap and inflation. Output gap concept indicates the actual situation of economy and foretells whether it is going to be a boom period or a slack period. To understand the association between the real economy and inflation, where the real economy relates to fiscal policy and inflation relates to monetary policy, the formulation of monetary policy is crucial. We can see the impact of inflation on real economy through the output gap. In macroeconomics, the concept of the output gap is an important component of link between real economy and inflation. The Output Gap provides a useful measure of understanding the inflationary pressure in the economy¹⁷.

6.1 Introduction

Policymakers and academicians widely use the potential output to gauge inflation and typically define it as the level of output consistent with no pressure for fluctuations in the prices in the economy. In this context, the output gap is an indicator of the relative demand and supply components of economic activity. As such, the output gap measures

¹⁷Output gap is the difference between the actual and the potential Gross Domestic Product (GDP) and is a valuable indicator in the study of business cycles.

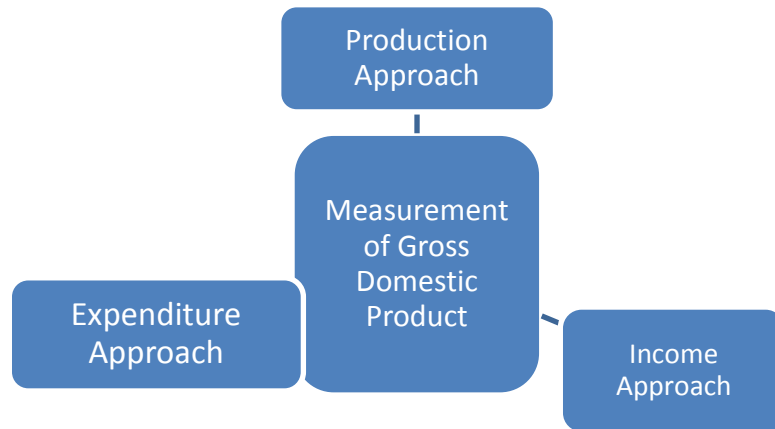
the degree of inflation pressure in the economy and is an important link between the real side of the economy, which produces goods & services and inflation. It processes a central role in policymaking. For many central banks, including the U.S. Federal Reserve, maintaining full employment is a policy goal. Full employment corresponds to an output gap of zero. Nearly all central banks seek to keep inflation under control and the output gap is a key determinant. It gauges when the economy may be overheating or underperforming, it has immediate implications for *monetary policy*

Generally during a recessionary situation, actual economic output drops below its potential, which creates a negative output gap. That below-potential performance may spur a central bank to adopt a monetary policy designed to stimulate economic growth by lowering interest rates, for instance, to boost demand and prevent inflation from falling below the central bank's inflation rate target.

6.1.1 Concept of Gross Domestic Product

Gross Domestic Product is the market value of all final goods & services produced within a country in a given specific period of time which is received money value. The concept of GDP may be simple or easy to explain, however, it is complex to measure and countries across the world have different approaches to arrive at their country's GDP. This definition provides the three approaches for measurement of Gross Domestic Product which are: the Production Approach, the Income Approach and the Final Expenditure Approach.

In India, the collection of macro variable is done by the Central Statistics Office (CSO), under the Ministry of Statistics and Program Implementation (Seth, 2017). The GDP in India is calculated using two different methods. The first method is based on economic activity (at factor cost), and the second is based on expenditure (at market prices). Further calculations are made to arrive at nominal GDP and real GDP. Among the four released numbers, the GDP at factor cost is the most commonly followed figure and reported by the academicians to show the prospectus of countries.



Production Approach: This approach is also called the *Output Approach* and it is the measurement of Gross Domestic Product as the difference between value of output less the value of goods and services used in producing these outputs during the period of time.

Income Approach: It measures Gross Domestic Product as the total of the factor incomes created to the economy.

Expenditure Approach: The expenditure approach measures the all final uses of the produced output as the total of final consumption, Gross Capital Formation and Exports less Imports (Vu Quang, 2009).

When we measure the National or Per Capita Income, equal results are applied for all the methods, as in: Production Approach = Income Approach = Expenditure Approach¹⁸.

$$\text{Gross Domestic Product} = C + I + G + (X-M)$$

Where

C = consumption is total spending by households on goods & services.

¹⁸It is important to note that this holds true only for the final or finished goods and not the intermediates goods. GDP is available in two basis such as GDP at Constant Price or Factor cost and GDP at Current or Market Prices. Since the information on inflation can be misrepresented in case of the economic variable of GDP, we have two versions of GDP. One is corrected for inflation; the other is not which is called the Nominal GDP values output using current prices and it is not corrected for inflation. Real GDP values output is known by using the prices of a base year. Real GDP is corrected for inflation. Gross Domestic Product includes so many factors and variables that we can say that GDP is total expenditure on economy. After that the total expenditure has been divided into four sub categories, for instance.

I = investment is total spending on goods that will be used in the future to produce more goods. G = government expenditure or purchases, is all spending on the goods & services purchased by government at the federal, state, and local levels.

X-M = (net export) and minus import. Exports represent foreign spending on the economy's goods & services and Imports are the portions of C, I and G that are spent on goods & services produced abroad.

In simple words, we can say that gross domestic product (GDP) includes all economic activity of a country within one year. In the economic activity or movement of a country is categorised into the three main sectors. These sectors are primary sector which includes agriculture, agro based commodities and allied activities, forestry, mining and quarrying. The Secondary Sector includes manufacturing industries, construction and electricity, water and gas supply. Furthermore, is the last sector which is the Service sector and this includes banking, insurance, transport, communication, trade and commerce (*Tripathi, 2015*). Gross Domestic Product is an essential variable or indicator of an economy. It has been used by policy makers for measurement of health of the economy. Gross Domestic Production is an amount of final goods and services in economy that is the measure of money term. Real Gross Domestic Product is an important measure of economic activity and it is widely used by policy makers and academicians (*Chakravarty, 2016; Keohane, 2016; Zhong, 2016*).

GDP gap is also called the Output gap, Economics have two concepts of output gap, a Keynesian and the Friedman's, on which Okun's law has based his monetarist concept. The Keynesian concept was formulated and refined in the 1960s in connection with active fiscal policies intended to deliver full employment. The monetarist concept by Friedman was based on the accelerations hypothesis and the natural rate of unemployment with the link of monetary policy. Measuring the level of an economy's potential output and output gap is crucial in pinpointing a sustainable non-inflationary growth and assessing appropriate macroeconomic policies. The estimation of potential output helps to determine the pace of sustainable growth while output gap estimates provide a main benchmark in contradiction of which to assess inflationary or disinflationary pressures suggesting when is the expansion or contraction of the monetary

policies (Denis, Morrow and Roger, 2002). Potential output is considered the best composite indicator of the aggregate supply side capacity of an economy and thus becomes an important aspect of research interest or area. Apart from this, the Potential output is the maximum output an economy could sustain without generating rise in inflation (De Masi, 1997). The potential rate of growth of an economy is the maximum sustainable rate at which an economy can grow without causing a rise in the rate of inflation. The potential growth rate is determined by the growth in the economy's productive capacity which, in turn, depends on the growth in inputs such as labour, capital, land, technology, etc. An economy can develop above the potential rate for certain time but that will trigger expanding inflationary pressures. Growing below the potential rate will imply an increase in the rate of unemployment (Joseph, et al. 2011).

Output gap is the difference between actual GDP or actual output and potential GDP or potential output which can possibly be negative and positive both. Potential output is defined as the level of output that can be achieved without giving any increasing or decreasing pressures on inflation (Okun's Law, 1962); widely used in the literature. Where the output gap is either positive or negative, either one are unfavorable for the economy. Any positive gap in the economy indicates more demand for goods and services in the economy which is beneficial but also a high demand will create even more inflation. This is because the labor and cost of production increases in the economy. On the other hand, the negative output gap shows the lack of goods and services in the economy; thus pointing to the sluggish economy resulting from the deteriorating condition in the demand for goods and services. That's why every economy is targeting the *Zero Output Gap*.

When the Output Gap is zero, there is no upward or downward pressure on inflation, as the actual demand coincides with economy's potential. Shocks can affect actual output and potential output inversely, leading to non-zero output gap levels. According to the Bank of Canada (2012), the positive output gap is usually related to the boom period and this is a sign of economic activity that exceeds capacity; also creating pressures on the labour market and on the price levels. Moreover, the positive output gap is expected to have repercussions towards a lower unemployment and a higher level of inflation.

Alternatively, a negative output gap is usually related with a recessionary period and the pressures would be in the direction of higher unemployment and lower inflation. To measure the output gap, below is a simple formula;

$$\frac{(\text{GDP}_{\text{Actual}} - \text{GDP}_{\text{potential}})}{\text{GDP}_{\text{potential}}} \times 100$$

The percentage of GDP gap is the actual GDP minus the potential GDP divided by the potential GDP.

*Koske and Pain (2008), propounded that “output gaps remain a significant influence on inflation, but their influence is now weaker than in the past, and the usefulness of output gap estimates for real-time inflation projections is limited” (p. 2).*¹⁹

6.1.2 Okun’s Law

Okun’s law is an empirical relationship between changes in aggregate output (relative to its potential trend) and changes in the unemployment rate (relative to its natural rate) given by Arthur Melvin Okun. To summarize, this law intends to tell us how much of a country’s Gross Domestic Product may be lost when the unemployment rate is above its natural rate. Many economists have argued that Okun’s law is a useful guide for monetary policy because it suggests room for policymakers to improve aggregate output by further reducing unemployment (Wen, 2012, P.1).

The general idea of excess demand or supply is not mean or constant all the time and there are frequent fluctuations. Moreover, the Output Gap concept has also played an important role in the process of inflation and disinflation in the economies. Furthermore, we have discussed here three concepts or theories about indicating the relationship between the Output Gap and Inflation Rate. First, the level of Output Gap is connected to the Inflation by the theory of General Equilibrium, which describes that the rate of change in each commodity’s price depends on the extra or excess supply or demand for that commodity. Similarly at macro level, this denotes that the rate of change in price level depends on the level of slack and boom period or the Output Gap. For instance, the

¹⁹Useful information on this topic can be found also in Bouis et al. (2012).

Phillips curve relationship discusses a stable association between the rate of change in money wages and the unemployment rate. Second, the level of the output gap might be connected with the rate at which inflation rate increases, or the acceleration of the general price level to illustrate the Non-Accelerating Inflation Rate of Unemployment (NAIRU). Third, the change in output gap might be connected with the rate of inflation such as the Great Depression. Significantly, the general price level started to increase in the United States economy just after the Great Depression, reflecting the quick shrinking of the output gap where the level measured by the GNP gap still being over 40 percent. Some argue that this sort of relationship was observed in instances other than Great Depression and call it the *Speed Limit Effect* (Romer, 1996).

This study is based on this understanding. We will first investigate the output gap as a measurement of excess supply or demand. Beside this we will examine the association between the Output Gap and Inflation. The Phillips Curve approach is evidenced as a useful tool for a policy investigation and huge evidence also proves that output gap is a significant determinant of inflation for numerous countries.

6.2 Objectives and Hypothesis of the Study

- To examine the negative or positive inclination of the Output gap over the period of study.
- To provide empirical evidence to support the direction of Output Gap.
- To examine the relationship between Inflation and Output Gap.
- H_0 = there is negative Output Gap over the period of study.
- H_0 = there is no significant relationship between rate of Inflation and Output gap.

6.3 Methodology Estimation

We have used time series dataset which is based on purely secondary database. The present study covers the period from 2002 – 2015 at the constant price in the base year 2004-05 and 2011-12. The data was collected from the Hand Book of Statistics on Indian Economy, Reserve Bank of India. In this analysis, we have used SVAR econometrics model and to apply this model, we have used algorithm $\log^{10}$ for change of percentage.

This present study used quarterly available Gross Domestic Product (GDP) and Wholesale Price Index (WPI) rate of inflation data series. The measurement of output gap is calibrated by the Hodrick-Prescott (HP) Filter method and it is also used to calculate growth rate. In addition to the above variables, we have taken two more variables which are: the Total Expenditure by the government and Total Investment from Neeti Ayog statistics.

The simplest methodology to estimate potential output is the Single Variate (SV) filter. This is a purely statistical methodology which filters the actual GDP data to extract the trend as its estimate of potential output. The most common SV filter is the Hodrick-Prescott (HP) filter. The Hodrick-Prescott filter represents one of the most popular methods for trend cycle extraction in macroeconomic time series (*Poloni & Sbrana, 2015*). It is very easy to use the HP filters because it only requires one data series (output).

