

**LABOUR PRODUCTIVITY AND WAGES IN THE
ORGANISED MANUFACTURING SECTOR:
AN INTERSTATES ANALYSIS IN INDIA**

ABSTRACT OF THESIS

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

**BABASAHEB
BHIMRAO
AMBEDKAR
UNIVERSITY**



• LUCKNOW •

प्रज्ञा शील करुणा
ESTABLISHED 1996

FOR THE AWARD OF DEGREE OF

Doctor of Philosophy
IN
ECONOMICS

**Under the Supervision of
DR. SURENDRA MEHER**

**Submitted By
KUHAWASTHI**

**DEPARTMENT OF ECONOMICS
SCHOOL OF ECONOMICS & COMMERCE
BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
(A CENTRAL UNIVERSITY)**

Vidya Vihar, Raebareli Road Lucknow-226025, (U.P.), India

Enrollment No. 1239/19

Year 2024

ABSTRACT

The manufacturing sector is crucial for the economic development of nations, serving as the foundation for social and economic progress. It transitions traditional agrarian economies towards highly productive manufacturing activities, absorbing surplus labour and enhancing technical capabilities. Manufacturing fosters robust supply chains, raises national income, and improves living standards by maximizing resource utilization. Investments in manufacturing yield higher value-added and economic activity compared to service sectors, significantly impacting a nation's Gross Domestic Product (GDP) and overall economic performance.

Moreover, manufacturing drives infrastructure development, employment generation, technological innovation, and regional development, contributing to export competitiveness and economic diversification. In the global context, post-1950s witnessed significant manufacturing growth, with various regions like Western Europe, East Asia, Japan, and China experiencing industrialization booms through strategic policies and investments. This period also marked the emergence of Industry 4.0, integrating advanced technologies for enhanced efficiency and sustainability.

However, in recent years, the share of global manufacturing in GDP has declined, primarily due to the rise of the services sector and challenges like wage differentials and supply chain disruptions exacerbated by events like the COVID-19 pandemic. India, with its economic reforms since 1991 and burgeoning manufacturing capabilities, aims to position itself as a global manufacturing powerhouse, leveraging its demographic dividend, industrial infrastructure, and policies like "Make in India."

In India, the post-independence era marked a notable transition from agrarian to industrial sector propelled by planned development strategies and economic liberalization reforms. While the services sector dominates GDP, manufacturing remains crucial for employment and export competitiveness. Manufacturing policies have evolved from import substitution to export-oriented strategies, emphasizing technology upgradation, skill development, and infrastructure enhancement. Successive Five-Year Plans have prioritized industrialization, economic growth, and self-

sufficiency, adapting to changing priorities and global dynamics by incorporating liberalization and globalization.

However, the manufacturing sector in India is primarily divided into the registered/organised sector and unregistered/unorganised sector, with the organised sector's contribution to total manufacturing value-added steadily increasing over time (around 80% of total manufacturing Gross Value Added in 2019-20). However, the unorganized sector still represents a significant portion of manufacturing employment, highlighting the challenges of dual presence and the need for welfare improvements in the manufacturing sector.

Almost all the economies that are currently prosperous, have had a period since the 1970s, when their share of manufacturing employment exceeded 18% to 20%. In addition to that, it has also been established that the percentage of manufacturing output is not as reliable a predictor of a country's wealth as its employment in the manufacturing sector is (Felipe, Mehta, & Rhee, 2014). Furthermore, the manufacturing sector also possess a unique ability to provide gainful employment to semi or low skilled labourers and create strong forward and backward linkages. However, a research gap in the post-reform era regarding labour productivity, wage structures, and elasticities within India's organized manufacturing sector, particularly at the inter-state level persists due to a lack of comprehensive investigations and advanced panel data analysis techniques.

Considering the growing population dividend of India, in need of jobs, coupled with the performance of organised manufacturing outdoing the unorganised sector (with better working conditions), the present study explores labour productivity and wage levels in the organised manufacturing sector of India for seventeen major states, in a post reform period specifically, facilitating a clearer understanding of the current situation and future steps. In addition to that, trends in employment, elasticities, and overall performance have also been focused on as it could lead to better resource allocation, competent income distribution, labour market efficiency, social welfare, better forecasting, planning and policy formulation.

Objectives of the Study

1. To analyse and assess the composition and growth trends in the organised manufacturing sector of India.
2. To estimate the trends and factors affecting wages in the organised manufacturing sector of India and at interstate level.
3. To compute the trends and factors affecting labour productivity in the organised manufacturing sector of India and at interstate level.
4. To calculate state and national level elasticities in the organised manufacturing sector of India.

