Drivers of Labour Productivity: Evidence from Manufacturing Sector

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Introduction

The relationship between labour productivity and real wages has been an important area of policy debate during post reform period in India. Though labour productivity is expected to be significantly affected by wages, several other factors also influence it. The neoclassicals suggest that labour demand would increase if productivity per unit of labour would increase at a given wage rate. Literature indicates that growth in manufacturing is significantly influenced by rising labour productivity as it acts as the deciding factor in adoption of improved technology and expansion of capacity, which in turn is directly related to the wages (Das et al , pp: 41-56 2017) . The argument that the wage growth below productivity growth would increase employment level is particularly important in currently policy debate in the light of high unemployment rates in many developing countries following the neoliberal reforms (De, Long, 2002)

The relationship between wages and labour productivity is important since the standard of living and distribution of incomes between labour and capital depend upon it. If wages are growing faster than labour productivity , labour forces receives greater part of national incomes therefore incentives to invest in capital decrease. As a result , technological development in the sector slows down and during a long period conditions the both , labour productivity and wages, decrease (Zita and Stankaityle, pp: 24-35, 2013).Over the years, several studies have been conducted to examine the various factors affecting the wage rate in the manufacturing sector of India. The present paper explores the relationship between labour productivity and wage and its implications for employment outcomes in manufacturing industries in India.

Over the years, various studies have tried to establish the linkage between wage and productivity at a theoretical level. Theoretically, wage is closely related to labour productivity. Liebenstein's (pp: 1957) analysis says that wage is related to productivity through the nutritive values of good intake. A higher wage level enables the worker to increase the caloric content of his diet and this in turn will cause an increase to the amount of effort that he supplies. According to Kerr, Clark (pp: 1949) wages and productivity in the short run may be linked together primarily in two ways (a) direct linkage of productivity and wages (b) indirectly through profits and prices while Ross (pp: 1950) did not find any relationship between labour productivity and real hourly earnings. It is observed that most of the studies on wage employment relationship through productivity growth are based on

macro economic data from the developed countries. Zavodny (1999) analyzed the US data for the period 1974-1994 and observed that strong labour union is associated with smaller increase in wage productivity gap. Golder et al. (2004) revealed a positive relationship between labour productivity and wage rate but the marginal effect of labour productivity on wage rate is very low. Harrison (2009) observed that the widening gap between productivity and real earnings is significantly related to rising wages. Apart from wages, there are number of other factors, which affect the labour productivity at industrial level, and number of studies has also been conducted to investigate the factors that affect labour productivity in manufacturing industry. Voulgaris and Popadogonas (2005) conducted a study to investigate determinants of labour productivity growth in Greek manufacturing firm by using regression models on longitudinal data of 3035 firms. They used labour productivity as the dependent variable and while the independent variables were taken as physical capital, wage, firm size, foreign ownership, research and development export orientation of firm size, education of employment, skill and industry age and found that firm size is negatively associated with labour productivity. The other variables like physical capital, proportion of skilled workers and education of the manager were positively related with labour productivity. Narayan and Smyth (2009) using the co integration technique investigated the relationship between inflation, real wages and growth of labour productivity in the seven counties in 19960-2004. And they found a positive statistically significant relationship between real wages and productivity growth. Fiouz et al. (2011) investigated determinants of labour productivity of Iran's manufacturing sector at industry level. Results of the study show that among the explanatory variables, wage came out to be the most significant and important factor affecting labour productivity. Tang, Chor Foon (2012) empirically investigated the Malaysian manufacturing sector using annual data from 1980 to 2009. They found a quadratic relationship between labour productivity and real wages instead of a linear relationship Heshmati and Su (2014) attempted to analyze the labour productivity in 31 Chinese provinces during 2000-2009. The study found that the share of industry output, investments in fixed assets, and total volume of telecommunications investments, enterprises profits and the average wage of labour had positive effect on labour productivity. Xuedong et.al (2016) examined the impact of high-temperature conditions on the productivity of workers involved in construction sector. Findings of the study concluded that high temperature environments imposes heat stress on the human body as a result of which there is decrease in labor productivity in the construction industry.

From the above review it is clear that despite the considerable debate on the issue of impact of wages on labour productivity in international context, little systematic empirical work has been done to examine this issue in Indian manufacturing sector. The modest but growing literature in this field has mainly focused on the relation between trade reforms and relative industry wages and very few studies have been conducted to examine the wage and labour productivity relationship and other factors, which affect the labour productivity of manufacturing sector.

