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Effect of Industrial Agglomeration on Wages in Unorganised Manufacturing Sector

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ABSTRACT

The study investigates the possible relation between agglomeration economies and wages of hired workers in the unorganised manufacturing sector. In particular, effect on firm level wages of industrial diversity of organised manufacturing sector in a district, measured by Herfindahl index, has been analysed. Industrial diversity creates opportunities for intra-industry linkages, knowledge spillovers and greater innovation. Using geographical map of India, the study observes that the districts which are industrially more diverse have relatively higher level of wages. While empirical estimations reveal that a number of industries that are situated in districts with diverse presence of industries in the organised manufacturing sector have a positive effect on the per capita wages of hired worker in unorganised manufacturing sector. The impetus required in augmenting the process of agglomeration at regional level has been highlighted at the end.

Keywords: Unorganised Manufacturing Sector; Organised Manufacturing Sector; Industrial Agglomeration

1. INTRODUCTION

Wage differentials exist among various groups of people segmented on the basis of occupation, industrial sectors, gender or regions. Workers in different occupations may be paid differently, or those in the same occupation located in different regions may receive different wages. There are several factors that are responsible for wages to differ across various groups. The famously known framework proposed by Mincer (1974), called the Mincerian equation includes the individual characteristics of workers such as education, age,

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work experience and gender as the determinants of wages. The equation has been used extensively in literature to estimate the returns to education, gender wage gap as well as the impact of individuals' work experience.

Wage differential can also be characterised as being spatial by nature. The location of the firm as well as the individuals working therein is considered to be one of the important factors in affecting wage rates. The earlier studies that marked the beginning into the investigation on regional wage differential in urban areas found a negative relation between wages and the distance between location of an individual's job and the central business area (refer to Segal, 1960; Moses, 1962; Eberts, 1981; Madden, 1985; McMillen and Singell, 1992; Ihlanfeldt, 1992 among many). A negative relation indicates existence of wage gradients that are steeper as one moves closer to the central business area within an urban area. Here, gradient refers to the higher concentration of wages in the central business area vis-à-vis, the peripheral areas.

The concentration of industries in a few locations that result from the various factors discussed above lead to higher wages and/or attract workers to migrate from nearby regions, thereby leading to overall higher incomes and expenditures in these regions.

With this background, the study attempts to test the hypothesis that industrial agglomeration affects wages in unorganised manufacturing sector. Industrial agglomeration is not restricted to large industries alone, but also to small scale industries that tend to agglomerate in certain areas. However, the focus is not on the factors affecting the agglomeration of unorganised manufacturing sector firms. The study assumes the presence of agglomeration. The effect of such industrial concentration on wages has been investigated at district levels for eighteen states across India. Herfindahl Index has been used as a measure of the industrial diversity in a region or the composition of local economic activity. Industrial diversity provides a platform to the firms to create inter- and intra-industry linkages that lead to exchange of information and technological knowledge among the firms that helps them to build production networks and innovate. The study finds diversity of the organised manufacturing at district level to be affecting wages in unorganised manufacturing sector positively for a number of industries at NIC 2 digit level.

The study is organised into the following parts: section 2 pertains to literature review followed by descriptive statistics in section 3. The data used, its sources and the methodology followed in the empirical estimations for testing the assertion is described in section 4. Section 5 presents and discusses the empirical estimation results and section 6 concludes.

2. LITERATURE REVIEW

The wage-agglomeration linkage causing inter-regional variation in wages has been perceived by different studies in a number of ways. We can divide the explanation into the direct effects and indirect effects of agglomeration on wages. The direct effect is generated by the distance factors as well as the externalities/economies created in an agglomeration discussed below. While the indirect effect of agglomeration permeates through the relationship between labour productivity and wages. We discuss the direct effects before going into the indirect effects.

The early literature on intra-urban wage differential marked the beginning of the importance of studying location of the firm and distance factors as important determinants of wage differentials. The intra-urban wage differential by these studies has been envisaged to be consisting of a core/central city where all economic activity takes place and a peripheral suburban area which is mostly residential (Segal, 1960; Moses, 1962; Eberts, 1981; Madden, 1985; McMillen and Singell, 1990; Ihlanfeldt, 1992). As the core is approached, wages tend to be higher, indicating negative relationship between distance to the core and wages, termed as wage gradient.