Hypotheses

1. There exist variations in the composition and growth trends within the organised manufacturing sector of India and at interstate level.
2. Factors such as Labour Productivity, Employment Composition, Capital Labour Ratio etc. significantly influence wages in the organised manufacturing sector at interstate level.
3. Factors such as Real Wage Per Worker, Employment Composition, Capital Labour Ratio etc. significantly influence labour productivity in the organised manufacturing sector at interstate level.
4. There exist significant and positive Employment Elasticities and Elasticities of Factor Substitution etc. in the organised manufacturing sector of India and at interstate level.

Methodology

The study relies on secondary data sourced from various published reports of the Annual Survey of Industries, Central Statistical Office, Ministry of Statistics & Programme Implementation, with a particular focus on the post-reform period (1990-91 to 2019-20). Seventeen major states viz. Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal

have been selected based on their significant aggregate contribution to All India totals in terms of factories, workers, real capital, real output, and real Gross Value Added, which exceeded 80 percent in both 1990-91 and 2019-20. The study employs various methods at both aggregate and disaggregate levels, which majorly includes Indexed Trends, Percentage Share, Compound Annual Growth Rate (CAGR), Malmquist Productivity Index, Unconditional Convergence Analysis, and Panel Data Analysis for factors affecting wage and labour productivity. The study also employs double-log or log-linear model for elasticity calculations. These methods provide a comprehensive framework for analysing the organized manufacturing sector in India across different dimensions and geographic levels.

A brief methodology for the above-mentioned statistical tools is presented below:

1. **Indexed Trends** involve measuring and comparing changes in data points over time relative to a base value, aiding standardized analysis across different time periods or datasets to identify trends and fluctuations.
2. **Compound Annual Growth Rate** has been used to measure the annual growth rate over a specified period, considering compounding effects, indicating the hypothetical steady annual growth rate over that period.
3. **Malmquist Productivity Index** assesses the changes in productivity over time by comparing the efficiency of production units relative to a benchmark frontier.
4. **Unconditional Convergence Analysis** examines whether regions with initially lower levels of income or productivity catch up to those with higher levels over time, irrespective of initial conditions or characteristics.
5. **Panel Data Analysis** incorporates both time series and cross-sectional data, to estimate effects of independent variables while addressing individual-specific characteristics or unobserved heterogeneity, with fixed effects suitable for time-invariant factors and random effects assuming uncorrelated individual-specific effects.

The general regression model for panel data can be expressed as follows:

$$y_{it} = \beta_0 + \beta_1 x_{it,1} + \beta_2 x_{it,2} + \dots + \beta_k x_{it,k} + v_{it}$$

$$i = 1, \dots, N; t = 1, \dots, T; k = 1, \dots, K$$

And the error component model can be expressed as follows:

$$y_{it} = \beta_0 + \beta_1 x_{it,1} + \beta_2 x_{it,2} + \dots + \beta_k x_{it,k} + a_i + u_{it}$$

Where,

$$v_{it} = a_i + u_{it}$$

In our study, we employed the **Lagrange Multiplier (LM) Test** to select between **Random Effects** and **Pooled OLS models**, focusing on assessing correlation and favouring fixed effects if violated. Additionally, the **Hausman Test** was utilized to compare **Fixed Effects** to Random Effects, favouring fixed effects in case of significant coefficient differences, which was the case in our study. Therefore, we applied the Fixed Effects model to panel data, employing a dummy variable technique to account for variations in intercepts among states/union territories. This estimation method is commonly referred to as the Least Squares Dummy Variable (LSDV) technique.

The fixed effects panel data model can be expressed as:

$$y_{it} = a_i + x'_{it}\beta + u_{it}; \quad i = 1, 2, \dots, N; \quad t = 1, 2, \dots, T$$

This Fixed Effects regression model can be specified using N dummy variables, making it a **Fixed Effects LSDV** panel data model:

$$y_{it} = \sum_{j=1}^N \alpha_j d_{it}^j + x'_{it}\beta + u_{it}$$

Assumptions were rigorously evaluated using **Pesaran CD Test**, **Breusch-Pagan Test**, **Wooldridge Test**, and **Levin Lin Chu Test**. Furthermore, **Driscoll-Kraay Standard Errors** were applied to mitigate issues related to serial correlation and heteroscedasticity, ensuring robust estimation in our analysis.