Papole (1970) analyzed the productivity relationship in cotton textile industry in India for the period 1939-62. The study found that in the long run wages are found to be moving in line with the value of production per worker. Sinha and Sawhny (1970) found an inverse relationship between the share of labour in product gain and the rate of increase in total productivity for Indian manufacturing sector. Bhatnagar (1988) attempted to study the relationship between wages and productivity in case of seven engineering industries in India for the period 1960-1980. The study found that capital intensity was positively correlated with both wage rate and labour productivity. Paul (2004) examined the effect of technological change on wage differential in Indian manufacturing using the data from NSSO for the years 1983-84 , 1987-88 and 1993-94 and observed that introduction of new technology worked against the educated worker. Bhattacharya et al. (2011) investigated the long run relationship between labour productivity and real wages for Indian manufacturing sector at two-digit level of disaggregation by using ASI data for the period 1973-74 to 1999-2000 and found long run relationship between labour productivity and wage as well as between productivity and employment. Das et al. (2017) explored the relationship between labour productivity and wage rate across the industry groups at two - digit NIC in a panel data framework for the period 1998-2013. The study not found a causal relation between employment, wage rate, and productivity in registered manufacturing industry in India.

The present study contributes to the literature by estimating the growth rates in average real wages and labour productivity by industry and examining the determinants of labour productivity in Indian manufacturing sector employing cross section data for the period 2014-15.

The present paper has been structured as follows. Section I gives the introduction and the brief overview of earlier studies. Section II presents the data source and methodology used for the present study In Section III we outlines trends in wages and labour productivity in Indian manufacturing sector. Section IV is devoted to examining the factors which affect the labour productivity of Indian manufacturing sector. Section V concludes with some important policy implications.

Data Base and Methodology

This paper is concerned with an analysis of factors contributing to labour productivity of Indian manufacturing sector. To achieve this objective regression analysis is applied on the cross –section data for the period 2014-15. In order to examine the trend of labour productivity, wages and capital intensity among different manufacturing industries, Time Series data is used for the period 1985-86 to 2014-15. Four explanatory variables were considered for the study purpose. These variables are average annual wages per worker, the ratio of contract workers to total employment, capital intensity and skill intensity. The following functional relationship is postulated.

LP=f (S, Ki, CI, W) (i)

LP=labour productivity

S=Skill intensity

Ki=capital intensity

W=Average wage rate in a given industry

CL=share of contract labour in total workers

The following equation has been estimated

$LP=\alpha_0+\alpha_1 w+\alpha_2 sk+\alpha_3 ki+\alpha_4 cl+\mu$ (ii)

The above functional relationship is estimated from the data on industries at the two digit level of aggregation method provided by the Annual Survey of Industries (ASI). National Industrial Classification (NIC) based on United Sates International Standard Industrial Classification (UNISIC) is used for the compilation of data in the ASI. For the study purpose, four NIC classifications 1987, 1998, 2004 and 2008 codes have been used for the data collection. "The ASI provides data on 26 industries in total industry at 2–digit classification and 19 sectors in manufacturing. From the year 1998-1999 onwards there is change to three-digit NIC codes, therefore, the clubbing of some industries is required for pooling the time series data at the two digit NIC level. After clubbing the industries according to different NIC codes, the number of industries for the present study has been reduced to fourteen" (Sidhu, Hina, 2008) . These industries are (1) food products and beverages (2) Tobacco Products (3) Textiles ,wearing apparel, dressing and dyeing of fur (4) Leather and leather products (5) Wood and Wood products including furniture (6) Paper and paper products including publishing and printing (7) Rubber, plastic , petroleum , nuclear fuels and coal products (8) Non-metallic mineral products (9) Chemicals and chemical products (10) Basic metals (11) Fabricated metal products except machinery (12) Computers, electrical machinery radio , TV , communication equipment etc. (14) Motor vehicles, transport equipment and parts.

Further, to make the analysis of time series data comparable, the nominal values of all the variable considered for the study purpose were deflated with the appropriate price indices. In order to convert gross value added and fixed capital into real the sector specific WPI (Base 2004-05) has been employed for the corresponding manufacturing industries. The Consumer Price Index for industrial workers has been used to convert the nominal wages and salaries into real wages. The data on the Whole Sale Price index has been collected from the various issues of Handbook of Statistics on Indian Economy and data on Consumer Price Index for industrial workers have been collected from various issues of Reserve Bank of India Bulletin.