Eberts (1981) estimated wage gradients for different groups of labour employed in various municipalities in six counties of Chicago. The study found significant wage gradients for four out of five labour groups, with the monthly wage on an average declining by $24 with each additional mile from the city's central area.

A similar study by Ihlanfeldt (1992) for various worker groups, as well as, across gender and race was done for Philadelphia, Detroit and Boston urban areas. The study also found statistically significant negative wage gradients. Additionally, the study found that the blacks working in the suburban areas travelling from the central city were not being compensated for the higher commuting costs incurred to get to their workplace.

Using the work location and individual characteristics data for seven northern US cities, McMillen and Singell (1990) found significant negative wage gradients, using the predicted work location choice as an explanatory variable in the estimated wage equation.

The more recent literature has extended the discussion to include the economies that are generated in an industrial agglomeration, to explain the difference in wages across regions. Based on the New Economic Geography (NEG), the agglomeration economies arising out of the existence of a large market potential, employment density and specialisation have been used by many studies to explain inter-regional variation in wages (Graham and

Melo, 2009; Graham and Kim, 2008; Mion and Naticchioni, 2005; Combes *et al.*, 2008a; Combes *et al.*, 2008b).

Market potential signifies the extent of product market interactions related to input-output linkages. Agglomeration economies may not be limited to being intra-regional. There may be neighbouring effects as the location of firms producing for final demand and the intermediate production firms may not be in the same administrative regions (Tirado *et al.*, 2003), but they may be interacting with each other. In such case, the market potential measure of agglomeration economies is an appropriate choice to capture this interaction.

Graham and Melo (2009) find that for Great Britain, the effect of market potential is significantly positive. The elasticity of wages to market potential is estimated to be 0.058, implying that doubling the size of market potential leads to approximately 5.8% rise in wages after controlling for firms' unobservable heterogeneity and correcting for reverse causality between labour productivity and agglomeration.

Similar elasticity measured by Graham and Kim (2008) is 0.84% for manufacturing sector, however, the individual industry elasticities range from -13.3 per cent in manufacture of basic metals to 14.3 per cent for the manufacture of machinery and computers. Combes *et al.* (2008b) find 2.4 per cent elasticity for a panel of French workers, controlling for worker characteristics, industry and worker fixed effects and local market characteristics. Mion and Naticchioni (2005) found market potential elasticity for Italian provinces between 1991 and 1998 to be 3.19 per cent.

Urbanisation economies that signify between-industry interactions are also important factors for wage differential. Employment density measures (employment in a region as percentage of its total land area) have been used in the literature to capture the effect of urbanisation economies (Fingleton and Longhi, 2013; Matano and Natichhioni, 2013; Combes *et al.*, 2008b; Graham and Melo, 2009; Ciccone and Hall, 1996).

Fingleton and Longhi (2013) find a significant positive relation between employment density and wages, particularly, for female full time employees in England. The effect on male wages is not very significant. Doubling employment density leads to a 6.22 per cent increase in female wages, while that for men it increases by 2.4 per cent which is not statistically significant.

Matano and Naticchioni (2013) also find a significant positive effect of employment density after controlling for individual fixed effects, both for industry and services sector. Combes *et al.* (2008b) estimate an elasticity of wages with respect to employment density to

be 3 per cent. While Mion and Naticchioni (2005) find a lower employment density elasticity of 0.22 per cent for Italian provinces in the period 1991-1998.

The localisation economies also contribute to the regional variation of wages. Industrial diversity in a region or the composition of local economic activity, measured as the inverse of a Herfindahl Index, has been used as a measure of the industrial diversity (Combes *et al.*, 2008b; Graham and Melo, 2009).

In the Indian context, there has been hardly any study that has looked at whether industry agglomeration has an effect on wages in the unorganised manufacturing sector firms. The effect of agglomeration economies on wages can be explained from the influence that the industrial agglomeration has on the ability of firms to decide wages.

