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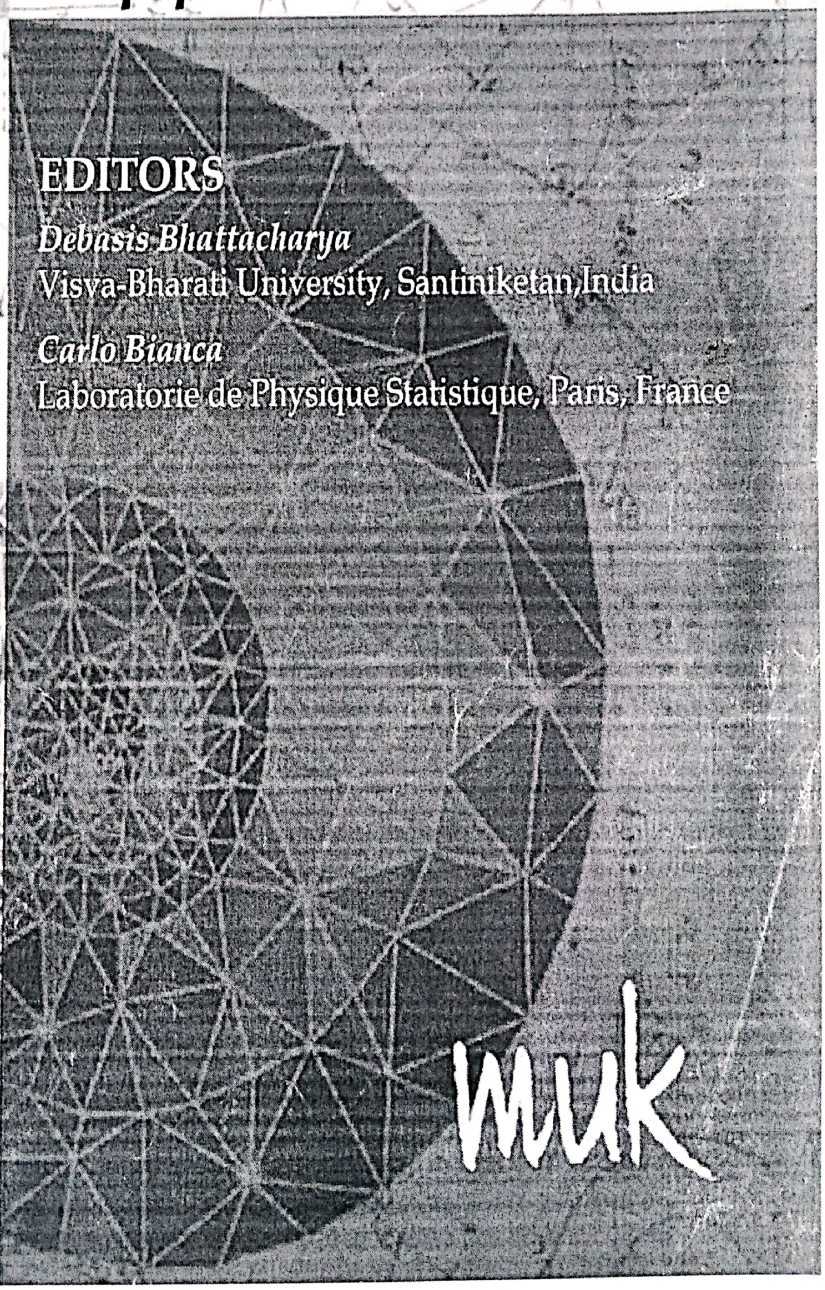

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ANALYSIS OF THE REAL WAGE- PRODUCTIVITY RELATIONSHIP IN THE ORGANIZED TEXTILE SECTOR OF INDIA USING THE VECM APPROACH

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ABSTRACT

The paper examines the wage-productivity relationship between the real wage rate and labour productivity in the organised manufacturing sector of India for the period of 1980-81 to 2018-19 using the Annual Survey of Industries data. The study aims to establish causality between the two variables in the short run and the long *run.* Analysis suggests *that the organized textile sector of India has experienced a substantial wage productivity gap, where labour productivity have shown the accelerating trends but at the same time the real wage rate have remain stagnant during the study period. Further, the pair-wise Garner Causality test shows that in the organised textile sector of India, the causality runs in a unidirectional way from real wage to labour productivity. Further, to understand the real wage rate and labour productivity causality in short-run and long-run, the study applied the Vector Error Correction Model (VECM). The VECM results also reveal unidirectional causality from real wages to labour productivity operates in the long-term and the short-term. Moreover, any deviation in the long-run equilibrium will be corrected by 13 percent each year as per error correction term estimates. Thus, considering the positive influence of real wages on labour productivity, it would be appropriate to link wages to labour productivity in organised textile sector of India.*

INTRODUCTION

Families and wage earners need wages to sustain their living standards. Economic progress and social justice are also closely associated with wages and labour productivity. The studies have shown that higher wages increase productivity since it improves workers' health and physical capabilities. In addition, a wage increase stimulates employees to carry out more intensive work (Yusof, 2007). According to Erumban et al. (2016), a real wage is a tool by which productivity is deciphered into welfare. Further, living standard depends critically on real wages (Katovich and Maria, 2018). A close relationship between wages and productivity helps the country to achieve international competitiveness and deplete wage-price spiral risks. Also, the most common reason for industrial disputes is wage issues. Collective bargaining is centered on them. Higher productivity facilitates higher wages and an increase in wages induces an increase in productivity (Patra, 2012). When labour productivity rises, it provides a ground for labours to demand higher wages. The real wages of workers must rise significantly in order to benefit from the gains in labour productivity.