6. *The Double-Log or Log-Linear model* involves taking the natural logarithm of both the dependent and independent variables, facilitating the estimation of elasticity coefficients. It is interpreted as representing proportional percentage changes in the dependent variable in response to proportional percentage changes in the independent variable. We have calculated this model for estimating the Employment Elasticity of Output which can be written as:

$$\frac{\left(\frac{E_t - E_{t-1}}{E_{t-1}}\right)}{\left(\frac{Y_t - Y_{t-1}}{Y_{t-1}}\right)}$$

Which can lend itself to an econometric model:

$$e_t = \beta_1 + \beta_2 \gamma_t + \varepsilon_t$$

Taking log on both sides,

$$\log E_t = \beta_1 + \beta_2 \log \gamma_t + \varepsilon_t$$

Therefore, the coefficient of γ_t will provide the employment elasticity of output. Similarly, Elasticity of Substitution between Capital and Labour and Elasticity of Capital Labour Ratio with respect to Average Wage were also estimated.

The present study is compartmentalised into seven chapters:

First chapter of the study titled “**Introduction**” provides an overview of the pivotal role of the manufacturing sector in economic development, highlighting its contributions to GDP, job creation, regional development, and technological progress, alongside challenges like sensitivity to economic cycles and resource intensity. It discusses India's manufacturing sector classification, emphasizing the Organised vs. Unorganised Sectors, and how the former is more productive and contributes more to value added. Consequently, the chapter delves further into existing research of the organized manufacturing sector, revealing shifts in growth, output, employment, and regional differences, emphasizing increased labour productivity and varied wage dynamics, with contract labour exacerbating wage gaps. This is followed by elaborating the research

gap and significance of the present study, objectives of the study, hypotheses, methodology employed and the chapter plan.

The second chapter titled “**Conceptual and Theoretical Framework**” provides a comprehensive exploration of foundational concepts, theories, and classifications relevant to the subject matter under investigation. Consequently, the chapter was divided into seven main sections: The introduction, which underscores the pivotal role of manufacturing in economic development, tracing its evolution from manual labour to modern automation, shaping diverse industries and technologies. The concepts and definitions relevant to the study are discussed in the second segment. The third section delves into theoretical literature on wage determination across various economic schools of thought. The fourth section provides an in-depth examination of other comprehensive wage theories like fair wage theory etc. Whereas the fifth section deals with theoretical literature on wage determination in various market structures like perfect, monopolistic etc. The sixth section examines theories elucidating the complex interplay between wages and productivity. The seventh section concludes the chapter.

The third chapter titled “**Performance of the Organised Manufacturing Sector in India**” is in line with the study’s first objective, and thus examines the shares, growth rates, trends etc. prevalent in the sector. Furthermore, this chapter is split into five sections: After Introduction, the second section details the definitions of the variables employed from the Annual Survey of Industries and the third section details the nation level trends in the sector. Subsequently, the state level trends were examined in the fourth section and the last section concluded the chapter.

The fourth chapter titled “**Inter State Analysis of Wages in the Organised Manufacturing Sector of India**” examines the second objective of our study which is assessing the trends in and factors affecting labour wages in the organised manufacturing sector of India, at a disaggregated (state) level. The chapter is divided into six sections. The first section introduces the chapter, and the second section explains the additional variables included in this chapter from the latest manual of

Annual Survey of Industries. The third section attempts to analyse the trends in real wages in the organized manufacturing sector of India before the economic reforms of 1991. This fourth section scrutinizes post-reform wage trends in India's organized manufacturing sector, emphasizing inter-state differences, gender-based disparities, variations between regular and contractual workers, widening gaps between workers and senior employees, and changes in labour costs. The fifth section deals with the panel data analysis revealing factors affecting real wage per worker in the sector. It details methodology employed, findings, and implications, encompassing model selection, data characteristics, and coefficient interpretation. This is followed by the last section that concludes the chapter.

The fifth chapter of the study titled “**Inter State Analysis of Labour Productivity in the Organised Manufacturing Sector of India**” investigates the third objective of assessing trends in and factors affecting labour productivity in the organised manufacturing sector of India, at a disaggregated (state) level. This chapter is sectioned into five parts. After the first section introduces the chapter, the next section evaluates Total Factor Productivity growth in India's organized manufacturing sector using the Malmquist Productivity Index to measure changes in technical efficiency and technological progress in the post reform period. The third section assess Single Factor Productivity in the form of Capital and Labour Productivity, followed by an assessment of the relationship between labour productivity and real wage per worker and unconditional beta convergence analysis. The fifth section conducts a panel data analysis to assess the factors affecting labour productivity in the sector. The chapter's conclusion was covered in the last section.