The presence of a number of firms within an industry or different industries in a region provides a pool of appropriate labour that reduces the search costs for the firms. However, if the own industry concentration is high, the firms may be competing with each other to obtain and retain labour and in the course, wages tend to rise. This can be explained by the efficiency wage theory (Shapiro and Stiglitz, 1984) where the firm is willing to pay more than the marginal revenue product to the labour employed to retain them.

In the context of unorganised manufacturing sector which is characterised by low levels of skills, the efficiency wage theory may seem implausible because majority of enterprises within this sector is own account by type of ownership. Nevertheless, one-third of the total number of enterprises is non-Directory (NDME) and directory manufacturing enterprises (DME) that employ hired labour. This study pertains to the study of wages of such enterprises that have hired labour below ten in number. Thus, the direct effect of industrial agglomeration on wages can be explained through the inter-play of demand and supply forces in the labour market.

2.1 Wage-Productivity Linkage

The other strand of explanation of the effect of agglomeration on wages pertains to the indirect effects indicated in the beginning of the discussion. The indirect effects are based on the linkage between wages and labour productivity.

Wages are the compensation for the ability of the labour to produce a good or service. Therefore, productivity in general and labour productivity, in particular, is an essential factor in determining wages. It is also well noted that the regions that are more productive fetch the labour more compensation. Thus, labour productivity is an important factor that can explain the regional wage differentials. Mitra (2014) notes that the large cities that are more

productive are able to provide better economic as well as non-economic opportunities and therefore, better wages.

Fu and Ross (2013) have found that the agglomeration effects are enhanced when unobserved worker productivity is controlled for by using residential locations fixed effects as workers sort themselves in residential locations based on their permanent income or productivity they possess. The rationale is that more productive workers locate themselves in agglomerated areas as they expect they would be able to afford the higher housing costs, whereas, the less productive workers would prefer the areas around the agglomeration. Any wage difference after controlling for productivity would then arise because of greater commute time from different residential locations within the agglomerated areas due to congestion (Timothy and Wheaton, 2001).

However, the direct link between wages and labour productivity has been observed to be weak in nature as there are other factors that do not allow wages to grow in tandem with the growth in labour productivity. In case of India, Paul (2014) notes that the direct link between the two is weaker due to the archaic labour laws and ineffective enforcement systems. Mishel and Gee (2012) note that the median wages in the US as a proportion of labour productivity has fallen over the years, that is, from 45.9 per cent in 1973 to 26.4 per cent in 2011.

There has been an overall widening gap between the average wages and labour productivity in the developed countries. According to the Global Wage Data by the International Labour Organisation (ILO), Figure 1 gives a broad overview of the fact where average real wages have not kept pace with the rising labour productivities. The data pertains to 36 developed economies and the index is calculated as weighted average of year-on-year growth in average monthly real wages based on 1999 values.