Economic growth is inextricably linked with real wages and both of these factors contribute to welfare. Considering neoliberal reforms taking place in developing countries, the relationship between wages and productivity has become increasingly relevant (Das et al., 2017). According to theory, labour productivity should increase together with real wages, but recently, there has been a growing disparity between them (Erumban and Vries, 2016). In reality, wage distribution tends to diverge depending on economic and institutional factors (Katovich and Maria, 2018). Although real wages, employment and productivity are correlated, the evidence is contradictory about their relationship. For instance, according to Bhattacharya and Mitra (1994), wages in the organized manufacturing sector of India are growing more slowly than productivity. Based on the methodology, the data and perhaps the deflator used, there is varying support for the wage-productivity relationship. Policies in the area of wages must be understood and implemented by policymakers to establish comprehensive and continuous growth.

Considering the significant nexus between real wage rate and labour productivity, we attempt to explore the nexus between labour productivity and wages in organized textile industry of India. We found previous studies on real wage rates and labour productivity is mainly aggregate-based. There have been no studies specifically dealing with the issue of causality between the real wage rate and labour productivity. Receiving cognizance of this, we offer to fill this void by estimating labour productivity in the textile industry of India. Our study is precisely industry specific as we recognise that, Indian industries have a formidable degree of intra-industry diversity. Policy measures based on the macro level will fail to transmit a rewarding outcome due to significant contradiction in policies of each state, the sectors and deviation in the performance of each industry (Kathuria, 2010). The in-depth study of this issue will be of enormous value to validate the implication of real wage-productivity relation particularly in labour-intensive industry like textile. Thus, this paper will be a potentially

useful addition to the existing literature and policy debate for highlighting the issue of real wages and labour productivity in India.

The arrangement of the remaining paper is as follows. The profile of the textile sector is detailed in section II. Section III provides a theoretical underpinning of real wage and labour productivity relationships. We have provided empirical evidence on real wages and labour productivity by intensely surveying the past literature in section IV. Data description and methodology has been provided in section V. Section VI of the paper deal with pair-wise Garner Causality test. We have provided a empirical evidence of real wage and labour productivity gap in section VII. Section VIII deals with the results interpretations of Vector Error Correction Model. We conclude our paper with section IX by dealing with policy implications and concluding remarks.

Profile of Textile Sector

It has been largely admitted that increasing productivity in all sectors of the economy is a compelling requirement to put the economy on a prosperity path. To accomplish these, the precise valuation of policy measures becomes inevitable to get an in-depth understanding of the impact of various measures implemented to boost productivity. The trends in labour productivity will give us a clear understanding of the productivity performance of specific sector manufacturing. In the Indian context, we have not come across studies that have estimated nexus between real wage rate and labour productivity in the textile sector. The textile industry, eminently being labour intensive, exquisitely suits our framework for evaluating the performance of real wage and labour productivity. Most notably, it is the single largest industry in the economy and form the backbone of the socio-economic structure of India (Tondan, 2013). Also, this industry is regarded as typical 'starter' industry for nations that have initiated an exports-orientated industrialization (Gereffi, 2001). Besides these, its contribution to industrial production and the gross domestic product is highly noteworthy. It contributes around 14 % of industrial production and 4 % to gross domestic product respectively. In terms of employment, it is the second-largest employer after agriculture, providing a livelihood for 45 million people directly (Ministry of Textile, Government of India, 2014). Additionally, it provides indirect employment to around 60 million people, mainly preoccupied with agriculture-based raw material and trade-related handling. Around 15 % of foreign exchange in India is earned by this sector (Dhanabhakyam and Shanti, 2007). Moreover, due to its low capital prerequisite, it is the preferred industry to achieve the objective of decentralization and rural development.

Real Wage - Productivity Relationship – A Theoretical Perspective

The theories have well elaborated the connection between wages and productivity. As per marginal productivity theory, the factors of production are compensated for their marginal product. As long as the addition made to the total output is greater than the price increase, the firm will employ an additional unit of labour. When real wages rise, capital replaces labour as a factor of production. A positive effect of this is to raise marginal productivity and, therefore, average labour productivity. Alternatively, the Solow model suggests that profit maximizing firm requires continuous improvement in labour productivity. Also, fair wage-effort model developed by Akerlof and Yellen (1990), noted that labours will put in less effort if they are paid below what they perceive to be reasonable. Akerlof and Yellen's fair wage model assumes that firm pays its workers close to the workers' fair reference wage. Lower wages will result in lower productivity for the firm. In their opinion, a firm will exhibit low morale, absenteeism, dissatisfaction and shirking if its morale is low. The Leibenstein Nutritional Efficiency model suggests that higher wages for the labour provide better nutritional value to feed him and therefore increase the firm's output. According to the Gift Exchange model, employees reciprocate increased production efforts when a firm pays higher wages than competitors do.