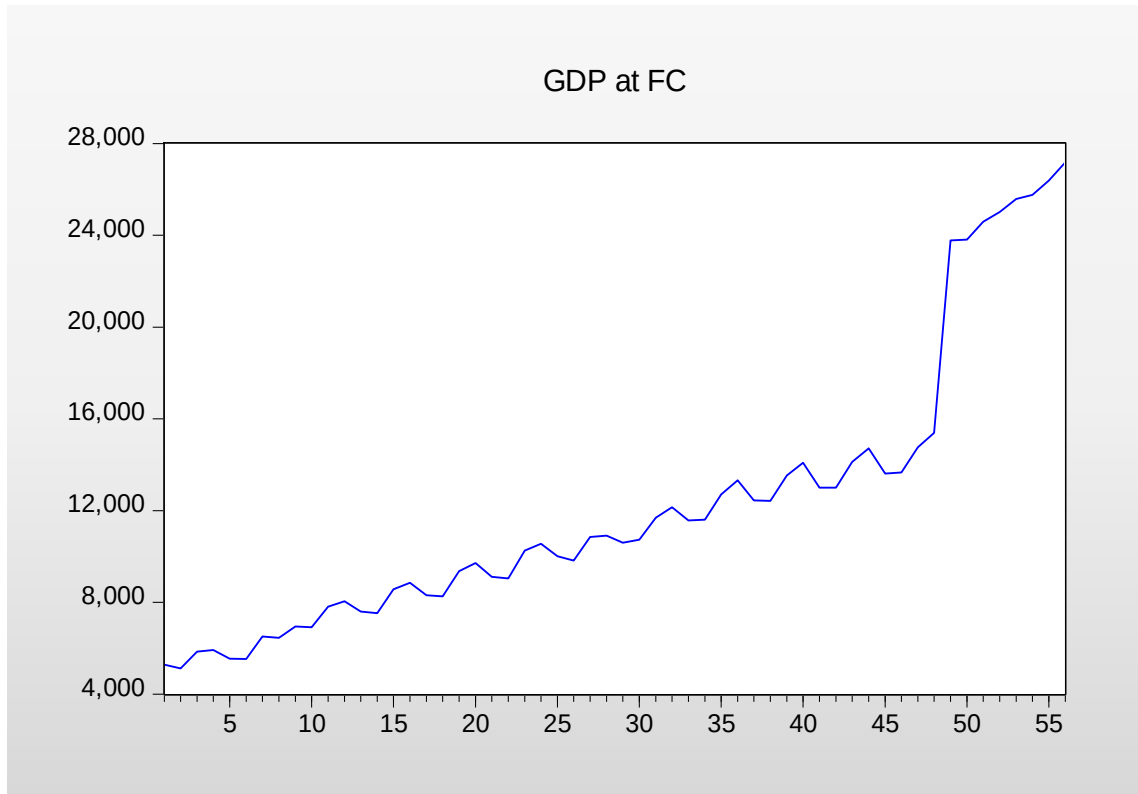
The HP filter techniques proposed by Hodrick and Prescott (1980) is the most commonly used method to estimate the potential growth rate of an economy. It is a data-smoothing technique. The Hodrick-Prescott Filter is commonly applied during analysis to remove short-term fluctuations that are associated with the business cycle²⁰. The Hodrick-Prescott Filter is a smoothing method that is widely used among macroeconomists to obtain an estimate of the long-term trend component of a series. The method was first applied to analyse post-war U.S. business cycles in a working paper and was later published in 1997 *Hodrick and Prescott*(1997). As a matter of fact, this method was suggested a long time before by *Leser (1961)* for trend extraction(*Mills, 2009*). This approach extracts a stochastic trend which moves smoothly over time and is uncorrelated with the random irregular term representing the cyclical component. The ratio between the variances of the two noises (i.e., the signal-to-noise ratio) is the key scalar that determines the smoothness of the extracted trend. For instance (*Hodrick & Prescott, 1997*), propose specific values for time series observed at different frequencies. The unobserved components representation of the smooth-trend model, also known as Hodrick-Prescott filter, was firstly used by *Akaike (1980)*.

²⁰<https://www.investopedia.com> (Financial Analysis)

As we have used only one Data series or Variable, which is named GDP, therefore we have used the Hodrick Prescott (HP) filter method which is frequently used for measurement of output gap. The output gap is unobservable and we can't estimate it directly. So first we have estimate of potential GDP from real GDP by the HP Filter method. After that we estimate the output gap through the potential GDP.

6.4 Results and Discussion

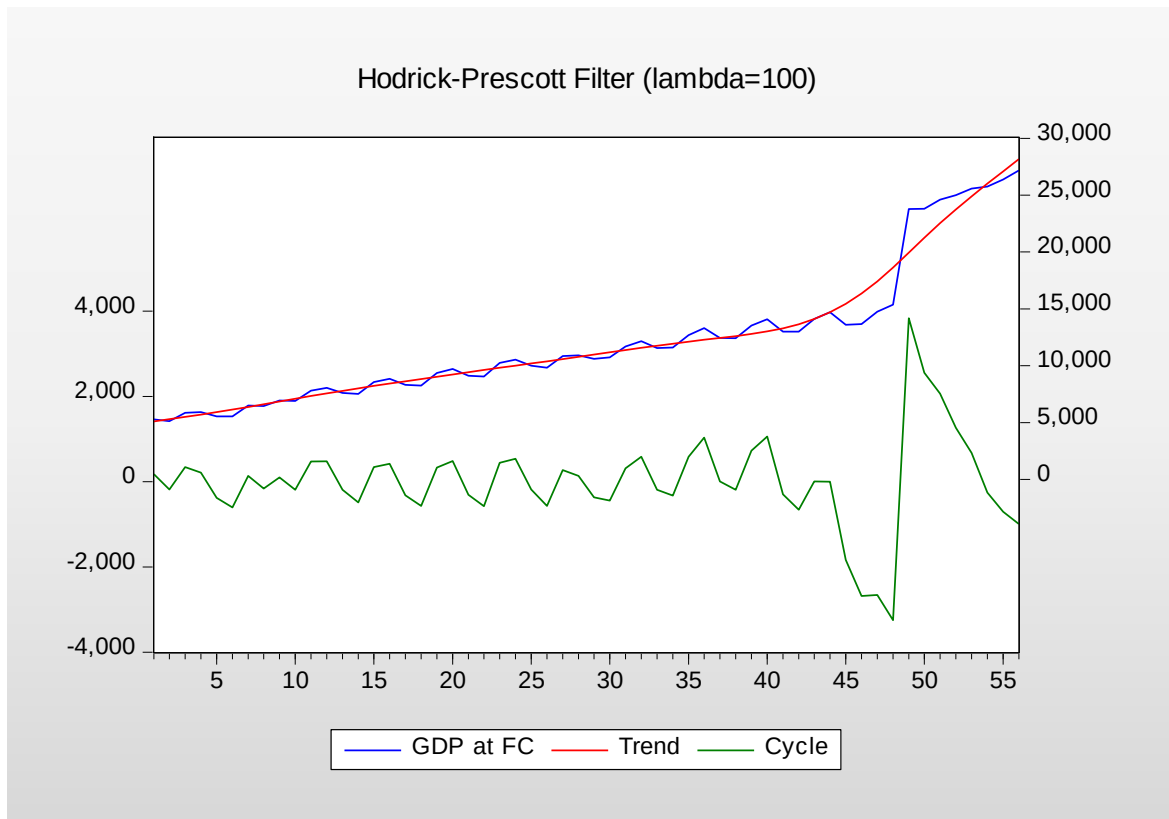
Figure 6.1: Trends of Real Gross Domestic Product (GDP)



Data Source :Handbook, the Reserve Bank of India

The figure 6.1 shows that the real Gross Domestic Product is increasing with a positive pattern but in 2013-14 quarter IV a sudden increase of high rate is observed. According to this figure, economy is working in proper and significant manner.

Figure 6.2: Smoothing of GDP and Potential Output Gap

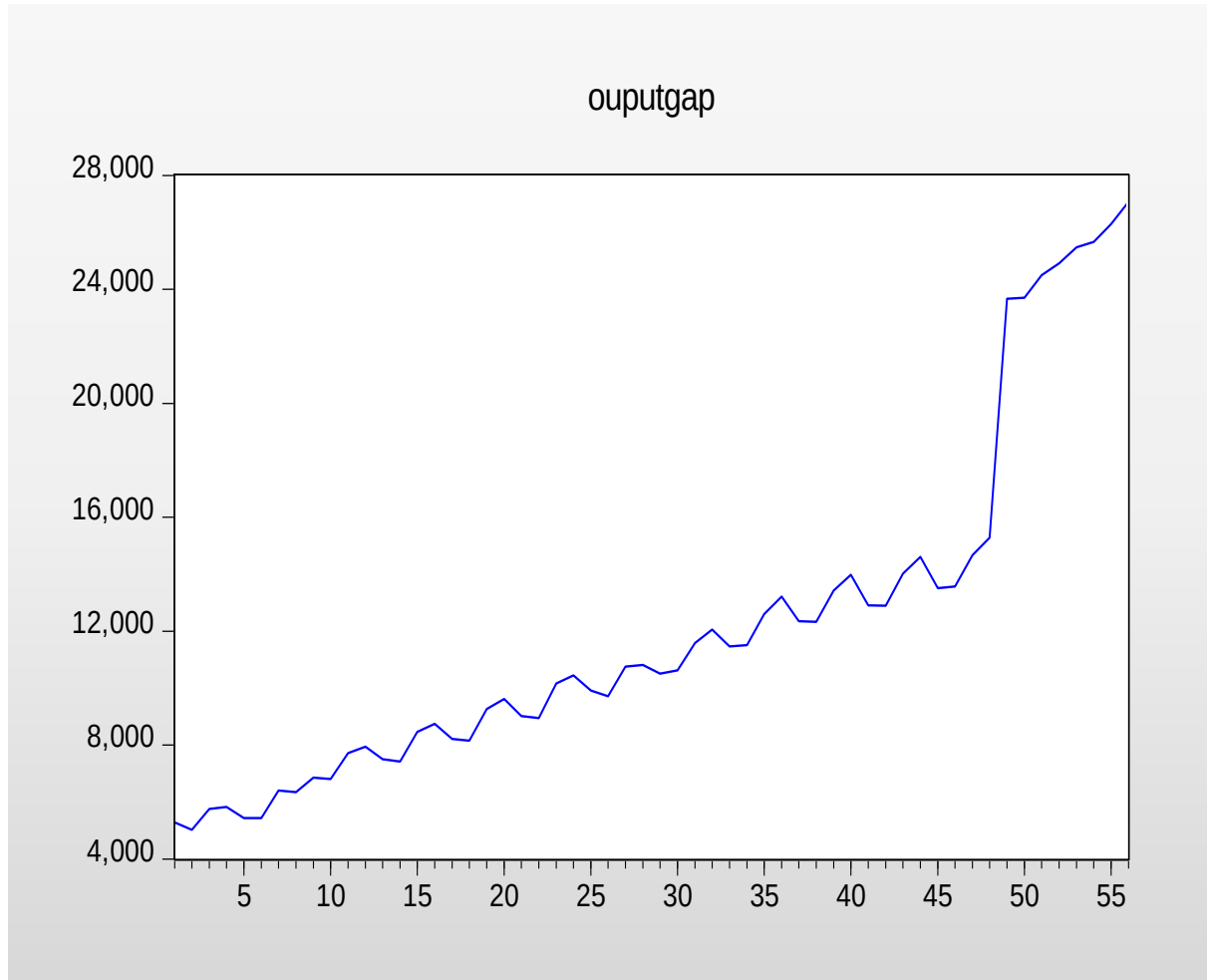


The figure 6. 2 shows the result of Hodrick Prescott filter method. The blue line indicates *the real* Gross Domestic Product (GDP),red line indicates the trend of *real GDP* also known as *potential* GDP while the green line indicates *Business Cycle*. Trend of real GDP is increasing at low rate but in 2013-14 quarter IV we can witnesses a sudden increase at a high rate. Other than the above changes observed, there is also a simultaneous disturbance noted in the short term fluctuation such as cyclical fluctuations with no impact on Indian economy in the lines of Global Financial Crisis. It has affected the others factors as well.

Estimation of the Output Gap with the help of HP filter and this formula

$$\frac{(\text{GDP Actual} - \text{GDP potential}) \times 100}{\text{GDP potential}}$$

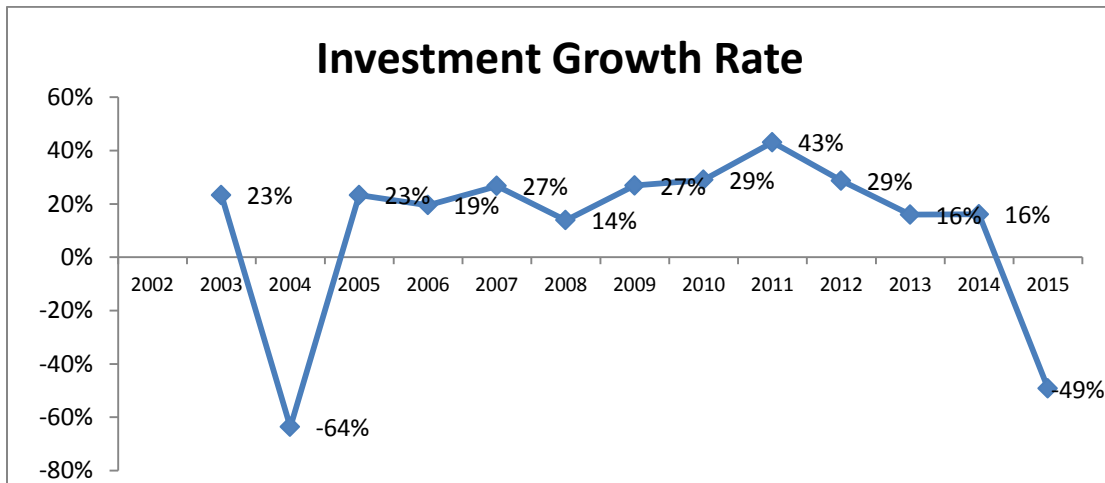
Figure 6.3: Output Gap



Author's Estimation

The figure 6.3 shows the output gap over the time period of study. It shows the positive output gap in the whole study of period. It started at a slow pace and continuously increased at the same rate positively. This propounds that there is no impact of Global Financial Crisis on Indian economy followed by a high demand in goods and services, thus, creating an optimistic environment for employment and inflation in economy. This is evident if we look at the expenditure of the government which was higher on investment and expenditure in Indian economy during 2014.