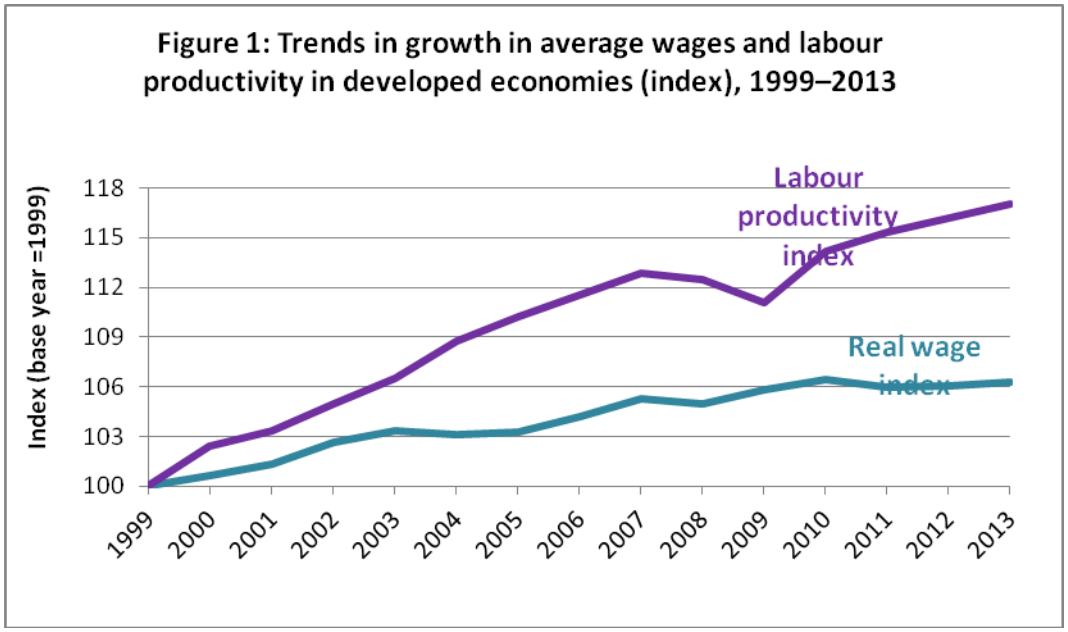

Figure 1: Trends in Growth in Average Wages and Labour Productivity in Developed Economies (index), 1999-2013

Source: ILO, Global Wage Database

A similar story has been observed for India's unorganised manufacturing sector between 2000-01 and 2010-11. Figure 2 depicts the growing gap between average wages and labour productivity in real terms across time. Although the time span is not very long, the growing disparity in both measures can be clearly observed.

This is true for the organised manufacturing sector also, where the disparity in labour productivity and wage share in total gross value added has been rising over the years since 1980-81 till 2009-10 as found by Sood *et al.* (2014). They observe a rising share of profits in total gross value added in the organised manufacturing sector in the same period that implies that the rising gains in labour productivity has gone to the capital rather than to workers in the form of higher wages.

Figure 2: Trend in Average Real Labour Productivity and Real Wages in Unorganised Manufacturing Sector in India for 2000-1, 2005-6 and 2010-11

Source: Calculated from NSS Unorganised Enterprise Survey 56th, 62nd and 67th Rounds

In theory, wages are considered to be strongly linked to labour productivity, although the country or sectoral level data paints a different picture all together. However, at the firm level, the inter-relationship needs to be studied empirically that may reveal a different picture.

3. DESCRIPTIVE STATISTICS

3.1 Wage Differentials: India's Manufacturing Sector

The disparity in income distribution in India as discussed above is evident in the manufacturing sector. Table 1 shows the annual per capita wages of workers in the organised and unorganised manufacturing sector. In all the three time periods, the wages in organised part of this sector have been almost two times that in the unorganised sector. Although the wages in both sectors have witnessed an increase over time, the disparity has continued to remain.

TABLE 1
ANNUAL REAL WAGES PER WORKER IN ORGANISED AND UNORGANISED MANUFACTURING SECTOR

	2000-01	2005-06	2010-11
Organised Sector	52,936	51,542	66,103
Unorganised Sector (NDME+DME)	21,714	26,057	32,621

Source: Reports on ASI and NSS Enterprise Surveys of the respective years

An industry distribution of annual per capita real wages is given in Table 2 for both organised as well as unorganised manufacturing sector for 2010-11. The wage disparity is

more pronounced at the industry level where the organised manufacturing sector wages are more than ten times that of the unorganised sector in some industries.

TABLE 2
ANNUAL REAL WAGES PER CAPITA IN ORGANISED AND UNORGANISED MANUFACTURING SECTOR IN 2010-11

NIC	Organised Sector	Unorganised Sector
10	62,196	19,366
11	83,478	18,291
12	32,437	17,412
13	71,641	29,415
14	65,020	22,196
15	61,854	25,237
16	58,338	28,272
17	86,944	31,272
18	91,755	29,127
19	268,384	27,634
20	106,553	25,848
21	103,065	28,736
22	80,051	31,389
23	62,035	25,873
24	125,321	26,472
25	95,414	35,875
26	112,537	36,829
27	104,621	32,914
28	113,255	39,848
29	123,371	42,512
30	115,216	34,482
31	92,832	27,712
32	93,451	26,382
33	146,582	26,904
1632	NA	21,308

Source: Organised sector wages have been sourced from the ASI Summary Results for 2010-11 and unorganised sector wages have been calculated from the NSS 67th Round Survey Data