However, in the Adverse Selection model, a firm fixed higher wages to attract the best workers. The increasing output will result in higher wages for the firm because its workers are of higher quality. A shirking model, however, provides another explanation for wage-productivity relationships. According to the model, the firm pays the employees over the market rate to prevent shirking. A higher wage is accomplished; shirking is avoided because employees put more effort into the production. According to the theory of Induced Technological Change, an increment in wage percentage brings a significant rise in labour productivity. Corresponding, Verdoorn's law indicates that output impacts productivity positively. The law of averages states that productivity grows roughly proportionately to the square root of output over time. In the presence of increasing returns, faster output growth results in rapid productivity growth. Any wage-cost reduction strategy will have a disruptive effect on demand and innovation, according to the law. The Vintage Return Model predicts that when trade unions demand increments in wages, vintage capital will be changed by new capital-intensive embodied machinery. Using old vintage capital as a weapon, firms can exploit trade unions that demand a modest wage instead of aggregating wages.

Based on the neoclassical model, a profit-maximizing firm will substitute capital for labour once the price of labour escalates to such an extent that the marginal productivity of labour corresponds to the given real wage. According to Shapiro and Stiglitz (1984), wages should reflect marginal output instead of being based on wages. According to this theory, firms are rationally motivated to pay a higher wage than market rates to retain and recruit more productive employees. Specifically, higher productivity is realized through a combination of wages and labour market institutions, such as unemployment benefits. According to theory, the productivity of experienced workers is higher and the workers are less likely to leave the firm. Baumol's cost disease (or Baumol effect) occurs when wages in non-productivity growing jobs rise in response to wage growth in other employment with better labour productivity. The neoclassical model predicts that increased labour demand would arise from cost-effective labour input. An inelastic labour supply results in escalating wage rates when wages are commensurate with marginal productivity. The medium and long term can entail a change of employment levels and capital stock for firms. Thus, through a change in wages or interest rates, firms can substitute labour for capital. The short-run wage increase has a scale effect; however, wage increases are likely to have scale and substitution effects in the medium and long-term. At exogenously given prices in perfect competition goods market, wages make no sense if they increase. Even though the economic theory does not always fulfill the assumptions, wage-setting rules are justified (Das et al, 2017).

REVIEW OF LITERATURE

Numerous studies have examined the connection between real wages and labour productivity. Observations from these previous studies indicate that the two variables have different types of links depending on the context. According to Papaola (2008), the relationship between labour productivity and real wages is not as direct or closed as the relationship between income and output. According to evidence, real wages and labour productivity are linked and if this relationship is managed effectively, it can promote employment and inclusive growth. There is, however, a significant level of variation between wages and productivity and no uniform link exists between the two variables. Several factors may explain the observed variation, including data complications, measurement issues and labour market segmentation. In addition, while law presses for a basic and minimum wage, there is no governing body that examines the issue of the distribution of those gains in India.

The three percent gap between labour productivity and real wage rate growth from 1985 to 1999 was reported by Golder and Banga (2005). Their study explained the weak relationship between wage and labour productivity and according to the study; it was due to weak bargaining strategies and the decline in the pay of the public sector. Strauss (2004) discovered that the link between productivity and wages was relatively inelastic, compared to real wages in the USA manufacturing sector during 1956-1996. Meghan (2002) found, wages in the Netherlands, Canada and Italy were determined based on the efficiency theory of wages. Furthermore, their research shows that trade unions play an enormous role in setting wages than labour productivity. According to Ho and Yap (2002), there is an inverse link between wages and labour productivity, recommending that higher capacity does not equate to a higher earnings. However, they noticed a conclusive but less significant nexus between real wages and labour productivity. In their study, Mischel and Chierholz (2004) note a growing divergence between real wages and labour productivity. Their research indicates that the private sector in the United States has experienced lower increases in productivity and real wages. In the Indian industrial sector, Sidhu (2008) demonstrated that the significant factor determining wage rates was technology rather than labour productivity. Pradhan (2018) found that, after reforms, the wage discrepancy has widened between the wages of workers and labour productivity across the states in India. For the period between 1974-94, the productivity wage-gap ratio was 2.15 percent. However, it increased to 4.15 percent from 1994-95 to 2016-17. A study by Sing (2013) showed that the real wage growth rate declined between 1983 to 2013, reflecting a downward trend in productivity growth. This finding is supported by Chakraborti and Choudhery's (2004) research. A discrepancy was found between the real wages of workers and mean productivity, in which the real wages had declined by 3.6 percent annually. Nonetheless, Papola (1970) found that wages and productivity were uncorrelated in cotton textile industries of India. Rather than labour productivity, he found that the cost of living played a larger role in influencing wages