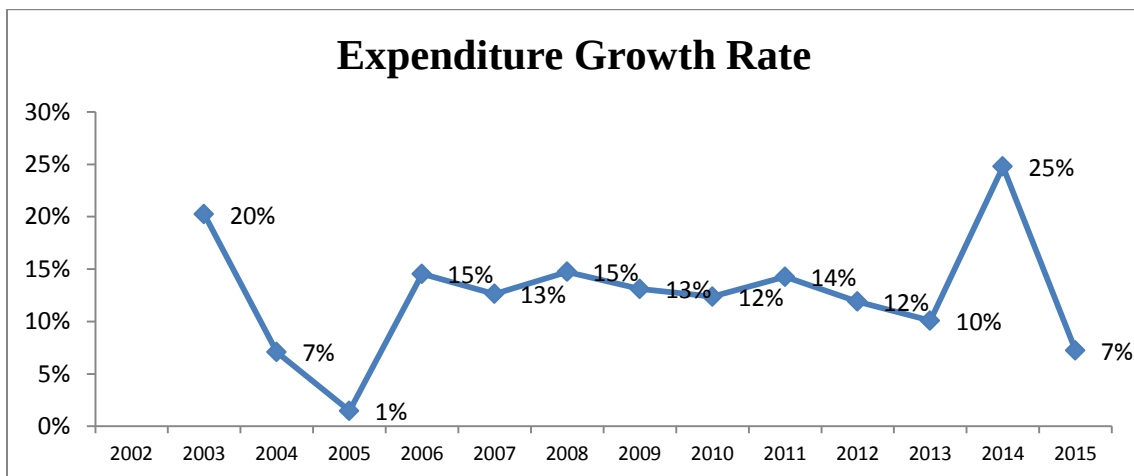
Figure 6.4: Growth Rate of Investment



Data Source: The Reserve Bank of India

The figure 6.4 shows the growth rate of investment in the economy. The graph above clearly shows that the growth rate starts with 23 percent in the year 2003 and completes with a negative value of 49 percent. In this trajectory, we observe the maximum point of fall in the growth rate in the year 2004 at -64 percent. It was only in the year 2011 that it reached its highest possible range. In the whole time period of 2005-2014, the increase was gradual and positive. It is significant to note a sudden decrease to -49 percent in 2015. The analysis of the above growth rate of investment postulates that there was no impact of the Global Financial crisis because of the sudden fall in year 2004 and 2015.

Figure 6.5: Growth Rate of Total Expenditure



Data source: Neeti Aayog Statistics

The figure 6.5 shows the growth rate of total expenditure during 2002 -2015. In 2003, the growth rate of expenditure is at its highest at 20 percent with a consequent drastic decrease to a low rate of 1 percent in the year 2005. Since then the graph demonstrates a continuous increase at a low rate during 2006 to 2013. In a time period of ten years, the growth rate reached its highest point of series which was at 25 percent. Overall in this series, the lowest growth rate of total expenditure was in the year 2005 and the highest growth rate of total expenditure was in the year 2014.

6.5 Relationship between Inflation and Output Gap: Structural Vector Auto Regressive (SVAR)

We have estimated the Output Gap by the HP filter methods. Later we have investigated if there is any relationship such as short run or long run association between the rate of inflation and output gap during same period in the context of India. In simple words, we examined this study period, to understand whether the demand is more or supply is more. To fulfill this objective we applied the SVAR model to capture the demand or supply shocks. VAR models are widely used for macroeconomic forecasting and structural policy examination. The reduced form VARs are sufficient for forecasting the model whereas structural investigation needs economic identification of the model, so structural VARs (SVAR) will be used. The SVAR can be used to inspect the response to the shocks.

For example, SVAR would enable economists to know what would happen to prices and output if a demand shock hits occurs. The Second major use is for the Business cycle fluctuations or they can provide the bench mark against which modern or current dynamic macroeconomic theories can be evaluated, that is VARs can help to distinguish between the computing theoretical models.

VAR model is divided into three sub categories that are:

1.Reduced Form; 2. Recursive;3. A reduced-form. VAR states each variable as a linear function of its own past Values and the past values of all other variables being considered and a serially uncorrelated error term. In theory, the VAR uses all available or relevant

past values. The error terms are viewed as surprises and movements in the variables, after taking its past into account. If the different variables are correlated with each other, then the error terms will also be correlated across equations. A recursive VAR constructs the error terms in each regression to be uncorrelated with the error term in the preceding equation. This is done by adding carefully-selected contemporaneous values as regressor. Estimation of each equation by OLS produces residuals that are uncorrelated across equations. The recursive VAR amounts to estimating the reduced form, then computing the Cholesky factorization of the reduced form VAR covariance matrix (Lutkepohl, 1993). Unfortunately, the result depends on approximate variables. Changing the order changes the VAR equations, coefficients, and residuals. A structural VAR uses economic theory to sort out contemporaneous links among the variables. Structural VARs require identifying assumptions that establish causal links among variables. These produce instrumental variables (Stock and Watson, 2001).

The Structural Vector Autoregressive Model (SVAR) based on Taylor rule was given by John Taylor in 1992 which is mainly used for forecasting of interest rate. It discussed about the how central banks should change interest rates to account for inflation and other economic conditions.

6.6 Taylor rule

Taylor rule is a monetary policy rule that describes the fluctuation in the nominal policy interest rate in response to the goals, viz. inflation, output and other economic circumstances. According to the original version of Taylor rule, the nominal interest should respond to divergences of actual inflation from target rates and actual output from the potential output.

$$it = r^* + \beta_1 (\pi_t - \pi^*) + \beta_2 (y_t - y^*)$$

The above equation, it = is the target short-term nominal interest rate, r = equilibrium real rate of interest, π_t = actual rate of inflation in the present period, π^* = target or desirable rate of inflation, y_t = log of real GDP and y^* = logarithm of potential output calculated by linear trend.

According to the Taylor rule, the coefficient values β_1 and β_2 should be positive and as a rule of thumb β_1 and β_2 must be equivalent to 0.5. The rule thus suggests a higher interest rate when either inflation is above its target or when output is above its potential or full employment.

Table 6.1: Descriptive Statistics of Variables

Variables	Output Gap	Inflation	Dum Output	DumInf
Mean	12146.37	557.7214	0.160714	0.500000
Median	10687.53	540.3000	0.000000	0.500000
Maximum	27076.16	738.0000	1.000000	1.000000
Minimum	5020.460	406.7000	0.000000	0.000000
Std. Dev.	6024.401	83.34078	0.370591	0.504525
Skewness	1.248535	0.406297	1.847623	0.000000
Kurtosis	3.642399	2.472418	4.413712	1.000000
Jarque-Bera	15.51208	2.190188	36.52466	9.333333
Probability	0.000428	0.334508	0.000000	0.009404

Data Source: RBI & MOSPI

Table 6.1 clearly demonstrates the disposition of the data series. Converging over the value of Skewness, the regress and variables have positively skewed, implying long right tail about the mean and the regressors closer to normal distribution though positive. Now if we stress over the value of kurtosis, except the independent variable all the dependent variables have an almost non-normal distribution with kurtosis above or below to 3. The inflation rate has a normal distribution (mesokurtic curve) with closer to 3 value as seen in the table.

6.7 Outliers

Figure 6.7.1: Outliers

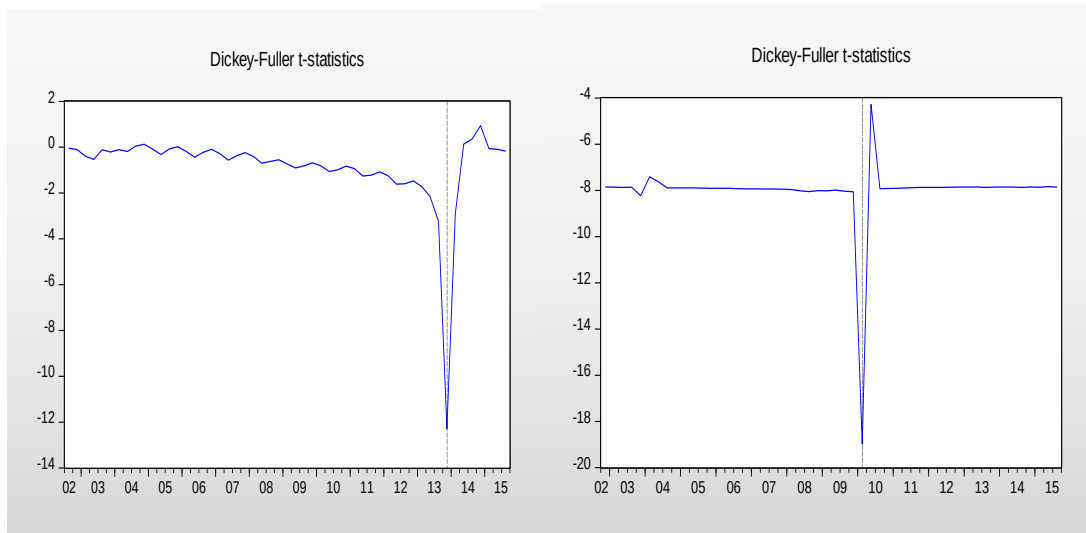


Table 6.7.1: Kim and Perron (2009) Structural Break Unit root Test

Variable	Break period	t-stat.	Prob.	Decision
Unemployment	2013Q4	-3.252691	0.5339	Non-Stationary
Inflation	2009Q4	-4.317981	0.0715	Non-Stationary

* shows the significance at 1 % level of significance

The table 6.7.1 presents the Kim Perron test results that found that structural breaks date in non-stationary data series. We have also applied of chow test above these breaks dates significant or not.

Chow Test: 6.7.2

Table 6.7.2: Chow Test

Model	Break date	f-value
Output gap	2013Q4	35.60361* (0.0000)
Inflation	2009Q4	106.3468 *(0.0000)

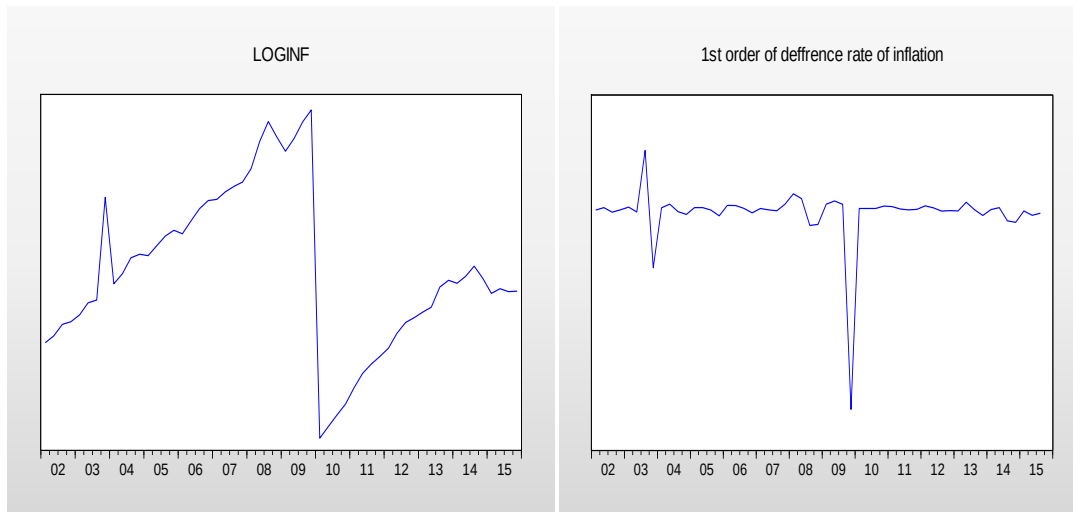
*,** and *** represents result to be significant at 1%, 5% and 10%

Table 6.7.2 shows the chow test result. The breaks have been introduced in 2013Q4 of output gap series and 2009 Q4 in inflation series. The chow test done to check the

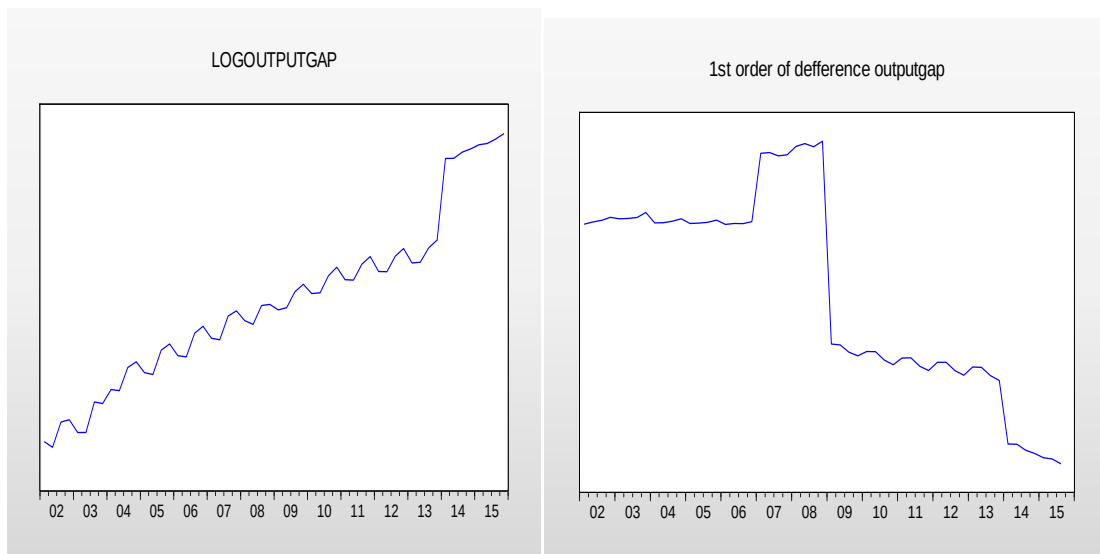
whether this break time is significant. The F- value is significant at one percent showing presence of structural break for we incorporate dummy variables such as dummy inflation and dummy output gap.

6.8 Trends of Inflation and Output Gap

Figure 6.7.2: Trends of Inflation and Output Gap



Data source: MOSPI



Data source: Handbook of Statistics (RBI)

6.8 Augmented Dickey Fuller Test for Stationary

Table 6.8.1: ADF Test for Differences First Order Data (2002 to 2015)

Variables	ADF Value DF-T Statistics	Critical value of Mackinnoon in levels of significance		Result of Test	Stationary or not Stationary
		1%	5%		
Ln Inflation (WPI)	-8.00714	-3.557472	-2.916566	H0 is rejected	Stationary
Ln Output Gap	-7.121630	-3.560019	-2.917650	H0 is rejected	Stationary

Table 6.8.1 describes that the both the series of inflation and output gap is non-stationary at the level after that we have converted it into the first difference order for stationarity. Further, we have applied Phillips Perron test for stationary.