3.2 Regional Wage Differential

Regional variation of unorganised manufacturing sector wages is evident from Figure 4 that depicts visually the geographical differential in average wages per hired worker in non-directory (NDME, employing less than six hired workers) and directory manufacturing enterprises (DME, employing six or more hired workers) in the unorganised manufacturing sector for 2010-11 at the district level for the 18 states in our study. There is substantial variation in the distribution of wages across districts within a state, as well as, across states. The districts such as Gautam Budh Nagar in Uttar Pradesh, Gurgaon in Haryana, Alwar in Rajasthan in the northern part of India and Bangalore and Mysore in Karnataka, Trivandrum, Wayanad and Idduki in Kerala, Thiruvallur and Kancheepuram in Tamil Nadu and

Aurangabad in Maharashtra towards southern part of India have much higher wages per hired worker compared to other districts in their respective states.

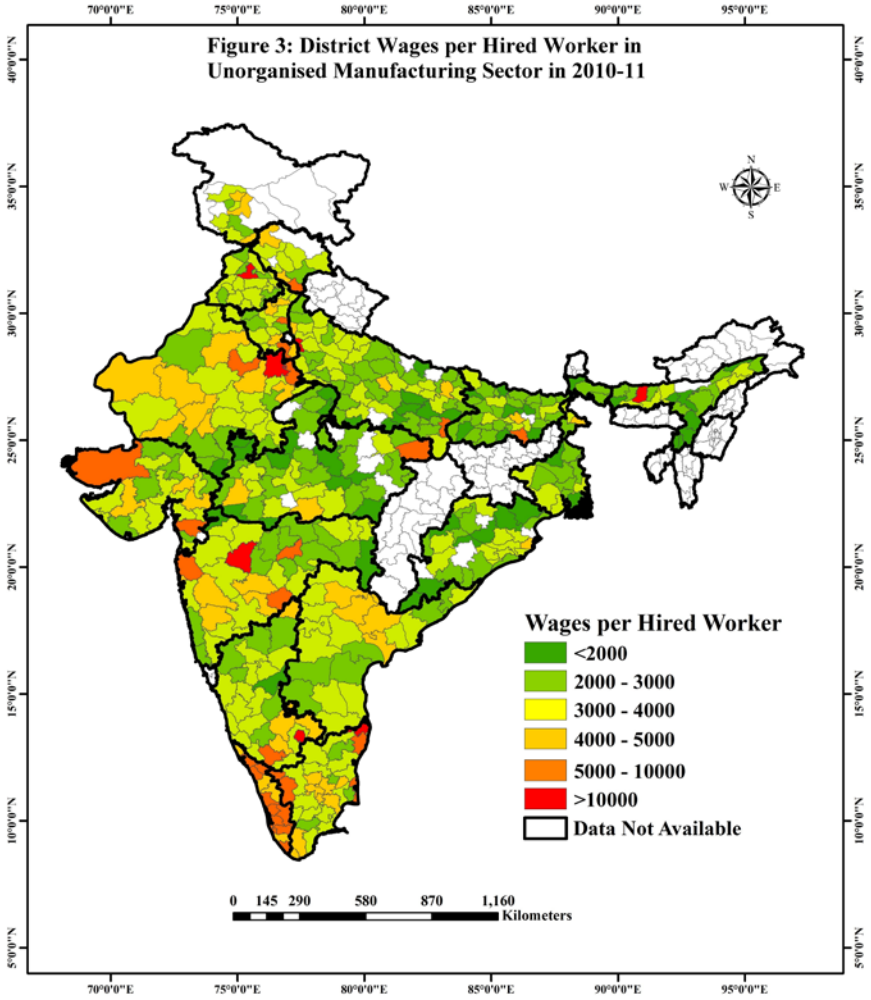

Figure 3: District Wages per Hired Worker in Unorganised Manufacturing Sector in 2010-11

The measure of agglomeration that is considered in the study is the Herfindahl index for the organised manufacturing sector that indicates the extent to which a region is co-agglomerated by diverse industries. A higher value of the index indicates that the region is concentrated by a very few or even one industry.