In a study of Fonesca (1964), wages were significantly influenced by labour productivity between 1953 and 1963. Because higher wages do not translate into higher labour productivity, the relationship between labour productivity and wage growth was weaker. Similar results were reported by Swany (1969) in 29 manufacturing industries over the period 1953 to 1963, demonstrating the existence of a negative relationship between the two variables. Suri (1976) also supported the finding of the causal association between wage and productivity. Based on his conclusions, labour productivity has a higher global significance than any other variable involved

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in the study, including capital-output ratio, employment index and living costs index. According to Emilia Herman (2019), in Romanian manufacturing between 2008 and 2016, wages and labour productivity exhibited a positive relationship. The study, however, pointed out that gaps between labour productivity and wages were increasing across the entire manufacturing sector, which may lead to increased social inequalities. An inverse relationship between wage rate and productivity was found by Mishar (2008). According to Sharpe et al. (2008), wages and productivity were positively correlated in Canada and OECD countries. In their view, higher real wages were the result of increased labour productivity. Using the Cobb-Douglass production function Harrision (2008) showed that productivity correlations between real wage rates and labour productivity significantly increased from 1980 to 2005. Their study found that productivity expanded by 37.4 percent during the study period. The study noted that increasing labour productivity elevates the living standards via increases in real wages. Serneels (2005), identified that productivity and wages are linked to economic development. In another study (Goh and Wong, 2010) found that between 1970 and 2005, real wages and productivity existed in equilibrium, despite a dichotomy between unemployment and this relationship. The elasticity of real wages exceeded one, regardless of the fact that labour productivity was a significant long-run factor in regulating real wages. Over time, therefore, labour productivity advances lag behind increases in real wages. As demonstrated by Ho and Yap (2001), labour productivity and real wages were positively correlated with each other in the Malaysian manufacturing industry. The significant relationship between real wages and employment were found, whereas union density had no significant relationship with real wages. Goldar et al. (2005) found marginal effect was very small, but the relationship between labour productivity and wage rate was found to be positive.

Data Description

A time series data spanning 19980 to 2019 are used in this study. The data has been compiled for the Annual Survey of Industries published by the Central Statistical organization, Ministry of Statistics and Programme Implementation, Government of India. NIC codes are changing constantly over time; hence, a different year has been concorded to arrive at consistent series before being utilised in empirical work. We have adjusted pre-2004 and post-2004 data to reflect the appropriate adoption of industries. Also, ASI data are reported at current prices. To make the value of different variables comparable, the single deflation method is used for deflating data. The splicing method of index number has been employed to evolve arithmetically price index series. Gross value-added data has been deflated using wholesale price index obtained from Economic Advisors, Minister of Commerce and Industry, Government of India for the base year 1993-94=100. Total emoluments were deflated by using the consumer price index (General) for industrial workers published by Labour Bureau, Government of India (base year 1993-94=100). Furthermore, nominal data of fixed investment was deflated using the wholesale price index for machinery and tools published by the Reserve Bank of India (base year 1993-94=100).

Measurement of Key Variables

A consistent, efficient and reliable estimate of the results requires accurate measurements of variables. The complication arises in selecting an appropriate variable from alternative ones since there are multiple ways to measure the variables. This section provides a summary of the key variables as well as their measurement.

Labour Productivity: Labour productivity is calculated by dividing a firm's real gross value added by the number of employees.

Capital Intensity: Capital intensity is measured as the proportion of fixed capital to employees in a firm.

Capacity Utilization: The ratio of gross output to productive capital, as quantified by Badrinarayan, (2008) and is interpreted as a proxy for technological adoption.

Output: Nominal gross output is deflated by the wholesale price index to calculate output.

Wage money: An employee's nominal wage.

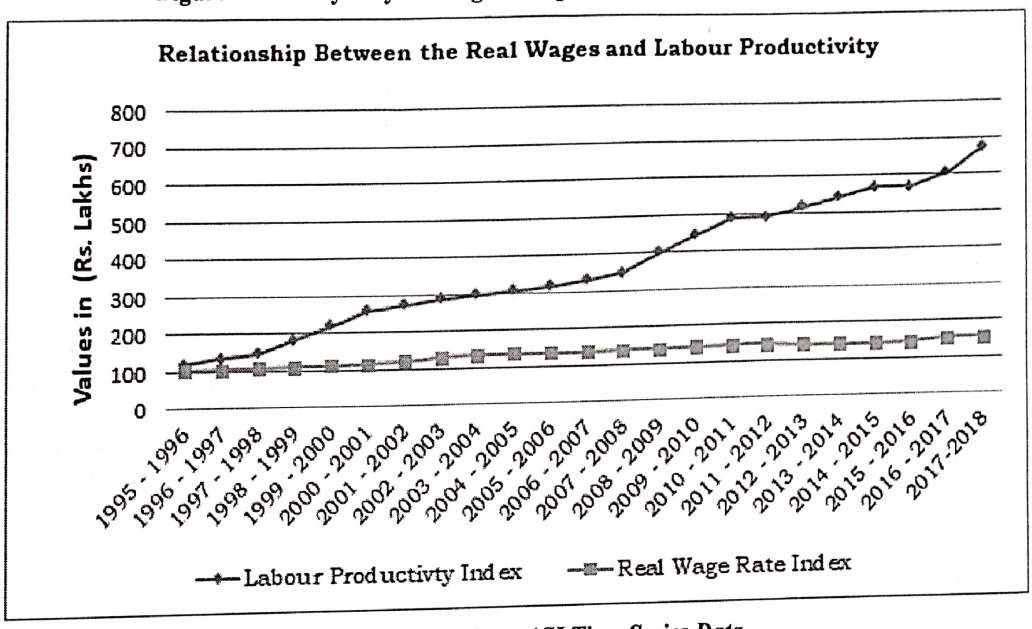
Real wage: Inflation-adjusted gross wage for industrial workers, 1993/1994=100.