Table 6.8.2: Phillips Perron Test

Variables	Phillips Perron Value DF-t Statistics	Critical value of Mackinnoon in levels of significance		Result of Test	Stationary or not Stationary
		1%	5%		
Ln Inflation	-8.057994	-3.557472	-2.916566	H0 is rejected	Stationary
Ln output gap	-8.638327	-3.557472	-2.916566	H0 is rejected	Stationary

Table 6.8.2 describes Phillips perron test result that the both the series of inflation and output gap is non-stationary at the level after that we have converted it into the first difference order for stationarity. Both tests confirmed that we should apply Structural Vector Auto Regressive (SVAR) model.

Table 6.8.3: Lag Length Criteria

The maximum dependent and dynamic regressor lag limit according to AIC, SC and HQ criteria for quarterly data is chosen one. The table 6.8.3 represents optimal lag criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	142.3041	NA	1.64e-05	-5.345258	-5.117985	-5.258410
1	202.3482	108.3149*	1.82e-06*	-7.543067*	-7.164278*	-7.398320*
2	203.1518	1.386662	2.07e-06	-7.417719	-6.887414	-7.215074
3	208.2267	8.358539	1.99e-06	-7.459870	-6.778049	-7.199326
4	209.9263	2.666122	2.19e-06	-7.369660	-6.536323	-7.051217
5	210.8589	1.389788	2.49e-06	-7.249370	-6.264518	-6.873029

The table 6.8.3 shows the lag length criteria which tell us that many criteria like the AIC, SC and HQ are supported and suggested to choose one lag length.

Table 6.8.4: Johanson Test for Cointegration

Eigen value	Likelihood ratio	Critical Values 5%	Result (Hypothesized) No.of Cointegration(s)
0.095323	None	15.49471	No co-integration
0.003297	206.0614	3.841466	No co-integration

The figure 6.8.4 indicates that there is no cointegration between the rate of inflation and output gap. Since the trace statistics value is less than the critical value, if $TS < CV$, it tells us that variables are not cointegrated with each other. Thereby, meaning that there is no long run association among these variables. If trace statistics value is more than the critical value ($TS > CV$), it tells us that variables are cointegrated.

The previous result and tests prove that we can use SVAR Model for estimation. According to the result of Johnson cointegration test, there is no cointegration between the rate of inflation and output gap. Therefore, we are using Structural Vector Auto Regressive Model (SVAR). We have found two breaks dates such as 2009Q4 and 2013Q4.

We have attempted to develop new SVAR model. General form of SVAR model is follows;

$$\text{Output Gap} = f(\text{Inflation, Output Gap})$$

Used the dummy variables now VAR model became as:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 \Delta y_{t-1} + \alpha_3 \Delta X_{t-1} + \alpha_4 \Delta X_{t-2} + \epsilon_t$$

Output Gap = f (INF, OG, DINF, DOGAP)

ΔY = endogenous variable (dependent variable)

ΔX = exogenous variable (independent variable)

ϵ_t = error term

ΔY = Endogenous variable with time, ΔX = Exogenous variable and ϵ_t = Error term. Where INF = Inflation Rate (WPI), OG = output gap DINF= dummy variable for inflation, DOGAP= Dummy variable for output gap. 0 dummy = No Impact of Structural breaks on other variable and 1 dummy = Impact of Structural Breaks on other variable.

We have used the Dummy Variable because even after having a data stationary in the series of Inflation and Output Gap, the structural breakshave been found. So we have used Dummy variables to capture the effect of structural breaks on the dependent variables, in other words, to see effect of structural breaks or changes through the dummy variable.

6.10 Structural Vector Regressive Model (SVAR) variables such as Output gap and rate of inflation

Table 6.8.5: An Analysis of Structural Vector Regressive Model (SVAR) Estimation

(SVAR) Eq.	Coefficient	Std. Error	t-Statistic	Prob.
Ln inflation	0.761292	0.069917	10.88854	0.0000*
Ln output gap	0.171361	0.049759	3.443843	0.0008*
Dummy inflation	-0.007628	0.021924	-0.347924	0.7286
Dummy output gap	-0.070465	0.028241	-2.495100	0.0142**
Ln output gap	0.065845	0.070857	0.929265	0.3549
Ln inflation	0.956163	0.050428	18.96113	0.0000*
Dummy inflation	-0.000663	0.022218	-0.029857	0.9762
Dummy output gap	0.021093	0.028621	0.736982	0.4628

The table 6.8.5 shows the result of SVAR model. The first model where the inflation is the dependent variable, there is positive and significant impact of own lagged value of inflation (past value) output gap and negative impact of Global financial crisis on the rate of inflation at the 1 percent and 5 percent level of significance. This model is a good fit because R^2 value is 0.708182 and Adj R^2 Value is 0.691017. The second model where output gap is dependent variable, there is significant positive impact of lagged value of inflation and output gap on the rate of inflation but the shocks of output gap has negatively affected the rate of inflation. Alternatively, when we take the output gap as a dependent variable, there has been a positive effect of the output gap and no impact of global financial crisis on the output gap at the 1 percent level of significance. This model is a good fit because R-value is R^2 value is 0.966460 and Adj R^2 is 0.964487.

In the economics terminology, we can say that in the study period, there is short run relationship between the rate of inflation and output gap in the Indian economy because demand of goods and services is more. This creates more employment by the consumption and multiplier theory in the Indian economy.

Table 6.8.6: Diagnostic Checking of SVAR Model

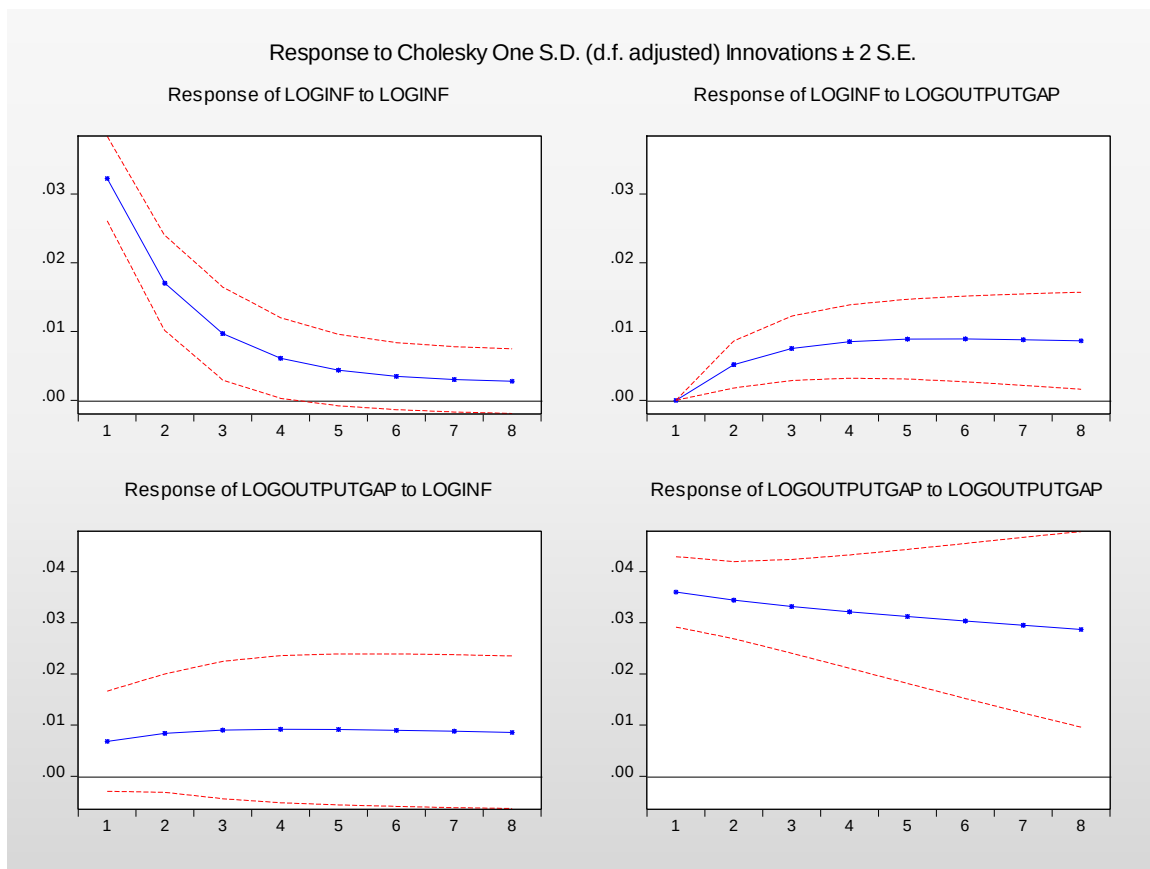
Tests	F-statistic	Obs*R-squared	Prob. F	Prob. Chi-Square
Serial correlation	1.537709	1.641012	0.2207	0.2002
Breusch-Godfrey				
Heteroscedasticity	0.626646	0.642999	0.4322	0.4226
ARCH Effect				

The table 6.8.6 shows that in the diagnostic checking of model in this study there is no serial correlation and heteroscedasticity problem. Breusch-Godfrey test and ARCH effects tests indicate that there is no problem. Therefore, model is accurate but this model's residual is not normally distributed, yet it is acceptable because in real life all things are not perfect or ideal.

Impulse Response Function (IRF): The projected impulse responses demonstrate patterns of persistent common variation measured in one standard deviation innovations

or shocks. Impulse variable means the root of the shock while Response variable means the variable being affected. The impulse response is graphed as a function of forward time periods. **Sims (1980)** popularized the method of choosing P to be the Cholesky decomposition of Σ . The Impulse Response Functions based on this choice of P are known as the Orthogonalized Impulse Response Functions. Choosing P to be the Cholesky decomposition of Σ is equivalent to imposing a recursive structure for the corresponding dynamic structural equation model.

Figure 6.6.3: Impulse Response Function (IRF)



Source: Estimated from unrestricted SVAR model in Eviews

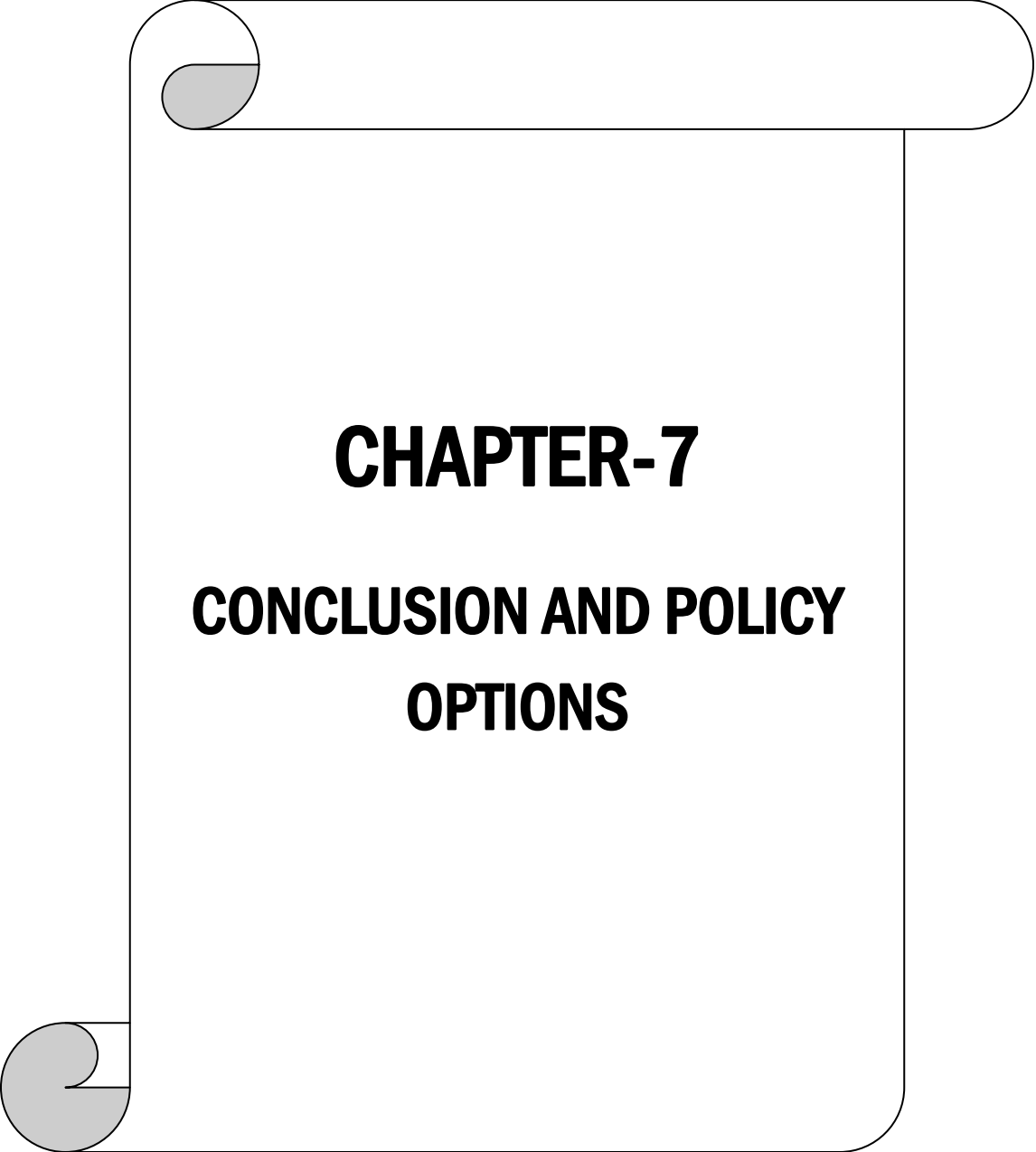
The figure 6.6.3 shows the response of inflation rate shock to impulse in output gap which takes four quarters. It identifies the responsiveness of the dependent variables in the SVAR system when a shock is put to the error term such as U_1 and U_2 , as in the equations given above. A unit shock in U_1 will bring a change in the inflation. It had impacted the output gap during the next four quarters. But before calculating the Impulse

Response Function, the ordering of variable is important. There are many methods. We have chosen the Cholesky dof adjusted, response to Cholesky one standard deviation innovation, shock or residual (error term) + 2 standard error. In the eight quarters, all variables in this entire function had been affected. The graph shows the impulse response function in the next eight quarters. When inflation is impulse variable and output gap is response variable, Inflation has affected the own lagged variable in a downward way. We can see that it has rectangular curve and it has affected the output gap which is positive with increased rate in the next eight quarters. When the output gap variable is impulse variable and inflation is response variable, output gap has affected its own lagged variable in positively with high rate in the next eight quarters.

