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Productivity-Wage Divergence: Evidence from Indian Manufacturing Sector

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Abstract: ***The study explores the long-term relationship between real wages and labour productivity growth in India's organised manufacturing sector, using panel data from 23 industries between 1999-2000 and 2017-18. Applying two-step System GMM, it confirms the efficiency wage hypothesis. Productivity is positively influenced by capital intensity and contract labour, but negatively by the male workforce share.***

Keywords: Productivity, Wage, Manufacturing

1.Introduction

The long-run relationship between labour productivity and wage is crucial in policy formulation. Researchers postulate a long-run relationship between real wages and labour productivity (Hall, 1986; Wakeford, 2004; Strauss & Wohart, 2004). An increase in labour productivity contributes directly to economic growth, while higher wages contribute to equitable distribution (Tsoku & Matarise, 2014). However, it is observed that the rise in real wages falls behind the labour productivity growth in recent years for Indian organised manufacturing (Bhattacharya et al., 2010; Jain, 2019). After the liberalisation in the '90s, the wage-productivity gap widened for the Indian manufacturing sector.

Researchers tried empirically validating the wage-productivity relation and finding the direction and determinants of causality. There is a common consensus on a positive correlation between wage and labour productivity; however, they differ in the direction of causality. Some concluded the causality ran from productivity growth to growth in real wages; some found causality from real wages to productivity growth, and some concluded bidirectional causality. Studies on the wage-productivity gap in Indian manufacturing confirm a widening gap as productivity grew faster than the real wage in the post reforms era.

The present study attempts to locate the long-run relationship between labour productivity and real wage rate for the Indian Manufacturing sector. The paper uses panel data for 23 industry groups from 1999-2000 to 2017-18. The rest of the paper is organised into four sections. Section 2 describes the data and methodology used in the study. Section 3 presents broad trends of major variables and discusses the results. Finally, the paper concludes and suggests policies.

2.Materials and Methods

2.1 Time Period and Data Sources:

The data used in the analysis are sourced from the Annual Survey of Industries (ASI) published by the Central Statistical Organisation (CSO), India. The paper used a panel data for 23 industries groups for the period 1999-2000 to 2017-18. The study models the logarithm of labour productivity (lp) as a dependent variable and represent it as:

$$lp = f(kl, rel\_w, skill, male, contract) \quad (1)$$

The independent variables used in the study are the logarithm of the capital-labour ratio, relative wage, skill, male share, and contractualisation. The source of the variables is presented in Table 2.

Table 1: Data Sources and Variable descriptions

Variable	Symbols	Specification
Labour productivity	lp	Real NVA/Total employees
Capital-labour ratio	kl	Capital stock per employee
Relative wage	rel_w	wage rate of a specific industry group to wage rate of the overall manufacturing wage rate
Skill intensity of the industries	skill	weighted geometric mean of the skill intensity of workers and skill intensity of managerial & supervisory staff
Sex ratio in the workforce	male	percentage of male workers in directly employed workers
Contractualisation	contract	percentage of contract workers in the number of workers

Source: Author's compilation.

2.2 Econometric methods and tests:

Second-generation unit-root tests are employed in the study as the first-generation tests failed to incorporate cross-sectional dependency. CADF tests developed by Pesaran (2007) are applied to examine stationarity in cross-section dependent panels.

The test can be formulated as:

$$CIPS(N,T) = N^{-1}\sum_{i=1}^{N} t_i\ (N,T) \qquad (2)$$

The $t_i(N,T)$ represents the cross-section augmented dickey fuller statistic for the i^{th} cross-section unit.

Fixed effects estimation with Driscoll-Kraay standard errors (DK-FE):

To estimate the FE regression model with Driscoll-Kraay standard errors, all the model variables, z_{it}, are at first within-transformed as follows:

$$\widetilde{z_{it}} = \bar{z_i} - \bar{\bar{z}} \text{ where } z_i = T_i^{-1}\sum_{t=t_{i1}}^{T_i} z_{it} \text{ and } \bar{z} = \left(\sum T_i\right)^{-1}\sum\sum z_{it} \qquad (3)$$

The regression model with the transformed variables is then estimated using pooled OLS with Driscoll-Kraay (DK) standard errors. The regression corrects for the autocorrelation, heteroscedasticity, and cross-sectional dependence in the error terms. The DK standard errors modify the covariance matrix of the OLS error terms by obtaining the square roots of the diagonal terms of the asymptotic covariance matrix.

3.Broad trends and Results

3.1 Trends of labour productivity and real wage rate

One of the major drawbacks of the liberalisation policy adopted in the early 90s is jobless growth and increasing wage inequality. Studies pointed to the increased divergence between labour productivity and real wage rate (Goldar, 2002; Banga, 2005; Mitra, 2016; Jain, 2019).