Labour Productivity and Real Wages: A Preliminary Investigation

Theoretical evidence shows that real wages and labour productivity have a bi-directional causality. For instance, real wages and labour productivity are positively correlated according to the efficiency wages theory. The neoclassical theory, on the other hand, suggests that higher productivity increases wages. Yet, previous studies contradict each other regarding the nexus between productivity and real wages. It is noteworthy that neither researchers nor policymakers attempted to grasp the relationship between the two in the organized textile industry, a second largest employer after agriculture in India. The increasing divergence between real wages and

labour productivity has attracted considerable attention because it affects living standards, social protection and the distribution of compensation between workers and capital (Erumban and Vries, 2016). Furthermore, minimum wages are fixed primarily on the relationship between these two variables in the economy. As presumed in economic theory, wages and labour productivity should move in the same direction, according to Klein (2012). In the long run, wages and labour productivity will continue to grow at the same rate (Feldstein, 2008). In Fig 1, the direction of real wages and labour productivity has been depicted in the organized textile sector of India since reform.

Figure 1: Three-yearly Moving Average of Growth Rates (1995-2018)



Source: Drawn from ASI Time Series Data

Labour productivity has increased substantially over the period, as shown in the above line graph. It can be observed that real wages have remained stagnant throughout the post-reform era. India's organized textile sector saw its mean labour productivity index increase from Rs.100 in 1995 to Rs. 764 in 2017; however, mean real wages index rose only to Rs. 148. Consequently, labour productivity increased by nearly four and a half times, but real wages increased only marginally. Figure 1 illustrates the widening gap between real wages and labour productivity. Further, it can be noted that the initial period showed a positive correlation between real wages and labour productivity. In the Indian context, the results corroborated with empirical findings of Bhalotra (1998), Golder and Banga (2005), Sidhu (2008). Our analysis indicates that the organized textile sector of India has experienced a substantial real wage and labour productivity gap. It shows that textile workers are not receiving wages commensurate with their ability to produce.

Several factors contribute to the existence of such wage-productivity gap. In the first place, the massive increase in capital intensity indicates mechanization, replacing labour with capital. Various studies argue that technological advances that deepen capital will lead to a decline in wages (see Humar, 1996; Verma, 2009; Ghosh, 2012; Chand 2017). Moreover, technological changes in the textile industry have created a high demand for workers. Based on previous studies conducted by Neogi at el.(2008), Nath (2008), Behle (2015), it is found that the textile industry find shortage of skilled workers to recruit. At the same time, there is fierce competition among unskilled workers to enter the industry for work. Due to this, there has been a decline in bargaining power since the supply of unskilled labour increased, leading to an imbalance between wages and productivity. Also, the trade union data suggests that workers' bargaining power has been waning over the years (Papola, 1994; Sundar, 2005; Golder, 2013; Sharma, 2015). Trade union statistics show that there is a decline in trade union strength in terms of the total number of unions and memberships. A large portion of the wage-productivity difference in India's textile industry is explained by the weak bargaining power of the trade unions (Golder, 2013).

Moreover, the number of women participating in the labour force has increased considerably in recent years. Women account for a large part of the workforce in the textile industry's supply chain, undertaking several

activities. In India, there is a huge disparity between men and women in terms of their wage levels. Several studies have identified a gender pay gap where women were earns half as much as men (Shaha 2007; Dutt, 2009; Swamy, 2018). The gender pay gap has resulted in a substantial preference to employ women permanently in a job. Additionally, it is found that women tend to be passive in negotiations and bargaining, making managerial decisions easier (Humar, 1996; Swamy, 2018). With the rise in female employment, the rate of male employment declines significantly, causing wages to decrease. Further, the growing real wage-productivity gap in the organized textile sector is related to the declining terms of trade. Based on the prices of the goods that workers produce, they earn a nominal wage. The textile product prices, however, have not increased proportionally in the domestic and international markets. When the rise in prices of products is relatively slower than those consumed by workers, it largely leads to decline in wages of the workers.