6.11 Concluding Facets

Chapter 6 concludes while examining the Output Gap and the relationship between the rate of Inflation and Output Gap based on empirical analysis of the data collated during the Global Financial Crises from 2002 to 2015.

To reach its intended objective, this study analysed that since the Output Gap is an unobserved variable and it cannot be observed directly, the Hodrick-Prescott method had to be applied to measure the Output gap. We found positive output gap and short run relationship was found between the rate of inflation and rate of unemployment in Indian economy over the same period. Due to more investment and government expenditure in Indian economy, the role of public expenditure is highly significant. In other words, we can say that in the Indian economy, there was no impact of the Global Financial Crisis because the output gap is positive. On the other hand, we find the short run relationship between the rate of inflation and output gap. This means that the economy was functioning properly and there was more demand of goods and services in the economy. This created favorable condition for inflation and employment under the threshold of inflation that ultimately support the developmental process of an economy.



CHAPTER-7

CONCLUSION AND POLICY OPTIONS

CONCLUSION AND POLICY OPTIONS

7.0 Main Comprehensive Findings

The present study's major objective was to examine whether the Phillips Curve shape or theory exists or not in the Indian context, particularly under the underpinnings of the Global Financial Crisis along with striving to the measurement of the Output Gap from 2002 -2015. The study has been divided into 7 chapters to outline the various foregrounds that inspired this research intent. Chapter 1 and 2 indicate the introduction of variables and theories related to research topic. Chapter 3 details the trends of Inflation; Wholesale Price Index and the Consumer Price Index in the Pre-Recession, During Recession and Post-Recession. Chapter 4 enlists the impact of recession on Macro-variables such as export, lending rate and inflation rate. In the Pre-Recession Period, the lending rate was affected due to supply shocks (permanent effect). The export has been affected due to both supply shocks and demand shocks (permanent & temporary effect) and there was no impact on the inflation rate. During the Recession Period, there was no impact on export and inflation rate. However, the lending rate were affected by supply shocks and demand shocks when structural breaks were also found in export, lending rate, and inflation rate. In the Post-Recession Period, all the variables such as export, lending rate, and inflation rate were affected by supply shocks and demand shocks and it is significant and proved. In addition, this chapter also aimed to comparatively, descriptively analyse the quinquennial unemployment rates taking into account the recession period. We found that there is significant impact of the Global Financial Crisis on recession and post-recession period in the Indian economy. Chapter 5 shows the relationship between inflation and Unemployment which is the main intent of this thesis. During the Global Financial Crisis, there was inverse relationship between the rate of inflation and the rate of unemployment in the Indian economy and this trend continued in the Pre-Recession (2002-2008), Post-Recession (2009-2010) and over the period of 2002 -2015. It was noted that when rate of inflation was high, then the rate of unemployment was low and vice versa. Furthermore, we also examined the Phillips curve relationship in the extended period from 1991 to

2015. We found existence of the short run and long run Phillips Curve theory for the period of study. We also found here a unidirectional rather than a bi-directional relationship between them. Chapter 6 shows the output gap concept which is proxy variable of unemployment. We found positive output gap as well as short run relationship between the rate of inflation and rate of unemployment in Indian economy over the same period. Due to more investment and government expenditure in Indian economy, the role of public expenditure became highly significant. These outcomes conclusively establish that the Phillips curve relationship as a crucial tool for policy makers as a relevant theory even in the present day economic landscape.

This Chapter is a summation of the whole thesis and an enunciation of the findings along with suggestions for further study in the similar domain. The existence or validity of Phillips curve in the present scenario is the most important concept. This theory emphasizes on the notion that ideal concepts are not possible to achieve in either a developing or a developed economy. To achieve full employment, we have to contend with certain inflation. Should the governments keep a cap on the price levels, an environment of unemployment is inevitable. This is indeed a major dilemma for the governments and policymakers. At present, most of the economies use Phillips curve as a controlling tool in an inflationary situation.

7. 1 Suggestions for Policy Recommendations

Developing economies are mostly labour oriented because they are not able to provide all the facilities for improving the standard of living of their citizens. Apart from this, the lack of infrastructure, education awareness, etc., prevents the desired level of development in the developing economies. If we talk about the Indian economy, it is also a labour intensive economy which can develop only by the labor oriented job opportunities. We know that the marginal propensity to consume is very high amongst the labour class and there is more demand for goods and services in the economy. This purchasing power helps to grow the economy. Therefore, government should promote labour class and provide good and quality based facilities. Moreover, the present day Indian demography of educated and skilled youth has varied interests and expects multitude of employment openings with the aspirations to accomplish comfortable, if not

highly affluent, standards of living. At the same time, the global climate for all economies remains pessimistic as many economies, India included, are facing a slowdown. We are living in the scenario where trade wars over tariffs threaten to engulf successful boom phases into depression. Market volatility adds to the inflation woes as Indian consumers' spending potential decreases with the rising inflation imposed upon them due to the global upheavals. In the backdrop of trade wars as well as the very recent USA and Iran confrontations that affected the oil prices, the average Indian consumer is bearing the brunt of sluggish economy. Hence, there is an imminent need to promote the policies for economic growth and development in the slowdown phases in the developing economies. Further, the Phillips curve describes a tradeoff, i.e., a certain rate of inflation can be traded for some rate of unemployment. For example, a lower rate of unemployment can be achieved only at a higher rate of inflation. This curve provides a large number of such tradeoff points that are known as the menu for choice between inflation and unemployment. Thus, the policymakers will always face problem of adjustment between inflation and unemployment in economy.

Suggestions

- India is labour surplus economy; therefore the government should provide more job opportunities. Phillips curve depicts a stable relationship, so the government should manage this relationship from time to time by focusing on both the fiscal policy and monetary policy such as demand and supply management of money.
- Taxation policy through the direct taxes and indirect taxes through the fiscal mechanism will finally assist in reducing unemployment and inflation. High inflation and high unemployment is harmful for a developing economy like India and it is not in the position to tolerate either.
- The main issue is how to achieve a workable balance between inflation and unemployment. This balance requires effective instruments. The policymakers should enlist concepts such as jawboning, wage guide post, wage freeze, tax linked wage policy and carrot & stick policy.²¹

²¹Details concept of these theories in the appendix attached at the end of thesis.

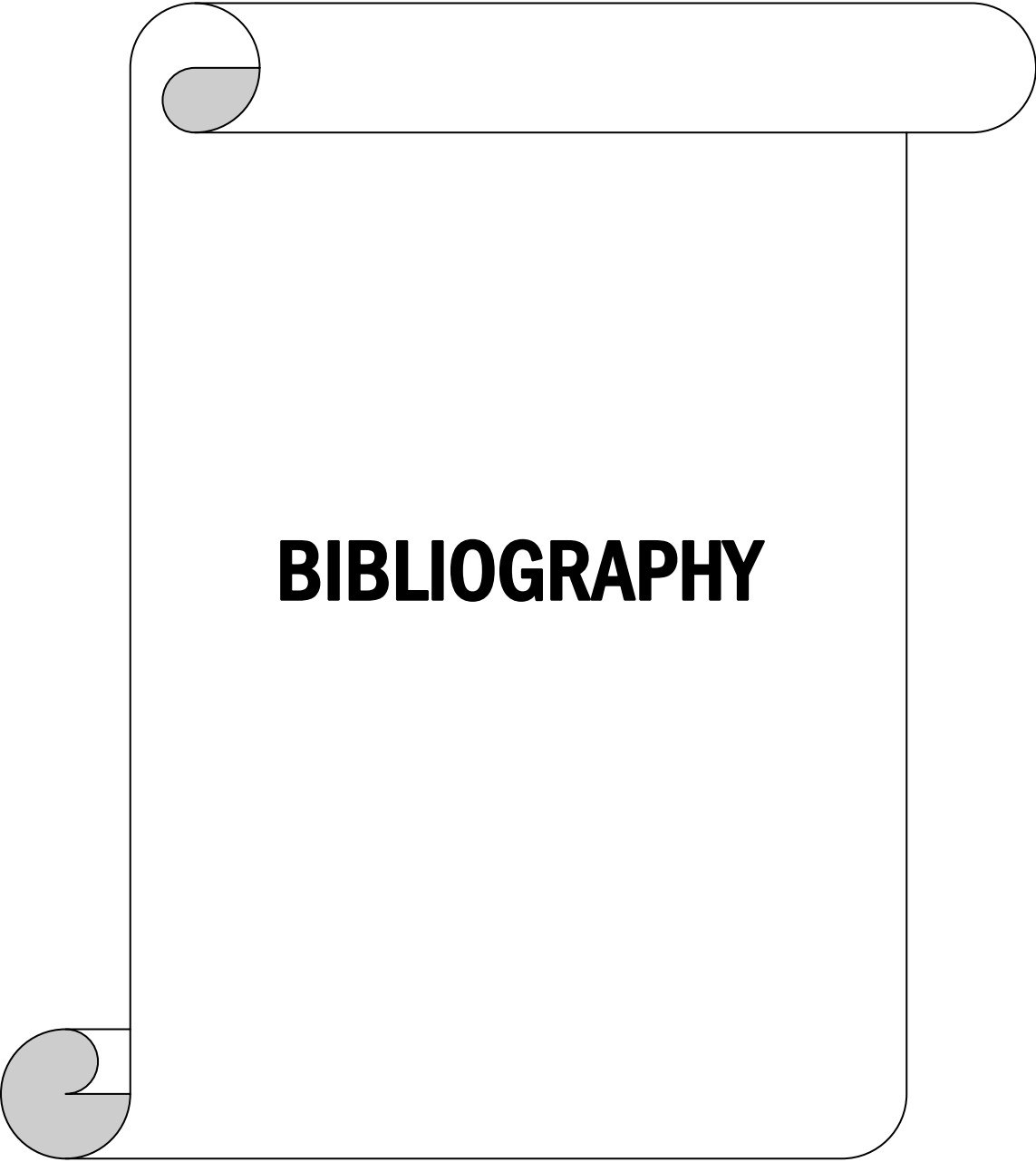
Note: *This research work's results are based on the dataset from the year 2002 to 2015. The current data is not part of the research's ambit. However, few limitations of the research work that could not be addressed are stipulated below:*

7.2 Limitations of the Present Study

- This study is valid only for the Indian economy from 2002 to 2015.
 - This Study has referred to National Sample Survey Organization (NSSO) for its empirical facts. But NSSO conducts its survey only after a period of five years. Hence, the data outsourced could be at variance from the actual one. Furthermore, the number of unemployed registered with the employment exchange is also highly unreliable.
 - This study focuses on only the estimation of Phillips curve shape rather than Phillips curve slope in mathematical form.
-

Notes

1. Detailed of unit root test and ADF- breakpoint test attached in the appendix end of the thesis.
2. Detailed of VAR/SVAR/ARDL model attached in the appendix end of the thesis.
3. Detailed theories of policy implication attached in the appendix end of the thesis.



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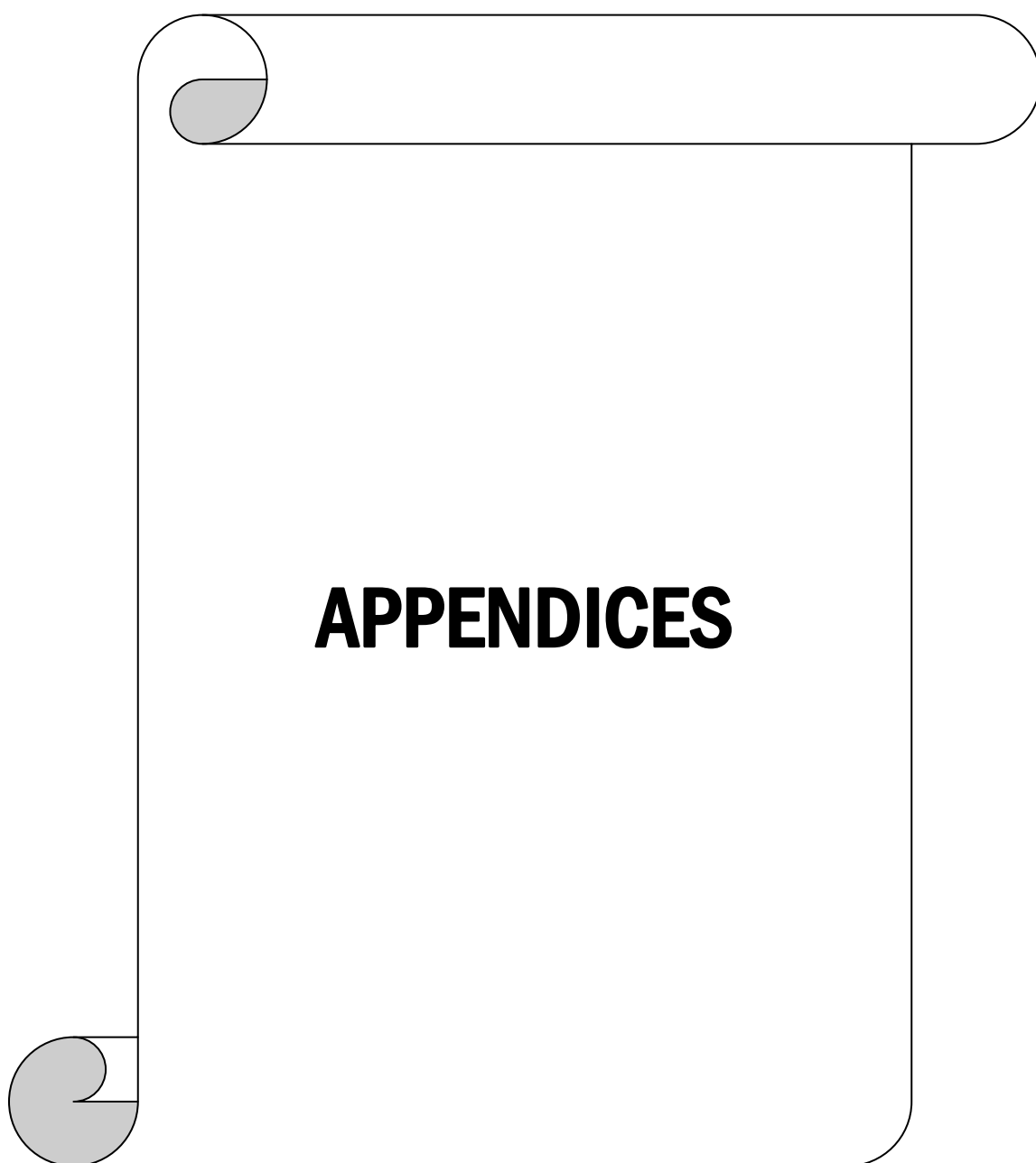
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APPENDIX

ALL ESTIMATION METHODOLOGY

ADF TEST AND ADF-BREAK POINT UNIT TEST

A unit root process is a well-known example of non-stationary processes and testing for a unit root against stationary has been a topic of substantial interest from both theoretical and empirical perspectives. These tests are conducted to eschew the existence of spurious assessment in two folds: One, the Null Hypothesis is that series is stationary using KPSS test. Second, Unit root tests such as Augmented Dickey Fuller tests. The study has used Augmented Dickey Fuller (ADF) where the null hypothesis says that the series possess a unit root. If a series is stationary without any differencing, it is said to be $I(0)$ or integrated of order 0. On the other hand, if a series is stationary after first difference it is said to be $I(1)$ or integrated of order 1.