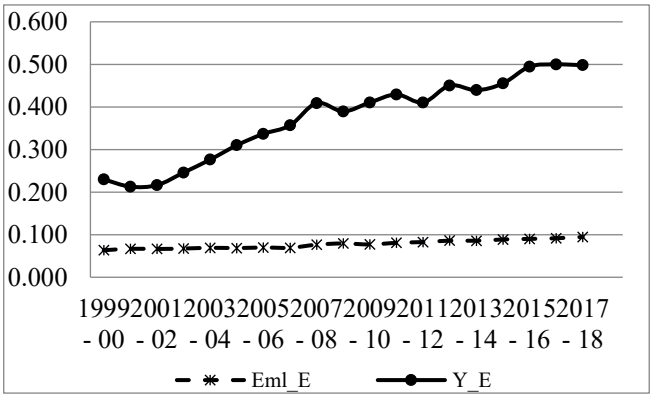

Figure 1: Trends in Labour Productivity and real wage rate (in Rs 'million)
Source: Authors Calculation from ASI Data

Figure 1 points out the increasing divergence between labour productivity and real wage rate in the study period. It is important to note that labour productivity growth has been significantly larger than the real wage rate for all the individual industry groups and manufacturing as a whole. These trends point towards the non-transfer of benefits of productivity growth to labour.

3.2 Results from Econometric Estimations

Table 2 depicts the pairwise correlation coefficient between the variables. The correlation coefficient between labour productivity and relative wage is 0.804 and is statistically significant. The correlations are positive and significant between labour productivity and other independent variables. Similarly, the correlations between relative wage and other variables are positive and significant. However, the table reports a negative but insignificant correlation between relative wage and contractualisation.

Table 2: Pairwise correlation Matrix

Variables	lp	kl	rel_w	skill	male	contract
lp	1					
kl	0.81*	1				
rel_w	0.80*	0.76*	1			
skill	0.34*	0.22*	0.42*	1		
male	0.40*	0.63*	0.62*	0.20*	1	
contract	0.37*	0.25*	-0.00	0.17*	0.04	1

Source: Authors' calculation.
Note: *, **, and *** denote 1%, 5%, and 10% significance levels, respectively.

We conduct the CIPS unit root test (Im et al., 2003) and Pesaran's CADF test (Pesaran, 2007) to check the variables' stationarity. Table 3 reports that all the variables follow I(0).

Table 3: Results of Second-generation panel unit root test

	CIPS test	CADF test
	at level	at level
lp	-3.727*	-2.808*
kl	-3.409*	-2.730**
rel_w	-3.952*	-2.989*
skill	-3.364*	-2.932 *
male	-3.380*	-2.568***
contract	-3.848*	-2.912*

Source: Authors' calculation.
Note: Figures in parentheses are the z-values of the t-bar. *, **, and *** denotes 1%, 5%, and 10% significance level, respectively.

The data exhibits fixed effects, heteroskedasticity, serial correlation, and cross-sectional dependency. The data is also a short-balanced panel as the number of cross-sections (23) is larger than the periods (18). So, we use the fixed effect panel model with Driscoll-Kray standard error. The results of the same are presented in Table 4.

Table 4: Results from Driscoll-Kray SE regressions

	Coeff	t-stat
kl	0.540*	12.23
rel_w	0.578*	4.00
skill	0.865	1.59
male	-0.068	-0.31
contract	0.522*	12.09
cons	-2.657*	-3.02
F-stat	90.64*	
R^2	0.609	

Source: Authors' calculation.

The coefficients represent the elasticity of the independent variable as we have taken the logarithmic values. The coefficients suggest log of capital-labour ratio, relative wage, and share of contract workers have a positive and statistically significant effect on the log of labour productivity. The results show that the coefficient for the log of capital-labor ratio for the model is positive and statistically significant. The result implies that a percentage increase in the capital-labour ratio affects a 0.54 percent positive change in labour productivity. The coefficient of the log of skill is positive but insignificant. In addition, we find an insignificant but negative effect of the log of male share in the workforce on labour productivity. The overall fit of the model is statistically significant. We also report a positive and significant effect of contractualization on labour productivity. A percentage increase in contractualization improves labour productivity by 0.52 percent. The results show a positive impact of relative wage on labour productivity, and the coefficient is statistically significant. The result suggests percentage change in relative wage affects a 0.57 percent increase in labour productivity. The result hints at the operation of the efficiency wage hypothesis in Indian organised manufacturing.

4.Conclusion and Policy implications

The paper investigates labour productivity- real wages relations for 23 industry groups from 1999-2000 to 2017-18. The study concludes the existence of a long-run relationship between labour productivity growth and real wage rate. The results conclude that relative wage increases positively impact labour productivity growth. Among other determinants, labour productivity growth is positively affected by growth in the capital-labour ratio and a rise in contractualisation; however, we report a negative and significant effect of growth in male share in the workforce on labour productivity growth. The study suggests no significant impact of skill intensity on labour productivity growth.

Efficiency wages boost productivity by motivating workers through higher pay and job security. However, they can burden producers, requiring better monitoring. Capital-intensive methods raise demand for skilled labour, encouraging skill development. Contractualisation improves productivity, so labour market reforms should enhance flexibility, increasing jobs and real wages in the long run.

Declarations:

Availability of data and materials: The primary data source of the study is Annual Survey of Industries. The data that support the findings of this study can be available from the corresponding author upon reasonable request.

Competing interests: The author declare that they have no financial or non-financial interests that are directly or indirectly related to the work submitted for publication.

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