Additionally, measurement errors are possible, which amplify wage and productivity gaps to some extent. Real wages are determined by the deflator used to convert nominal wages. There is strong evidence that the mismatch between price deflators and wage measures is a major factor behind the real wage-productivity gap (Feldstein, 2008). Nevertheless, Bosworth and Perry (2016) point out that deflating income does not close the real wage-productivity gap completely. Measurement of productivity depends on deflating output using producer prices, but the real wage is typically determined by using consumer prices because it better measures welfare. Due to this, the wage-productivity gap will be affected by the difference between these two prices. In the organized textile manufacturing industry, employment formalisation is increasing, which would explain the divergence between real wages and productivity. Evidence shows that despite the stagnation of direct employment, the number of contract workers has increased significantly in India (Shakthi, 2008; Uttaph, 2014; Ohaja, 2016).There has been a preference for contract workers because they do not have to comply with stringent labour regulations. Additionally, contract workers contribute to production in the same way as permanent labour for a lower wage. Furthermore, the widespread presence of contract workers provides an incentive for firms to lower the wages of permanent workers by weakening their bargaining power (Chakraborty, 2018).

Several other economists have put forth their view for explaining the wages lagging behind labour productivity. Spencer (1973) argues that firms find it difficult to assess workers' productivity due to information asymmetries. Thus, firms prefer to pay workers according to productivity signals, for examples, education. However, education itself may not be measured to judge the worker's true productivity. As explained in Biesebroeck (2015), an employer may temporarily skew wages by providing a compensation schedule at the start of an employee's final year of employment. Sahamoto and Kim (2014) provide a different argument. According to them, the firm will play the tactics of discrimination against the workers. Discrimination may be on race, gender, social state, etc. where the discrimination workers will be imposed wage penalties. They feel that such racial and gender discrimination in the economic sector can be possible explanations for wage productivity divergence. Manning (2010) considers imperfection in labour market results in a wage-productivity gap in the economy. He argues that both labour and firms are confronted with search costs. Thus, both parties are willing to agree at a wage rate divergent from actual productivity growth. Bentolila and Paul (2003) suggested that technology-based innovation and instrument leads to capital augmenting technical progress. This generates bias between capital and labour resulting in differences between real wage and labour productivity.

Wage-Productively Causality

Studies have found that wage increase is associated with improved productivity. A rise in real wages rate improve living conditions of workers and reduce poverty is widely acknowledged by policymakers. It is well documented in the literature that it is not possible to raise nominal wages without increasing labour productivity because such conditions would lead to inflationary pressure in economy. Although the real wage and productivity nexus has major implication from macroeconomic perspective, the evidence in the literature shows that long-term causality between the two variables is neglected in India. Therefore, several questions remain unanswered as a result of this. In particular, the question such as is there a long-run relationship between wages and productivity and what is the direction of causality between these two variables in short run and long run. Here, we examine the dynamics of the relationship between the variables using time series data. A period of 39 years beginning in 1980-81 to 2018-19 has been taken into consideration. The VECM model has been estimated for understanding the long-run causal relationship between wages and labour productivity. Estimates are done of all variables by converting them into logarithmic form. In this way, we can interpret the coefficient as elasticities.

Table 1 shows the summary statistics of the two variables: real wage and labour productivity.

Tables 1: Summary Statistics of Log Real Wages and Log Labour Productivity

	Log Series of Real Wages	*Log Series of Labour Productivity*
Mean	2.148	2.695
Median	2.318	2.568
Max	3.125	3.453
Min	1.234	2.564
Standard Deviation	0.419	0.330
Skewness	0.180	0.228
Kurtosis	1.800	1.733

Source: Author Calculation based on ASI time series data

A study found that the real wage series had a mean of 2.148 while the labour productivity series had a mean of 2.69. Similarly, the minimum value of the series of real wages is 1.234, and the minimum value of the labour productivity log series is 2.564. Real wages and labour productivity have standard deviations of 0.419 and 0.330, respectively.

Pair-wise Granger Causality Test

The relationship between wages and labour productivity is adequately bidirectional, as suggested by theories. However, relationship between the two variables can take any one of three forms at any given time: unidirectional, bidirectional or zero causality. The relationship between wages and productivity, however, may not be consistent with theories, but may be affected by several factors, including level of capacity utilization, capital intensity, skill development and rules and regulations that govern wages in the organised textile sector in India. The examination of relationship between the two variables with the Granger Causality test reveals that the relationship between wages and labour productivity is unidirectional, where the causality flows from real wages to labour productivity. Hence, we can conclude that wages Granger causes labour productivity in the orgainsed textile sector of India. As shown in Table 2, this relationship is evident.

Table 2: Granger Causality Test

Hypothesis	*Chi-Square*	*Probability*	*Outcome*	*Relationship*
H_0 – Labour Productivty does not Granger Cause Wages	0.765	0.12	No Causality exist	Unidirectional
H_0 – Wages does not Granger Cause Labour Productivty	10.98	0.003	Causality exist	

Source: Author's calculation based on time series data from ASI using STATA 0.16

A glance at Table 2 reveals that the null hypothesis of labour productivity does not Granger cause wages cannot be rejected because the P-value is much higher than the conventional 0.05 percentage. However, the null hypothesis of wages don't Granger cause labour productivity, on the other hand, is rejected due to the P-value being much lower than 0.05 percent, as reported in Table 2.