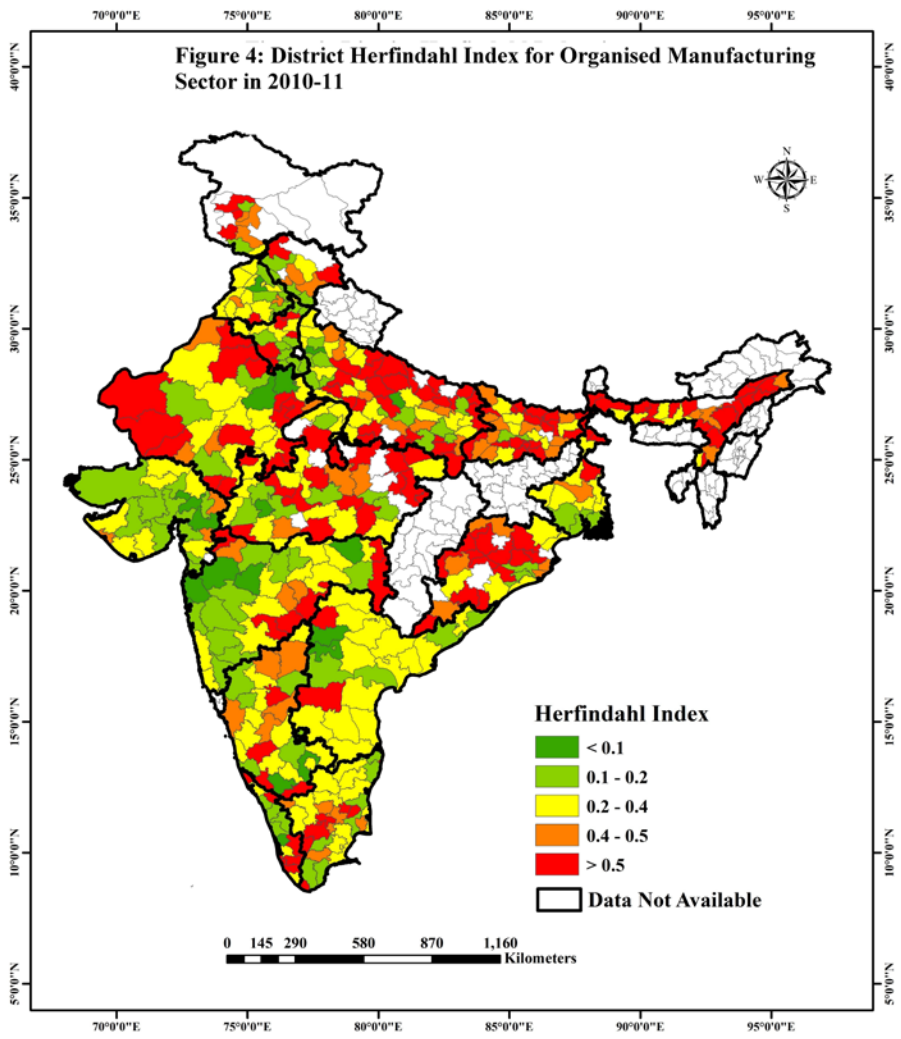

Figure 4: District Herfindahl Index for Organised Manufacturing Sector in 2010-11

Comparing the two figures, it can be seen that the districts where the Herfindahl index is lower, the wages per capita are relatively higher. It means that districts where industrial presence is diverse have higher wages than districts that are concentrated by a few or only one industry. For example, in Rajasthan three districts, viz., Alwar, Sikar and Bharatpur had a very low index value signifying the presence of diverse industries with relatively higher wages, whereas districts like Baran, Jhalawar, Churu etc. which are concentrated with firms in one or two industries have experienced lower wages per hired worker. This is true for other 17 states where districts with industrial diversity have seen firms paying better. The exceptions are districts like Panipat in Haryana, Jamui in Bihar, Latur in Maharashtra and Alapuzhha, Idukki, Pattanamthitta and Wayanad in Kerala where industrial concentration has been observed with very high levels of wages per hired worker in the unorganised manufacturing sector.

The study reveals a similar relation between industrial diversity and wages per hired worker at the industry level for the unorganised manufacturing sector based on the empirical estimations. The subsequent discussion pertains to the econometric estimations carried out to reinforce this observation.