Recently, Kim and Perron (2009) introduced a structural break unit root test (ADF-break point unit root test) to check the level of integration by identifying single unknown structural break. We are also using this new test in our research. See Vogelsang and Perron (1998) and Kim and Perron (2009) for discussion. The break date is selected where the t-statistic from the ADF test is minimum (most negative). Consequently, the break date elected is the most favorable break out of the various selected by the concerned test. The same can also be achieved and verified through the Additive Outlier (AO) and Innovational Outlier (IO) models. The AO model allows for a sudden change in mean (crash model) while the IO model allows for changes that are more gradual. Perron and Vogelsang (1992, pp.303) argues that these tests are based on the minimal value of t-statistics on the sum of the autoregressive coefficients over all possible breakpoints in the appropriate auto-regression. Perron and Vogelsang (1992) applied these two models for non-trending data (raw data), while Perron (1997) modified them for use with trending data. Applying the procedure for testing the unit root hypothesis, which allows for the possible presence of the structural break, has at least two advantages. First, it prevents yielding a test result that is biased towards non-rejection, as suspected by Perron (1989). Second, since this procedure can identify when the possible presence of structural break

occurred, then it would provide valuable information for analyzing whether a structural break on a certain variable is associated with a particular government policy, economic crises, war, regime shifts or other factors.

VAR' S THEORY

A structural VAR uses economic theory to sort out the contemporaneous links between the variables (Bernanke, 1986; Blanchard and Watson, 1986; Sims, 1986). Structural VAR requires “identifying assumptions” that allow correlations to be interpreted causally. These identifying assumptions can involve the entire VAR, so that all of the causal links in the model are spelled out, or just a single equation, so that only a specific causal link is identified. This produces instrumental variables which permit the contemporaneous links to be estimated using instrumental variables regression. The number of structural VARs is limited only by the inventiveness of the researcher. Until now, we have carefully distinguished between recursive and structural VARs: recursive VARs use an arbitrary mechanical method to model contemporaneous correlation in the variables, while structural VARs use economic theory to associate these correlations with causal relationships. VAR-based impulse response functions has stood the test of time well. The implementation of VAR-based estimations of impulse response functions means that certain technical issues have to be addressed (James H. Stock and Mark W. Watson, 2001, Vector Autoregression).

Impulse responses trace out the response of current and future values of each of the variables to a one unit increase in the current value of one of the VAR errors, assuming that this error returns to zero in subsequent periods and that all other errors are equal to zero. The implied thought experiment of changing one error while holding the 7 others constant makes most sense when the errors are uncorrelated across equations, so impulse responses are typically calculated for recursive and structural VARs.

DETAILED INFORMATION OF ARDL TECHNIQUES

The ARDL approach deals with single cointegration and was introduced originally by (Perason and shin, 1999).

ASSUMPTION OF ARDL

- If variables are stationary at first difference, i.e. integrated to the order 1 but not $I(2)$.
- Estimated with appropriate lags.
- Errors are serially uncorrelated.
- Model dynamically stable.
- In case of mixed form of stationarity, i.e. if variables are stationary at levels and also at first difference.

ADVANTAGES

According to Alam and Quazi (2003) estimation using ARDL model is possible even in challenge of endogeneity of explanatory variable as long as the model is free from residual correlation. This model stands unique against the Engle–Granger cointegration analysis where ARDL method can discern between dependent and independent variables. Moreover this method also has a vantage position in proceeding with consistent long-run parameters that are asymptotically normal regardless of whether the variables are $I(0)$, $I(1)$ or mutually integrated. One of the main advantages of ARDL modeling lies in its flexibility, as it can be applied when the variables are of different order of integration (Pesaran & Pesaran 1997). Another inside track of this approach is that the model uses competent numbers of lags to capture the data generating process in a general-to-specific modeling framework (Laurenceson & Chai 2003). Its popularity also heads from the fact that cointegration of non-stationary variables is equivalent to an error-correction (EC) process (for the linear transformation see: E.g. Banerjee et al. 1993), and the ARDL model has a reparameterization in EC form (Engle & Granger 1987; Hassler & Wolters 2006). The EC integrates the short-run dynamics with the long-run equilibrium without losing long-run information and the existence of a long-run cointegrating relationship can be tested based on the EC representation. In addition, it is also argued that using the ARDL approach avoids problems resulting from non-stationary time series data.

As this empirical and theoretical research intends to enquire about the long-run relations, our focus is towards modeling the series as stationary distributed lag or autoregressive distributed lag (ARDL). The long-run properties of the model are estimated and analysed using standard asymptotic normal theory on variables differenced stationary or $I(1)$. This thesis aims at estimating using the Autoregressive Distributed Lag (ARDL) approach to co-integrating testing rather than the single

Pesaran and Shin (1999) set forth that appropriate lags in the ARDL model are corrected for both residual correlation and endogeneity. Equation testing for co-integration based on Johansen residual based tests where pre- testing is also not required for the order of integration.

Based on Pesaran, Shin (1991) and Pesaran, Shin and Smith (2001), this technique is based on single ARDL equation thus reducing the number of parameters and also number of lags can be applied to each variable separately unlike VAR as in Johansen approach. A data generating process is represented by a general VAR of order p which is rewritten in vector ECM form constituting vector z of variables focusing on the conditional modeling of the dependent scalar variable y . In that front, vector z is partitioned into the scalar y and vector x of dependent variables. To examine the negation of level relationship between y and x , the approach used is F-statistic to test for joint hypothesis that all the coefficients of all lagged variables in the ECM equation are zero. PSS (2001) segregates five cases of ARDL approach to co-integration specifically; no intercepts, no trends, restricted intercepts, no trends; unrestricted intercepts. The resulting ECM may be inference as autoregressive distributed models of orders models where the F-statistic has asymptotic critical value bounds for all the cases. If the computed F-statistic fall outside the critical value bounds, the test allows a conclusive evidence without discerning about the integration situation of the underlying regressors. Whereas, if the F-statistic fall within the bounds, inference stands inconclusive and before advancing further, comprehension of the order of integration is required. If F-statistic lies below the 0.05 lower bound, there is evidence of no level relationship. Hence, no level relationship hypothesis cannot be rejected at 5 percent level.

A VECM envelops the long run relationship and short run dynamics contemporaneously that propels variable back to its long run equilibrium path after shocks that had provisionally driven it away from long run equilibrium. ECM model estimation needs a more parsimonious route.

DIAGNOSTIC TESTING OF THE DATA

Model checking is an important step in statistical modeling. Here the model as a whole would be evaluated using the following diagnostic tests:

(1) SERIAL CORRELATION TESTING: We test for serial correlation by employing the Breusch- Godfrey test. this test is useful in that allows for lagged dependent variables, higher order autoregressive process as well as single or higher order moving average processes. the main idea is to regress the residuals from the old regression on all of the independent variables and on the lagged values of the residuals. The null hypothesis is of no autocorrelation and rejection of null hypothesis would imply presence of serial correlation which must be corrected for.

(2) HETEROSCEDASTICITY TEST: It is essential to have homogeneity of variance (**Heteroscedasticity**) that is the error variance should be constant. It has been tested by the way of Breusch-Pagan-Godfrey test and ARCH.

Breusch-Pagan-Godfrey test is a large sample test for homoscedasticity. it regresses the squared residuals on the original regressor or by default. A finding of significance means the null hypothesis is rejected and homoscedasticity cannot be assumed. This test is more powerful than Goldfeld- Quandt and White's test.

Auto regressive conditional heteroscedasticity or ARCH allows for heteroscedasticity to occur in the variance of the error terms rather than in the error terms themselves. it regresses the squared residuals on lagged squared residuals and a constant. As before here as well a finding of significance means the null hypothesis is rejected and homoscedasticity cannot be assumed.

Presence of heteroscedasticity does not imply, that a good model should not be considered. in fact with the increasing use of heteroscedasticity- constant standard errors

(HAC), which allows for inference without specifying the conditional second moment of error term, testing conditional homoscedasticity is not as important as in the past.

Hence the present study adjusts for heteroscedasticity (if found), by HAC standard errors and covariance (Bartlett Kernel, Newey-West)

(3) CUMULATIVE SUM (CUSUM) AND CUMULATIVE SUM OF SQUARED RESIDUALS (CUSUMSQ) STABILITY TEST: We use the CUSUM test to detect any systemic eventual movements where the coefficients have values effecting a possible structural instability. It allows us to check if any break points prevail in the dataset. If the plot of CUSUM and CUSUMSQ statistics stays within 5 percent significance level then the estimated coefficients are said to be stable.

(4) NORMALITY TEST: the errors should be normally distributed. Technically normality is necessary only for hypothesis tests to be valid estimation of the coefficients only requires that the errors be identically and independently distributed. The Jarque-Bera test has the null hypothesis of normality and rejection of the hypothesis (because of a significant p value) leads to the conclusion that the distribution from the data came is non-normal.

THEORIES RELATED TO POLICY RECOMMENDATIONS

- The concept of *Jawboning* or *Moral Suasion* in economics is an informal method of public and private interactions. The government employs the subtle strategies of persuading the businesses and labour unions to reduce wages and thereby reduce the prices of commodities. Jawboning can contain price rise for a very transient time frame only and as many economists cite, the prices are again revised or increased when the demand or the production costs go up. As aptly put, *Jawboning is a blunt weapon against inflation* (Tucker, 2010).
- The intent of *Guidedposts* to stabilize the price-wage-productivity relationship to control inflation has been a highly contentious issue between the government and the labor and business enterprises. According to the theory, prices are determined by two key forces. The first is the equation of supply and demand in a competitive market. And the second force or contributor to the price rise is the decisions taken by the

business managers. The main objective of this theory was established by the Council of Economic Advisers. The core focus here is to check inflation by assuming that the price decisions by business managers might escalate the prices higher than the prices determined by the modalities of supply and demand. The second focus of this theory is to monitor the accumulation of presumably excessive profits. Huge profits trigger a demand for increased wages as every worker desires a larger share in the profits. As per the theory, the wages should rise only as much as the “national trend” of output per man-hour. This implies that companies in industries where productivity is rising more rapidly than the average- should reduce prices enough to distribute to the industry's customers the labor cost savings it would make under the general wage guideposts. Such a diktat is not a feasible option for any of the stakeholders.

- **Wage Freeze Policy:** Different strategies are usually employed by the governments to control inflation and these include wage and price controls, tax incentives, indexing or other measures to fix income shares. Control of wages or prices are the policies that governments undertake to control inflation induced in the emergencies of war or natural calamities. However, economies are now experiencing the more pervasive, peacetime inflation rates. To counter the inflation levels in this scenario, economists suggest alternatives like the inflation-fighting incomes policies that persuade the participants into willing acceptance.

The government intervenes here to enforce a law that restrains wage push inflation by holding wages at their existing level. Once the wage hike is contained, the employers would not add the extra costs to the goods to amass more profits and with the prices under control, inflation would be well within the confined levels.

There are two types of Remuneration and Price Controls: The Absolute Control and Rate of Growth Controls.

- **Absolute Controls:** It implies that the government can freeze the absolute level of wages and prices to inject income shares. In an inflationary situation, the frozen wages and prices are the maximum prices to be paid. In a deflationary situation, the frozen wages and prices are the minimum prices to be paid.
- **Rate of Growth Controls:** It implies that the government can freeze the annual percentage changes for wages and prices. This is done to ensure that income shares

remain fixed over time. In an inflationary situation, the annual percentage rise in wages and prices is inadequate for some concentrated rate of rise. In a deflationary situation, the annual percentage fall in wages and prices is inadequate for some concentrated rate of decrease.