The sixth chapter titled “**Elasticities in the Organized Manufacturing Sector of India**” fulfils the last objective of the study, which is to calculate the state and national level elasticities in the organised manufacturing sector of India. The chapter is divided into five sections. Introduction comes first followed by the next section detailing the variables included in the analysis. The third section reveals the methodology employed in the chapter. The fourth section deals with computation, and discussion of results

related to employment elasticity of output, elasticity of substitution between capital and labour and elasticity of capital labour ratio with respect to average wage within the sector during post reform period. And at last, conclusion of the chapter has been discussed in the fifth section.

Following which the last (seventh) chapter titled “**Major Findings and Suggestions**” which concludes the study.

The findings of the study are as follows:

In the organized manufacturing sector, at an all-India level, from 1990-91 to 2019-20, there has been substantial growth in output compared to employment, leading to a significant rise in labour productivity but a decrease in employment elasticity due to increasing capital intensity. The proportion of profits in factor payments has notably increased, while the share of wages has declined, highlighting a concerning outcome of post-reform industrial changes. Regularly employed workers have historically dominated employment but there's a rising trend in contractualization. Small firms have struggled to grow, impacting overall employment dynamics, with larger firms showing higher capital intensity and consequently, higher wage shares.

We have adopted the classification of states into Strong, Medium, and Weaker Manufacturing States, as outlined in a study by (Kapoor & Pachouri, 2012) titled "Manufacturing Competitiveness of Indian States." This categorization is based on various factors considered in their research. Accordingly, we organize our findings by grouping states into these predefined categories.

Our results revealed that Strong Manufacturing States like Maharashtra, Andhra Pradesh, and Tamil Nadu have held significant shares of employment, but have also experienced declines by 2019-20, while states like Gujarat and Tamil Nadu showed substantial growth in their employment shares. Gujarat emerged as the leader in real output and gross value added, displacing industrial giants like Maharashtra and Tamil Nadu, with Himachal Pradesh and Jammu and Kashmir demonstrating the highest compound annual growth rates in all the aforementioned factors. Additionally, Strong

Manufacturing States consistently demonstrated larger shares of real capital, while Medium to Weaker Manufacturing States like Bihar, Punjab, West Bengal, and Odisha lagged behind in terms of growth and percentage shares across these metrics.

There has also been a widespread increase in profit share across states, coupled with declines in wage, rent, and interest shares in Gross Value Added. Medium to Weaker Manufacturing States saw significant decreases in wage share and notable increases in profit share, while Strong Manufacturing States experienced substantial drops in rent share. Workforce composition has evolved, with the total workforce doubling from 1990-91 to 2019-20. Contractual workers, especially in states like Assam, Himachal Pradesh, and Odisha, exhibited higher growth rates compared to regular workers. Additionally, there's a rise in the proportion of female workers, indicating a growing feminization of the workforce. Capital intensity varies across states, with Gujarat, Maharashtra, and Karnataka being capital-intensive, while Bihar, Uttar Pradesh, and West Bengal lean towards labour-intensive production. These patterns often correlate with the labour regulations in each state, with capital-intensive states typically having more inflexible/pro-worker regulations. However, there's been a notable shift recently, towards capital intensity across most states.

Strong Manufacturing States like Andhra Pradesh, Gujarat, Maharashtra, Tamil Nadu, and Karnataka consistently held high real wage shares in Gross Value Added, with notable growth in Gujarat and Tamil Nadu. However, Medium to Weaker Manufacturing States like Himachal Pradesh, Jammu and Kashmir, and Assam maintained lower real wage shares, contributing to an overall decline, particularly in states like West Bengal, Bihar, and Uttar Pradesh. The real average daily wage increased for almost all states across all worker categories, with the highest growth seen for female and contractual workers in Medium to Weaker Manufacturing States. The wage gap between male and female workers decreased significantly, particularly in Strong Manufacturing States, while the gap between regular and contractual workers also narrowed. However, the wage gap between all workers (factory floor workers) and all employees (which includes supervisory and managerial staff in addition to the factory floor workers) consistently increased, signifying a more substantial rise in wages for individuals in higher management positions.