However, the major limitation of Granger causality test is that it does not demonstrate long-run or short-run cointegration between the variables. Moreover, it does not provide information about the speed of adjustment when variables diverge from the equilibrium position. We have estimated Vector Error Correction Model (VECM) to solve this problem. Estimation through VECM is advantageous because it provide interpretations of long-term and short-term equations and more efficient coefficient estimates. Furthermore, it provides a concept of error correction terms, which provides fair information about the correction of deviations from the long-run equilibrium.

The VECM model can be represented by the equation

$$\Delta lnLPR_t = \beta_0 \pi r^2 + \sum_{i=1}^{n} \beta_i \, \Delta \mathrm{lnLPR}_{t-1} + \sum_{i=0}^{n} \delta_i \, \Delta lnRW_{t-i} + \varphi ECT_{t-1} + \mu_t \qquad (1)$$

The ECT represents a residual from the following long-run cointegration regression model.

$$y_t = \beta_o + \beta_1 x_t + \varepsilon_t \qquad (2)$$

The above equation can be defined as

$$ECT_{t-1} = y_{t-1} - \beta_o + \beta_1 x_{t-1} \quad (3)$$

Augmented Dickey-Fuller Test

As our data consist of long period and we have employed a time-series data for this study it is imperative to check the stationary of the series to avoid making spurious predictions. As long as the series is time-variant, it is considered stationary. The hypotheses set are:

H_0: The series contains a unit root.

H_1 : There is no unit root present in the series.

At the level form and for the first difference, the results of the Augmented Dickey-Fuller Test are presented in Table 3.

Table No 3: Labour Productivity and Textile Sector Output Unit Roots Tests results

Variables	*t-Statistics*	*Critical Value at 5 %*	*Probability*	*Results*
At level				
Log of Labour Productivity	-3.151	-4.123	0.002	Non stationary
Log of Real Wages	1.02	-3. 034	0.000	Non stationary
At First Difference				
Log of Labour Productivity	-3.675	-3.061	0.000	Stationary
Log of Real Wages	-4.345	-3.089	0.004	Stationary

Source: Author's calculation based on time series data from ASI using STATA 0.16

In order to reject the null hypothesis, the critical value at 0.05 is compared to the t- statistics. The null hypothesis is rejected if the t- statistic value falls below the critical value. At a conventional significance level of 1 percent, the ADF test indicates that the null hypothesis of the presence of unit roots in both series can be rejected. The existence of unit root is a clear indication of non stationary series. The problem can be resolved by testing the unit root at a first difference of the series. The result of the testing the series at first difference by the ADF test shows that the critical value was lower than the t-statistics value. Therefore, the variables are stationary based on this evidence.

Akaike Information Criterion

Having achieved stationary of the series, the next step is to to determine the optimal lag length. In our study we have obtain the maximum lag in model using Akaike Information Criterion. The general rule for selection of lag length is lower value of Akaike Information Criterion. In our causality model, the maximum of two lag lengths were detected with the lowest value of -21.0856 a one percent significant level.

Cointegration Test

The decision to use the restricted Vector Auto Regressive model (short-run) or Vector Error Correction Model (long-run) depends on the presence of a cointegration vector. To examine cointegration vector into series, we used Johansen multivariate cointegration test. Using this test, the variables under consideration are integrated of first differencing with deterministic linear trends and intercepts without a structural break(s). Specifically, the hypothesis of the Johansen cointegration test is:

H_0: The model does not include a cointegration equation

H_1 : The model contains a cointegration equation.

The result of Johansen Multivariate Integration Test is reported in the table below.

Table 4 : Johansen Multivariate Cointegration Test

Number of Cointegration equations	*Trace Statistics*	*5 % Critical Value*	*Probability*
None	52.6342	27.87	0.0623
At Most 1	17.9756	15.78	0.0273
At Most 2	3.5656	4.78	0.125

Source: Author's calculation based on time series data from ASI using STATA 0.16

Table 4 confirms that there is one cointegration equations in the model, which suggests that we can proceed with the estimation of the Vector Error Correction Model. With this, long-term equilibrium to short-term disequilibrium by using error correction reconciles (Goh, 2009).

The error-correction term which refers to the last period deviation from long-run equilibrium (the error) influences the short-run dynamics of the dependent variables (Cherian, 2018). The coefficients of error correction term measure speed adjustment because they determine the rate at which dependent variables Y return to equilibrium after the change in independent variables X (Nayak, 2013). The coefficients of ECT will range from -1 to 0 when model is specified correctly and the data are appropriately adjusted. The positive sign is not good for the model because it implies that the process will not converge in the long run due to instability issues, misspecification of the model and some data issue.