LEGAL OR AUTHORIZED IMPLICATIONS OF THE CONTROLS

- **Voluntary Controls:** It strictures set as guideposts by the government to control inflation during the peacetime. In this case the government institutes a set of benchmarks for pricing behavior which are not legally binding. Hence the firms may or may not voluntarily adhere to these controls.
- **Mandatory Controls:** If "guidelines" or "guideposts" prove unworkable, the government can impose strictures that are legally binding and violation would entail penalties.
- **Absolute controls:** It intended to fix the wages and prices so that no specific group can raise income other than by the due process of working longer and producing more. This increases real output at current wage and price levels to increase real income. With increase in the real income, the wage-price spiral will be broken as no group can claim higher wages.
- **Tax Linked Wage Policy:** This mechanisms gained currency in the work of *Dawkins et al. 1999*. Dawkins and his colleagues suggest a three year freeze on award wage rates combined with tax (credits equivalent to tax cuts) for low wage workers living in low income families (*Dixon and Rimmer, 2000*). This system draws its example form variant of wage/tax bargain in Australia's current award wage system. This system covers workers accounting for about 21 percent of Australia's wage bill. Award wage rates for these workers are determined by the centarilsed bargaining in the industrial relations commission between the unions of the government and employers. The actual wage rate of workers in the award system is normally reflected in the award wage rates. This is because in determining award wage rates, the industrial relations commission reckons the factors which would be relevant in a freely operating labour market while deciding the wage rates for the group of workers currently in the award system.

- **Carrots and Sticks Policy:** This policy alludes to the popular practice of carrot and stick approach where the reward and penalty are intertwined. The allusion finds its base in the Pavlov's traditional Motivation Theory (*Herrnstein, 1969, Pp. 49-69*). More specifically, in the economic human model, there is a suggestion for containing the selfishness of few individuals or firms by instituting economic awards and supervisory tools. However, as Saylı,H., 2008, contends, such a method would only find and evaluate accusations instead of eradicating the source of the problem. Hence, a more conversant approach would be to encourage the principle that one's economic aspirations should not be achieved at the cost of country's social, economic and environmental goals.

RAW DATA

Chapter- 3

PRE RECESSION PERIOD

time	CPI-AL	CPI-IW	CPI-RL
Jan-02	2.33	4.94	2.64
Feb-02	3.01	5.19	3.32
Mar-02	3	5.17	2.98
Apr-02	2.66	4.69	2.97
May-02	2.64	4.66	2.29
Jun-02	2.61	4.16	2.59
Jul-02	2.27	3.89	2.57
Aug-02	2.24	3.86	2.23
Sep-02	3.22	4.3	3.19
Oct-02	2.88	4.06	2.86
Nov-02	3.19	3.6	3.16
Dec-02	2.88	3.2	3.18
Jan-03	3.9	3.43	3.54
Feb-03	4.55	3.86	4.18
Mar-03	4.85	4.06	4.82
Apr-03	5.5	5.12	5.13
May-03	5.14	4.66	5.11
Jun-03	5.1	4.41	4.73
Jul-03	4.75	4.16	4.7
Aug-03	3.76	3.1	3.74
Sep-03	3.43	2.89	3.41
Oct-03	3.42	3.29	3.4
Nov-03	3.1	3.07	2.76
Dec-03	3.43	3.72	3.09
Jan-04	3.75	4.35	3.73
Feb-04	3.11	4.13	3.4
Mar-04	2.47	3.49	2.45
Apr-04	1.53	2.23	1.83
May-04	1.83	2.83	1.82
Jun-04	1.82	3.02	1.81
Jul-04	2.11	3.19	1.8
Aug-04	3.02	4.61	3
Sep-04	3.31	4.81	3.29
Oct-04	3.6	4.57	3.58
Nov-04	3.3	4.17	3.28

Dec-04	3.01	3.78	2.99
Jan-05	2.71	4.37	2.69
Feb-05	2.41	4.17	2.39
Mar-05	2.41	4.17	2.4
Apr-05	3.02	4.96	2.99
May-05	3	3.74	2.99
Jun-05	2.68	3.32	2.66
Jul-05	3.55	4.06	3.82
Aug-05	3.23	3.45	3.21
Sep-05	3.21	3.63	3.19
Oct-05	3.19	4.18	3.17
Nov-05	4.65	5.33	4.62
Dec-05	4.68	5.57	4.94
Jan-06	4.69	4.75	4.66
Feb-06	5	4.95	4.66
Mar-06	5.29	4.95	5.26
Apr-06	5.57	5.03	5.23
May-06	6.41	6.31	6.38
Jun-06	7.25	7.65	7.2
Jul-06	6.29	6.71	5.95
Aug-06	6.53	6.32	6.21
Sep-06	7.34	6.78	7.02
Oct-06	8.43	7.3	8.1
Nov-06	8.33	6.33	8.01
Dec-06	8.94	6.91	8.31
Jan-07	9.52	6.72	8.91
Feb-07	9.8	7.56	9.47
Mar-07	9.5	6.72	9.17
Apr-07	9.44	6.67	9.12
May-07	8.22	6.61	7.9
Jun-07	7.84	5.69	7.53
Jul-07	8.6	6.45	8.02
Aug-07	8.8	7.26	8.51
Sep-07	7.89	6.4	7.61
Oct-07	6.99	5.51	6.72
Nov-07	6.15	5.51	5.88
Dec-07	5.9	5.51	5.63

DURING RECESSION PERIOD

time	CPI-AL	CPI-IW	CPI-RL
Jan-08	5.63	5.51	5.88
Feb-08	6.38	5.47	6.11
Mar-08	7.91	7.87	7.63
Apr-08	8.88	7.81	8.61
May-08	9.11	7.75	8.84
Jun-08	8.77	7.69	8.75
Jul-08	9.41	8.33	9.41
Aug-08	10.29	9.02	10.29
Sep-08	10.98	9.77	10.98
Oct-08	11.14	10.45	11.14
Nov-08	11.11	10.45	11.11
Dec-08	11.14	9.7	11.14
Jan-09	11.62	10.45	11.35
Feb-09	10.79	9.63	10.79
Mar-09	9.46	8.03	9.69
Apr-09	9.09	8.7	9.09
May-09	10.44	8.63	10.21
Jun-09	11.52	9.29	11.26
Jul-09	12.9	11.89	12.67
Aug-09	12.89	11.72	12.67
Sep-09	13.19	11.64	12.97
Oct-09	13.73	11.49	13.51
Nov-09	15.65	13.51	15.65
Dec-09	17.21	14.97	16.99
POST RECESSION PERIOD	CPI-AL	CPI-IW	CPI-RL
Jan-10	17.57	16.22	17.35
Feb-10	16.45	14.86	16.45
Mar-10	15.77	14.86	15.52
Apr-10	14.96	13.33	14.96
May-10	13.45	13.91	13.68
Jun-10	13.02	13.73	13.02
Jul-10	11.02	11.25	11.24
Aug-10	9.65	9.88	9.66
Sep-10	9.13	9.82	9.34
Oct-10	8.43	9.7	8.45
Nov-10	7.14	8.33	6.95
Dec-10	7.99	9.47	8.01
Jan-11	8.67	9.3	8.69

Feb-11	8.55	8.82	8.55
Mar-11	9.14	8.82	8.96
Apr-11	9.11	9.41	9.11
May-11	9.63	8.72	9.63
Jun-11	9.32	8.62	9.14
Jul-11	9.03	8.4	9.03
Aug-11	9.5	9	9.71
Sep-11	9.4	10.1	9.25
Oct-11	9.4	9.4	9.73
Nov-11	8.9	9.3	9.14
Dec-11	6.4	6.5	6.72
Jan-12	4.9	5.3	5.27
Feb-12	6.3	7.6	6.68
Mar-12	6.8	8.6	7.19
Apr-12	7.8	10.2	8.01
May-12	7.8	10.2	8.11
Jun-12	8	10.1	8.54
Jul-12	8.6	9.8	8.94
Aug-12	9.2	10.3	9.34
Sep-12	9.4	9.1	9.93
Oct-12	9.9	9.6	9.84
Nov-12	10.3	9.5	10.47
Dec-12	11.3	11.2	11.31
Jan-13	12.3	11.6	12.28
Feb-13	12.7	12.1	12.52
Mar-13	12.6	12.1	12.62
Apr-13	12.3	10.2	12.15
May-13	12.7	10.7	12.5
Jun-13	12.8	11.1	12.65
Jul-13	12.8	10.8	12.61
Aug-13	13.2	10.85	12.89
Sep-13	12.8	10.7	12.44
Oct-13	12.6	11.1	12.48
Nov-13	13.4	11.5	13.27
Dec-13	11.2	9.1	11.18
Jan-14	9.1	7.2	9.21
Feb-14	8.1	6.7	8.27
Mar-14	8.4	6.7	8.51
Apr-14	8.4	7.1	8.72
May-14	8.1	7	8.33
Jun-14	7.7	6.5	7.81

Jul-14	8	7.2	8.1
Aug-14	7.2	6.8	7.57
Sep-14	6.9	6.3	7.11
Oct-14	6.1	5	6.4
Nov-14	4.6	4.1	5.02
Dec-14	5.5	5.9	5.74
Jan-15	6.21	7.2	6.46
Feb-15	6.1	6.3	6.19
Mar-15	5.24	6.3	5.49
Apr-15	4.41	5.8	4.66
May-15	4.38	5.7	4.62
Jun-15	4.46	6.1	4.7
Jul-15	2.9	4.4	3.25
Aug-15	3	4.3	3.21
Sep-15	3.5	5.1	3.69
Oct-15	4.4	6.3	4.66
Nov-15	4.9	6.7	5.02
Dec-15	5.7	6.3	5.8

Data Source: Labour of Statistics Bureau, Ministry of Labour & employment, the GOI

Pre-Recession Time (WPI)	All Commodity	Primary Articles	Fuel &Power	Manufactured Product
jan 2002	161.0	166.4	228.1	144.2
feb 2002	160.8	166.7	227.3	143.9
Mar-02	161.9	167.3	233.0	144.1
Apr-02	162.3	169.0	230.4	144.9
May-02	162.8	168.9	230.4	145.5
june 2002	164.7	171.9	233.8	146.8
july 2002	165.6	172.3	238.4	147.1
Aug-02	167.1	175.4	237.8	148.5
sep 2002	167.4	176.1	238.8	148.6
Oct-02	167.5	175.2	240.9	148.4
nov 2002	167.8	176.5	240.8	148.5
n dec 02	167.2	174.7	238.8	148.6
jan 2003	167.8	173.8	241.8	149.2
feb 2003	169.4	176.5	244.3	150.3
Mar-03	171.6	177.9	254.1	151.0
Apr-03	173.1	179.9	254.2	152.6
May-03	173.4	180.8	247.6	154.3
june 2003	173.5	183.8	246.1	153.8
Jul-03	173.4	180.5	249.3	154.1
Aug-03	173.7	178.6	249.5	155.1

Sep-03	175.6	181.2	254.6	156.1
Oct-03	176.1	183.2	253.9	156.3
nov 2003	176.9	183.3	255.2	157.2
dec 2003	176.8	180.8	257.1	157.6
Jan-04	179.8	180.8	261.7	159.0
Feb-04	179.8	182.4	262.2	160.6
Mar-04	178.7	182.2	262.6	161.0
Apr-04	97.5	97	92.8	98.6
May-04	98	98.5	93	99
Jun-04	98.3	99	94.8	98.9
Jul-04	99.2	101	96.3	99.4
Aug-04	100.6	103.5	99.2	100
Sep-04	100.5	102.2	99.8	100.1
Oct-04	100.7	102.9	99.6	100.3
Nov-04	101.5	103.7	103.8	100.3
Dec-04	100.5	98.6	103.2	100.4
Jan-05	101	97.7	105.9	100.8
Feb-05	101.1	97.5	106.4	100.9
Mar-05	101.4	98.1	106.4	101.3
Apr-05	102.7	99.1	107.1	102.8
May-05	102.5	98.9	107.2	102.4
Jun-05	102.9	101.1	108.9	102.1
Jul-05	104	104.6	112.2	102
Aug-05	104.1	105.2	112.1	102
Sep-05	104.9	105.8	115.7	102.1
Oct-05	105.4	107.5	116.6	102.1
Nov-05	105.5	108.2	116.5	102.2
Dec-05	104.9	105.3	116.3	102.1
Jan-06	105.4	106.1	116.1	102.6
Feb-06	105.6	105.5	116.9	103.1
Mar-06	105.7	104.3	117.3	103.5
Apr-06	107.8	106.7	117.6	105.9
May-06	108.7	108.4	118.5	106.5
Jun-06	109.9	111.3	121.5	106.8
Jul-06	110.8	112.5	122.5	107.5
Aug-06	111.5	114.5	122.9	108.1
Sep-06	112.2	115.6	123.6	108.4
Oct-06	112.7	117.5	123.4	108.6
Nov-06	112.6	117.6	122.6	108.7
Dec-06	112.2	117	120.3	108.9
Jan-07	112.4	116.2	120.3	109.5

Feb-07	112.6	117	119.2	109.7
Mar-07	112.8	117.6	118.6	110
Apr-07	114.5	120.8	118.8	111.6
May-07	114.7	121.2	118.9	111.7
Jun-07	114.8	121.1	118.9	111.9
Jul-07	115.7	124.2	119.1	112.2
Aug-07	116	125.2	119.5	112.3
Sep-07	116	125.3	119.4	112.4
Oct-07	116.3	124.7	119.8	113
Nov-07	116.8	125.6	120.8	113.2
Dec-07	116.7	123.2	122.1	113.5

Duration of Recession Time	All commodities	Primary articles	Fuel & power	Manufactured products
Jan-08	117.5	121.2	122.8	115.1
Feb-08	119	124.8	124	116
Mar-08	121.5	128.9	127.4	117.8
Apr-08	123.5	132.1	130.2	119.2
May-08	124.1	134.2	131.4	119.2
Jun-08	127.3	138.3	141.7	120.7
Jul-08	128.6	141.1	143.2	121.4
Aug-08	128.9	139.2	145.6	121.8
Sep-08	128.5	138.3	144.6	121.8
Oct-08	128.7	140.8	143.1	121.6
Nov-08	126.9	141.4	136.2	120.2
Dec-08	124.5	137.5	129.1	119.3
Jan-09	124.4	137.2	127.2	119.8
Feb-09	123.3	134.4	124	119.7
Mar-09	123.5	135.8	123.1	119.8
Apr-09	125	140.8	124.2	120.2
May-09	125.9	143.3	124.8	120.8
Jun-09	126.8	146.5	125.7	121
Jul-09	128.2	149.3	130.5	121.1
Aug-09	129.6	152.9	131.5	122
Sep-09	130.3	153	132.9	122.6
Oct-09	131	155.3	133.4	122.9
Nov-09	132.9	161.6	134.7	123.6
Dec-09	133.4	162.2	135	124.2