Fixed Effects Regression with Driscoll and Kraay standard errors, which was conducted on a dataset of seventeen states over twenty years (2000-01 to 2019-20) including seven variables, forming a balanced panel of 340 data units, revealed positive and statistically significant relationship between real wage per worker and labour productivity, real wage per worker and real capital invested per worker and real wage per worker and the number of mandays worked. Conversely, a negative and significant relationship was observed between real wage per worker and the ratio of casual to permanent workers, as well as between real wage per worker and the ratio of female to male workers. Additionally, differential intercept coefficients suggested unobserved heterogeneity between states, possibly influenced by factors such as the impact of state and central government policy, rent sharing mechanisms, degree of unionisation, labour market regulations etc., not captured in the study.

The estimation of Malmquist Productivity Index revealed a widespread slowdown in productivity growth across India's organized manufacturing sector in the past two decades, with Strong Manufacturing States experiencing significant declines. State wise assessment of capital productivity and labour productivity showed a stagnant trend in the former but a consistent increase in the latter, particularly in states with low capital productivity growth. Analysis of yearly labour productivity and real wage per worker revealed positive correlations in Strong Manufacturing States but weaker or negative correlations in Medium to Weaker Manufacturing States. Unconditional convergence in labour productivity across states within India's organized manufacturing sector has been observed. States that initially lagged in productivity have shown the most significant growth rates post-reform, thus validating the theory of productivity catch-up and the reduction of differentials over time. Similarly, real wage per worker has converged across states, albeit at a slower pace compared to labour productivity.

The results of the LSDV Fixed Effects Regression with Driscoll and Kraay standard errors revealed positive and statistically significant relationship between labour productivity and real wage per worker, labour productivity and ratio of casual to permanent workers, labour productivity and ratio of female to male workers and labour productivity and real capital invested per worker. Additionally, differential intercept coefficients suggested unobserved heterogeneity between states, possibly influenced by

factors such as workers education level, their innate ability, available technology, incentive schemes, impact of state and central government policy etc., not captured in the study.

The analysis of employment elasticity of output and the elasticity of substitution in India's organized manufacturing sector yielded noteworthy findings. Across states, employment elasticity was generally low, whereas states like Bihar, Himachal Pradesh, and Jammu and Kashmir exhibited relatively higher elasticities, implying a higher utilization of labour to boost output levels in these states. Moreover, the estimation of elasticity of substitution indicated high substitution possibilities of labour for capital, wherein Medium to Weaker Manufacturing States showcased better substitution possibilities compared to Strong Manufacturing States. Therefore, the findings suggest that states that are employing more labour to produce output and are more open to using labour instead of capital are producing lower output, profits and Gross Value Added. Additionally, the elasticity of the capital-labour ratio with respect to average wage showed a positive relationship indicating that an increase in wage has increases the demand for capital. Therefore, even though, there were possibilities to substitute labour for capital, an increase in average wage rates has prompted a shift towards capital input, leading to increased capital intensity and contractualization.

Suggestions

1. Wage structures in organised manufacturing sector of India are rationalized around labour productivity, therefore, states with low annual wages should focus on increasing labour productivity, as this can lead to a more equitable and sustainable wage structure.
2. Labour productivity is intricately tied to the capital-labour ratio, in the organised manufacturing sector of India, therefore, to elevate labour productivity levels, it is imperative to align these objectives with an associated augmentation in capital investment.

3. Female and contractual workers earn lower wages than their regularly employed counterparts, despite demonstrating higher levels of productivity, in the organised manufacturing sector of India. Therefore, initiatives like performance-linked pay structures, social security benefits, providing tax incentives for companies hiring them, enforcing transparent labour agreements, along with robust monitoring mechanisms should be implemented to protect their rights and to prevent their exploitation.

4. The organised manufacturing sector of India has been facing low employment elasticity of output in the post reform period; therefore, strategies like promotion of skill development in labour intensive states and formulation of export-friendly policies, along with industrial expansion to boost employment should be considered. Furthermore, adoption of employment friendly technology and introduction of flexible labour market regulation should be undertaken.

5. India's organized manufacturing sector exhibited a high value of elasticity of substitution, which was calculated through elasticity of labour productivity with respect to average wage rate, i.e., the sector can substitute abundant labour force with scarce capital input until marginal productivity of labour is equal to average/marginal wage rate, implying more labour can be employed in place of capital, at the current wage rate. However, maintaining the current wage is crucial for this transition as the elasticity of capital labour ratio with respect to average wage was also found to be high, indicating that an increase in average wage would result in higher capital being employed in place of labour.