Manufacturing Sector: Contribution in Indian Economy

Indian economy has emerged as the fastest growing economy with a high growth of over 7 percent and manufacturing sector has been a major contributor in sustaining high growth rate (Government of India, Economic Survey, 2016-17). Though the contribution of the manufacturing sector to Gross Value Added (GVA) has been hovering around 17 percent for the last few years but its growth is low compared to its neighboring countries such as Thailand (where 35 perecent of GDP is from manufacturing), China (32 percent), Phillippines (30 percent), Indonesia (29 percent) (The Hindu , Business Line, 2017) .

Today, manufacturing in India presents a picture of many contrasts and during the recent past, the performance of the manufacturing sector in India has not been quite satisfactory. In the last decade, the average growth rate of manufacturing sector was around 7.79 percent despite the fact that overall growth of the economy had been quite impressive. In order to make it an engine of growth for the economy the modified Manufacturing Policy of 2011 aims that manufacturing sector should contribute at least 25 percent of GDP. In the recent years, the manufacturing sector has been the major focus for the Government of India. The Make in India campaign is one of the important initiatives taken by the current Government to attract foreign investors to invest in India. However though a number of industries have gained international prominence like automobiles and pharmaceuticals but still industries like garments, textiles, and engineering have shown significant job losses after the global economic crisis of 2008-09. "A persistent feature of Indian manufacturing since the 1980s has been its 'joblessness' – relatively fast rates of growth of output but not a corresponding rise in manufacturing employment" (Thomas,2013).

By examining Table 1 we see the average annual growth rates of labour productivity for the years 1985-86 to 2014-15. The average annual growth rates have been calculated by taking the simple average of annual growth rates. We have considered the 1985-86 to 1994-95 as pre reforms period because most of studies suggest that the impact of economic liberalization on the performance of different sectors starts after 1995. The results indicate that in terms of growth of labour productivity, Wood industry has shown a highest rank during the period 1985-1995. The Textile industry has shown a negative average growth rate in terms of labour productivity, as well as in terms of growth rate of wages during the period of 1985-1995 and 1995-2005. The findings reveal that during the post reform period average annual growth rates of wages deceased in all industries except for leather industry while during 2005-2015 annual average growth rates of wages have been shown increasing trend except for leather industry. The average annual growth rate of wages in leather industry is 8.84 percent in 1995-2005 which declined to 4.58 in 2005-15

It is also clear from the table that there is widening wage differential across the manufacturing industrial groups which can be attributed to the prevalence of job specialization and restricted mobility of workers outside the sector.

Table 1: Average Annual Growth Rates in Labour Productivity and Real Wages in Major Manufacturing Industries (1985-86 to 2014-15)

Name of the Industry	1985-1995		1995-2005		2005-2015	
	Labour Producvtivity	Wages	Labour Productivity	Wages	LabourProductivity	Wages
Food and Bevarges	16.86	12.73	6.71	10.68	17.56	12.73
Tabacoo Industry	15.65	8.53	15.37	8.43	11.54	10.30
Textiles	6.35	-0.854	-2.08	-0.63	14.09	12.93
Leather Industry	21.11	8.84	9.12	9.65	6.82	4.586
Wood Industry	26.3	9.85	8.64	7.04	22.06	12.22
Chemical and Products	16.94	11.13	10.20	8.31	15.53	14.53
Rubber Industry	9.85	9.81	9.55	7.99	11.31	9.29
Basic Metal	17.06	3.58	4.40	7.26	18.04	16.91
Machinery and Equipment	13.00	11.04	8.04	6.85	28.32	22.80

Source : Author's Calculations

Table 2 : Compound Annual Growth Rate in Labor productivity and Wages in Major Manufacturing industries (1985-86 to 2014-15)

	Labour Producvtivity	Wages	Real Wages Difference
Food and Bevarges	11.63	11.64	-.001
Tabacoo Industry	12.77	8.77	-4
Textiles	3.46	2.41	-1.05
Leather Industry	14.86	16.07	1.21
Wood Industry	9.41	10.69	1.28
Chemical and Products	11.65	10.52	-1.13
Rubber Industry	8.20	10.06	1.86
Basic Metal	12.74	10.79	-1.95
Machinery and Equipment	11.07	11.16	0.2

Source: Author's Calculations

The above Table indicates the industry-wise labour productivity and average wages of major industries in the manufacturing sector for the period 1985-86 to 2014-15. Table shows that in the industry except food and Beverages, leather industry, wood industry, rubber industry and machinery and equipment the growth in labour productivity is relatively higher than the growth in average wages. It means that share of wages in labour productivity has declined over the period 1985-2015. The major decline in the share of wages was recorded in the Tabacoo industry.