Post-recession

Duration of Recession Time	All commodities	Primary articles	Fuel & power	Manufactured products
Jan-10	135.2	164.9	135.8	125.9
Feb-10	135.2	163.6	136.6	126.1
Mar-10	136.3	165.9	140.1	126.2
Apr-10	138.6	171	141.1	127.9
May-10	139.1	172.6	142.8	127.9
Jun-10	139.8	176	143.2	127.8
Jul-10	141	177.8	147.8	128.1
Aug-10	141.1	177.3	148	128.3
Sep-10	142	180.8	147.6	128.7
Oct-10	142.9	183.4	148.1	129.2
Nov-10	143.8	185.3	148.6	129.8
Dec-10	146	192	150.2	130.9
Jan-11	148	195.3	151.3	132.6
Feb-11	148.1	189.6	153.5	134
Mar-11	149.5	188.2	157.6	135.6
Apr-11	152.1	196.8	159.5	136.6
May-11	152.4	194.9	160.4	137.4
Jun-11	153.1	195.9	161.6	137.9
Jul-11	154.2	198.2	165.6	138
Aug-11	154.9	199.4	167.1	138.4
Sep-11	156.2	202.9	168.3	139
Oct-11	157	203.5	170	139.6
Nov-11	157.4	201.8	171.6	140.4
Dec-11	157.3	198.9	172.7	140.9
Jan-12	158.7	200.7	177	141.5
Feb-12	159.3	203	176.7	141.8
Mar-12	161	207.8	177.8	142.6
Apr-12	163.5	215.6	178.8	143.8
May-12	163.9	215	178.9	144.6
Jun-12	164.7	215	181.1	145.3
Jul-12	165.8	219.1	179.5	146.1
Aug-12	167.3	221.8	181.7	147.2
Sep-12	168.8	221.6	188.5	148
Oct-12	168.5	219.4	189.8	147.9
Nov-12	168.8	221.1	188.7	148
Dec-12	168.8	219.9	190.4	148
Jan-13	170.3	223.6	193.4	148.5
Feb-13	170.9	224.4	195.5	148.6

Mar-13	170.1	223.1	191.6	148.7
Apr-13	171.3	226.5	193.7	149.1
May-13	171.4	227.3	191.9	149.3
Jun-13	173.2	233.9	194.7	149.5
Jul-13	175.5	240.3	199.9	149.9
Aug-13	179	251.9	204.7	150.6
Sep-13	180.7	252.7	210.6	151.5
Oct-13	180.7	251.4	209.8	152.1
Nov-13	181.5	254.9	209.6	152.3
Dec-13	179.6	243.7	211.1	152.5
Jan-14	179	238.8	212.4	152.9
Feb-14	179.5	238.5	212.6	153.6
Mar-14	180.3	239.4	214.2	154.2
Apr-14	180.8	242.4	211.8	154.6
May-14	182	246.8	212.1	155.1
Jun-14	183	250.3	212.3	155.4
Jul-14	185	256.6	214.6	156
Aug-14	185.9	261.2	214	156.1
Sep-14	185	257.8	213.4	156
Oct-14	183.7	253.3	210.8	155.9
Nov-14	181.2	250.8	200.1	155.2
Dec-14	178.7	244.4	194.6	154.7
Jan-15	177.3	242.1	189	154.5
Feb-15	175.6	240.9	181.2	154
Mar-15	176.1	239	188	153.9
Apr-15	176.4	243.6	184.3	153.9
May-15	178	244.2	192.1	154.3
Jun-15	179.1	249.1	193.5	154.2
Jul-15	177.6	246.4	189.8	153.6
Aug-15	176.5	250.2	179.3	153
Sep-15	176.5	251.9	175.6	153.3
Oct-15	176.9	253.4	176.4	153.3
Nov-15	177.5	256.2	178.1	153
Dec-15	176.8	255.6	176.8	152.4

Data source: MOSPI

Chapter-4

<u>obs</u>	EXPORT	LENDING RATE	CPI-IW
1	20555	17202.7	467
2	17212	17227.5	466
3	20182	21435.4	468
4	19740	19791.7	469
5	19992	14826.4	472
6	19407	14826.4	476
7	22350	16980	481
8	21970	15867.7	484
9	21723	15502.7	485
10	22987	14185.1	487
11	19537	12392.6	489
12	19184	12434.9	484
13	23246	10841.9	483
14	20459	12448.7	484
15	24541	12448.7	487
16	20438	9284.37	493
17	22111	11080.9	494
18	20543	8840.5	497
19	21435	9697.02	501
20	20744	10972.3	499
21	25129	10780.1	499
22	25456	8079.14	503
23	22315	7347.23	504
24	27902	7662.76	502
25	23711	5222.18	504
26	28188	6021.22	504
27	35396	5543.88	504
28	24791	5422.5	504
29	26983	5911.2	508
30	27614	3520.44	512
31	26792	5777.3	517
32	27726	7346.8	522
33	31894	8674	523
34	29846	7682.7	526
35	31974	9300.1	525
36	32354	8867	521
37	35854	8787.3	526
38	35147	5150.1	525

39	44367	7237.06	525
40	33595	7263.38	529
41	34689	8156.2	527
42	34402	9138.1	529
43	32619	6837.37	538
44	37392	6875.43	540
45	37138	7741.8	542
46	38643	9616.5	548
47	33348	9679.2	553
48	42151	7804.3	550
49	40703	6030.2	119
50	40141	7802.57	119
51	51426	7408.9	119
52	38769	8037.6	120
53	45905	7658	121
54	47990	8620.9	123
55	49244	8460	124
56	50118	10777.7	124
57	49609	10956.2	125
58	45143	11755.6	125
59	44758	12211.1	127
60	48360	10116.5	127
61	48619	10276.6	127
62	46636	10257.4	128
63	56628	13812.3	127
64	47741	9251.3	128
65	50796	7743.3	129
66	49340	7935	130
67	50571	10346.2	132
68	51600	10343.3	133
69	50512	7531.24	133
70	57982	9205.8	134
71	50910	7615	134
72	57682	12045.7	134
73	58624	12045.7	5.51
74	60061	10823.4	5.47
75	69631	10336.2	7.87
76	73883	8060.8	7.81
77	78717	9583.9	7.75
78	82133	10191.6	7.69
79	81523	11725	8.33

80	76254	10281	9.02
81	71941	10224.3	9.77
82	68754	11071.6	10.45
83	54699	10449.9	10.45
84	65016	9754.6	9.7
85	62844	8475	10.45
86	58822	9523.6	9.63
87	66169	10742.2	8.03
88	62460	7430.4	8.7
89	59780	8776.43	8.63
90	65000	8646.69	9.29
91	69520	6531.12	11.89
92	65670	6655.7	11.72
93	70840	8043.4	11.64
94	69180	6831.1	11.49
95	69540	6441.4	13.51
96	76910	5944.2	14.97
97	71500	5960.8	172
98	73000	5740.5	170
99	92150	7698.86	170
100	80720	8832.64	170
101	79170	7986.77	172
102	96240	6215.72	174
103	79410	8107.16	178
104	82660	7297.17	178
105	87440	7827.08	179
106	84740	8376.72	181
107	101630	8662.94	182
108	105440	7657.21	185
109	103010	7468.02	188
110	105610	8760.63	185
111	136860	9949.67	185
112	104134	10804.4	186
113	119095	10507.8	187
114	119024	9748.25	189
115	117380	10684	193
116	112148	8381.04	194
117	126520	9951.68	197
118	116406	9847.68	198
119	118341	8699.32	199
120	133619	10958.8	197

121	130294	13522.5	198
122	123874	10321.2	199
123	145123	14428.6	201
124	123271	19294.9	205
125	135211	15161.7	206
126	139651	11903.1	208
127	128192	10872.6	212
128	128535	9459.4	214
129	135979	11825.3	215
130	127432	10933.4	217
131	127359	10392	218
132	139120	10750	219
133	140003	13167.4	221
134	143408	11676	223
135	166159	14301.1	224
136	133354	15252.3	226
137	137103	12645.3	228
138	140144	12673.5	231
139	154430	10943.8	235
140	166479	10245.1	237
141	179372	10444.5	238
142	169320	9621.88	241
143	151583	10892.5	243
144	163400	11298.7	239
145	166932	11672	237
146	156540	9433.58	238
147	185123	13890.1	239
148	157123	10863.8	242
149	166035	11174.5	244
150	154862	11530.2	246
151	155045	7349.72	252
152	163353	8108.53	253
153	175837	8511.77	253
154	158823	8894.61	253
155	163428	7859.8	253
156	164242	9527.77	253
157	151926	10335.5	254
158	136380	8393.74	253
159	150083	10685	254
160	138400	8683.02	254
161	142573	8683.02	258

162	142342	8282.43	261
163	148150	8278.59	263
164	140443	8301.82	264
165	144814	10488.7	266
166	139589	11190.2	269
167	129331	10164	270
168	150462	13467.7	269

Data Source: EWPRF & Handbook of Statistics, RBI

Chapter- 5

YEAR	WPI INFL	lnwpi	unemployment rate	lunem
1991	31.89418753	1.503711544	3.832000017	0.583426
1992	35.67793008	1.55239965	3.717000008	0.570193
1993	38.34531659	1.583712328	3.740999937	0.572988
1994	42.38769638	1.627239815	3.65199995	0.562531
1995	46.34721181	1.666023613	3.71600008	0.570076
1996	48.4213579	1.685036964	3.813999891	0.581381
1997	50.61430184	1.704273251	4.059999943	0.608526
1998	53.59066937	1.729089182	4.06400013	0.608954
1999	55.44006279	1.743823713	4.063000202	0.608847
2000	59.07142382	1.771377439	4.316999912	0.635182
2001	61.91936126	1.791826468	4.326000214	0.636087
2002	63.48299771	1.802657426	4.43200016	0.6466
2003	66.9217136	1.825567053	4.308000088	0.634276
2004	71.32365523	1.853233592	4.368999958	0.640382
2005	74.69173456	1.873272545	4.395999908	0.643058
2006	78.23319453	1.893391064	4.236999989	0.627058
2007	82.05234979	1.914091023	4.059999943	0.608526
2008	89.17311124	1.950233919	4.116000175	0.614475
2009	91.27305175	1.960342572	3.750999928	0.574147
2010	100	2	3.539999962	0.549003
2011	108.8875669	2.036978294	3.529000044	0.547652
2012	117.6680547	2.070658574	3.621000051	0.558829
2013	125.0684117	2.097147634	3.463999987	0.539578
2014	129.964307	2.113824095	3.414000034	0.533264
2015	126.3747769	2.101660402	3.49000001	0.542825

Data source: World Bank

Chapter-6

time	GDP_AT_FC	HPTREND02	output gap	inflation rate
1	5277.76	5157.636919	5177.76	483.7
2	5120.46	5370.298998	5020.46	489.8
3	5850.55	5583.036154	5750.55	500.1
4	5922.6	5795.767314	5822.6	502.5
5	5536.54	6008.578603	5436.54	508.8
6	5535.22	6221.635414	5435.22	520
7	6506.7	6434.808117	6406.7	522.7
8	6448.84	6647.538073	6348.84	629.8
9	6950.01	6859.311575	6850.01	538.3
10	6907.79	7069.490728	6807.79	548.2
11	7810.54	7277.494326	7710.54	564.4
12	8046.29	7482.6401	7946.29	567.9
13	7600.8	7684.578932	7500.8	566.6
14	7522.77	7883.313988	7422.77	576.9
15	8561.39	8078.79607	8461.39	587.1
16	8845.78	8270.750642	8745.78	593.2
17	8308.76	8459.204787	8208.76	589.5
18	8258.33	8644.544983	8158.33	603.4
19	9362.37	8827.06368	9262.37	617.1
20	9714.18	9006.811943	9614.18	626.2
21	9116.02	9184.175404	9016.02	627.5
22	9045.29	9359.981798	8945.29	636.1
23	10258.18	9535.016266	10158.18	642.5
24	10546.85	9709.867265	10446.85	647.5
25	10009.47	9885.57523	9909.47	663.5
26	9816	10063.70371	9716	697.0
27	10849.93	10245.89368	10749.93	722.7
28	10911.35	10433.63132	10811.35	702.9
29	10601.26391	10628.78032	10501.26391	684.7
30	10725.12398	10833.50294	10625.12398	700.8
31	11682.50585	11049.94424	11582.50585	722.1
32	12151.82176	11280.18157	12051.82176	738
33	11564.66439	11526.68759	11464.66439	406.7
34	11608.78875	11792.47977	11508.78875	415.5
35	12698.77402	12080.5993	12598.77402	424.1
36	13313.08387	12393.97256	13213.08387	432.7
37	12447.06	12735.9123	12347.06	445.6
38	12421.35	13110.3057	12321.35	457.6
39	13525.51	13520.85943	13425.51	465.3
40	14081.36	13970.84954	13981.36	471.7
41	13002.21	14463.555	12902.21	479
42	12994.61	15002.32384	12894.61	492.1
43	14117.85	15589.59075	14017.85	501.9
44	14706.45	16226.53562	14606.45	506.1
45	13607.57	16913.41846	13507.57	511.3
46	13664.41	17649.54928	13564.41	515.9
47	14762.12	18432.17188	14662.12	535.2

48	15383.8	19256.03938	15283.8	541.8
49	23774.18367	20113.61113	23674.18367	538.8
50	23809.06082	20994.92629	23709.06082	545.8
51	24595.09509	21892.3119	24495.09509	555.9
52	25011.89948	22799.85385	24911.89948	543.6
53	25579.48972	23713.32725	25479.48972	529
54	25760.44475	24629.88973	25660.44475	533.5
55	26389.0485	25547.86529	26289.0485	530.6
56	27176.15689	26466.28452	27076.15689	531.2

Data Source: Handbook of Statistics, RBI