Table below presents the results of the VECM model

Table 5: Result of VECM Model

Variables	*Coefficient*	*Std. error*	*t- Statistic*	*Probability*
C (1)	-0.137	0.012	-2.785	0.0031
C (2)	0.414	0.055	8.975	0.0000
C (3)	-0.170	0.654	-3.085	0.0032
C (4)	-8.126	0.002	-0.395	0.0084
C (5)	-0.002	0.007	-1.345	0.0088
C (6)	0.012	0.087	0.998	0.0088
Number of Observation	39			
R^2	0.76			
F-Statistics	15.5643			
Prob. (F- statistics)	0.0000			
Durbin-Watson stat	1.7654			

Source: Author's calculation based on time series data from ASI using STATA 0.16

From the result, with R^2 value of 0.76 and F-statistics value being highly significant, it reveal that the model is correctly specified. In our model, the labour productivity is dependent variables and wages is independent variable.

The C (1) represents the long-run estimates of the error correction term. We can observe that the coefficient is negative and statistically significant, which provides a good indication of speed adjustment. The statistical significance at 0. 05 percent value of error correction term implies that real wages adjust back towards long-run equilibrium (but not productivity) following a shock. The negative sign of the coefficient indicates that if departure happens from equilibrium in one direction, it has to be corrected for another direction to restore the equilibrium. A coefficient of -0.137 indicates that the long-run equilibrium gets corrected in proportion to the coefficient for each period. Accordingly, the dynamic causal system provided by the econometric evidence shows that real wages affect labour productivity positively in long run. Therefore, a real wage adjustment is the only method of achieving equilibrium in the long run as there is a clear evidence of unidirectional causality running from wages to labour productivity.

Short-run Causality (Wald Test)

After studying the long-run dynamics of the relationship between the variables, the issue of short-term causality remains unresolved. A Wald test is employed to resolve these issues. The coefficients in models C (4) and C (5) correspond to the short-run. Table 6 demonstrates the result of the model.

Table 6. Result of Short-run Causality (Wald Test)

Test Statistics	*Value*	*df*	*Probability*
F-Statistics	1.006	2.365	0.3654
Chi-square	2.076	2.167	0.2365

Source: Author's calculation based on time series data from ASI using STATA 0.16

Wald test clearly shows that wages do not affect labour productivity. A null hypothesis to the effect that labour productivity does not affect wages cannot be rejected in this setting. As shown in the above table, the chi-square value is much higher than the significance level of p-value of 0.05 percent.

Diagnostic Test of the Residual

The result will be validated after performing several diagnostic tests. The results of the different diagnostic tests are presented below

Table 7: Diagnostic Test of the Residual

Test	*Null Hypotheses*	*Value*
Normality Test (Jarque–Bera Statistic)	Normal distribution of residuals	1.23 (0.382)
Serial Correlation (Breusch–Godfrey Serial Correlation LM Test)	No serially correlation	0.033 (0.940)
Heteroskedasticity Test (Breusch–Pagan– Godfrey)	Absence of heteroskedasticity	0.512 (0.708)

Source: Author's calculation based on time series data from ASI using STATA 0.16

VECM's diagnostic tests have revealed that it is normally distributed and it is also not affected by serial correlation or heteroskedasticity problem.

Policy Implications

The study found that wages are highly associated with labour productivity. To make a wage a tool for boosting labour productivity, wages can be linked to the performance of individual productivity and must be incentive-driven. No doubt the higher wages will increase the cost of production, but such an increase in cost will be offset by an increase in productivity and output. Also, the government must reform the minimum wage rate policy in the economy. Further, we suggest that since the present wage -incentives system like payment of production bonus, piece-rate system have several pitfalls, a policy change in these will be useful in achieving higher productivity in long run. In addition to these, flexibility in employment, scientifically determine the workload, multifold job training and implementation of welfare measures are suggested by this study. A focus should be on providing practical target and systemic workers training programs and implementation methods which will help in improving the worker's efforts.

CONCLUSION

The study examines looks at the dynamics of the wage-productivity relationship in the organised textile sector of India. This study also looks at the short-term dynamics of the relationship between real wages and labour productivity. The study demonstrates that in both the short run and the long run, there is a positive link between labour productivity and real wages rate in the organised manufacturing textile sector of India. A short-term dynamic model that incorporates error correction reveals that the real wage usually follows short-term labour productivity dynamics as well as adhering to deviations from equilibrium. Real wages are the most direct mechanism for transferring the benefits of productivity growth since increasing labour productivity provides long-term gains in living standards. Governments and the private sector must accordingly adjust wages according to the productivity of their workers, given the importance of the results. Also, wage determination laws in India need to be corrected and labour reforms are urgently needed. A wage linkage to the labour productivity could improve the productivity of India's organized textile sector. This research supports the assertion that it can be expanded in many directions. In our economy, the unorganized sector is the largest employer of labour. According to the National Sample Survey 2011-12, 436 million workers (92.8%) are involved in the informal sector. By comparing labour productivity and wages in the organized and unorganized sectors of the textile industry, a balanced perspective can be gained on this subject. In addition, present an analysis of can be extended to find the differences in labour productivity and real wages in other labour-intensive industries such as leather and footwear, gems and jewelry, food processing, tobacco, textiles, wood, furniture, etc. As such, such comparative inter-industry analyses might be useful for understanding the wage-productivity nexus and its trends. This can be the focal theme for further research.

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