Results of Regression Analysis

In this section, determinants of labour productivity in different industries have been estimated by employing single equitation, multiple regression model has been presented. The variables have been taken as

(i) Labour Productivity: Labor productivity is taken as dependedt variable for the present study. The movement in labour productivity based on the real wages is examined and a positive relationship between wages and labour productivity is expected. Following Golder (1986), Bhattacharya et al. (2011), Dholakia (1976), the present study used gross value added as an index of output in place of net value added because deprecation charges in the Indian industry are known to be highly arbitrary, fixed by income tax authorizes and represent actual consumption. Labour productivity is defined as the ratio of gross value added to per employee. As per ASI definition employment is defined as the total employment of an industry.

(ii) Average Wage: The term wage for the present study includes total wages and salaries plus non wages benefits like bonus, provident fund etc. A positive relationship is expected between labour productivity and wages (Johri (1972) , Verma (1966) , Dholika (1976)) because industries where productivity per worker is high there would be a larger surplus available for redistribution among workers. Average wages are calculated as follows.

Average Wage : Total Wages/ Total no. of Employees

(iii) Capital intensity: technology affects the labour productivity to a large extent indirectly through market –structural factors. By following Sidhu, Hina (2008 pp: 249-261) capital intensity is taken as a proxy for technology and it is measured as the ratio of fixed capital to the total number of workers employed in each industry. A positive relationship was hypothesized between cpaitla intensity and labour productivity.

(iv) Skill Intensity: ASI does not provide any information regarding the skill composition of the workers. Therefore we followed the methodology of Dholokia (1976 ,pp: 3342-3344) and skill intensity is defined as the propration of skill workers in total working force and skill workers include the managers, supervisors and office and field staff.

(v) Ratio of Contract workers to total employment: Ratio of contract workers to total employment is also taken as independent variable because it is hypothesized that more presence of contract workers in the industry negatively affected the productivity of workers.

The results of regression analysis are presented in Table 3.

Table 3: Results of Regression Analysis

Variable	β	p-value of β
Constant	-.691	.091
Wages	.143	.002**
Capital intensity	.830	.003**
Skill intensity	.500	.000**
Ratio of contract staff	.111	.683
R-square	.935	
Adjusted R-square	.922	

Note: significant at 1 percent level of significance

The above Table presents the results of regression analysis. The findings of the regression analysis indicate that the regression coefficients for skill intensity, average wages and capital intensity are found to be highly significant at 1 percent level of significant. It must be noted that all the regression coefficients except ratio of contract staff have a positive sign as it was expected. The value of R2 indicates the strength of the association between the dependent and the explanatory variables and the value of R2 is found to 0.93 which implies that 93 percent variation in labour productivity in Indian manufacturing industry is explained by these variables. The value of the coefficient for wages is positive (0.143) and statistically significant at one percent which shows that the increase in wages bring about an increase in the labour productivity. As far as the capital intensity is, concerned findings indicate that there is a statistically significant association between capital intensity and labour productivity. The value of regression coefficient for capital intensity is found to be 0.83, which means that a unit increases in capital labor ratio brings 83 percent increase in labour productivity.

Conclusion and Policy Implications

From the above discussion it is clear that today one of the major challenges facing by Indian economy is the creation of job opportunities for the growing labour force. The findings of the study indicate that inter industry wage disparities and strong and positive relationship is found between labour productivity and wages and also between capital intensity and skill inensity. The findings of the study suggest that for the sustained growth of manufacturing sector focus should be given on skill development along with research and development in technological innovation because it will enhance production potential in the manufacturing sector. In order to increase the productivity of labour, social security measures also needs to be adopted in the economy and special fund for workers should be created in the economy to pay lump-sum compensation to workers in the event of closure or downsizing of enterprise. Thus relevant policies related to knowledge which in turn encourage investments in human capital, technology and innovations have become the need of the hour for enhancement of labour productivity.

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