4 DATA, VARIABLES AND METHODOLOGY

4.1 Data and Variables

The aim of the study is to analyse the factors behind wage differentials across regions for the unorganised manufacturing sector firms. The data used in this study is the NSS Unorganised Manufacturing Sector Enterprise Surveys for the years 2000-01 (56th Round), 2005-06 (62nd Round) and 2010-11 (67th Round). The factors affecting wages per capita at the firm level have been analysed at the firm level, industry level and district level.

The NSS enterprise survey covers three types of enterprises, namely, own account manufacturing enterprises (OAME, which is run without any hired worker), non-directory (NDME, employing less than six hired workers) and directory manufacturing enterprises (DME, employing six or more hired workers). Thus, our analysis is restricted to NDMEs and DMEs only as they only employ hired workers whose wages are reported in the surveys. The OAMEs are family based firms run mostly by the family members, whose remuneration is not fixed.

The data on total emoluments of the firm is taken to calculate the wages per capita. The value includes the wages/salaries, allowances as well as imputed values of group benefits. The sector specific wholesale price index has been used to deflate wages.

The important determinant that is considered in this study is the presence of agglomeration economies that affect wages per capita in the unorganised manufacturing sector in India. Therefore, agglomeration economies using different measures have been included in this study.

The own industrial concentration in a region is an important determinant as the local labour markets play an important role in generating the appropriate pool of labour that is important for generating increasing returns, productivity and thus, higher wages. It also enables sharing of tacit and codified knowledge, intra-industry linkages and opportunities for greater subcontracting (Chakravarty and Lall, 2007). The study uses location quotients at the district-industry level as the own industry concentration measure.

The LQ is given by the following:

$$Lq_{ir} = (E_{ir}/E_r) / (E_i/E)$$

where, E_{ir} is the employment of industry 'i' in region 'r' (district in our study), E_r is the employment in region 'r', E_i is the total employment in industry 'i' and E is the total employment in the economy.

If the LQ is greater than one, the industry 'i' would be considered to be concentrated in the region 'r'. LQ, being a ratio of two ratios or proportions, can range from zero to very high values. For this study LQ would be calculated for each industry at NIC 3-digit level located in different districts of the 18 Indian states.

The diverse presence of industries in the same region also plays a crucial role for the smaller firms operating in the unorganised sector as it ensures that the input-output linkages are formed in the region and also provides a platform for innovation and technology and information spillover. Local suppliers present in a region help reduce transaction costs and thereby, increase productivity and wages (Amiti and Cameron, 2007). The industrial diversity in organised manufacturing sector is measured by the Herfindahl index of diversity given by:

$$HI_r = \sum_i \frac{E_{ir}}{E_r}$$

Here, E_{ir} is the employment of industry 'i' in region 'r' and E_r is the total employment in region 'r'. The maximum value of the Herfindahl index can be one that indicates that the region is dominated by only one industry, while lower values of the index indicate diversity of economic activity. Therefore, the coefficient is expected to have a negative sign if diversity has any positive bearing on the wages of the unorganised manufacturing firms. For the Herfindahl index, organised manufacturing sector employment data is collected by the Central Statistical Organisation under the Government of India, called the Annual Survey of Industries (ASI). The ASI collects data on factories that are registered under Sections 2m(i) and 2m(ii) of the Factories Act, 1948.

District GDP is also included in the study as a proxy for local demand generated at the district level. Those firms that produce for final consumption would be affected by the demand for goods and services within the region in which they are located. Higher demand would lead to greater production and thus, likely to lead to a hike in wages of workers employed in the firms. Although, the effect may not be very pronounced, the fact that local demand is an important factor for a firm's survival the effect is captured in the study. The data is taken from NITI Aayog website that provides district level data on GDP at constant

2004-05 prices for 15 states included in our study. The GDP data for Delhi, Gujarat and Jammu and Kashmir could not be found.

Firm level factors are also important in determining the wage differentials across industries. They are important to consider as the agglomeration variables included in the study only control for the industry and district level factors. However, the NSS enterprise surveys provide detailed data on the firms' characteristics, operation costs, assets and liabilities etc.

The foremost important factor that affects wages is the technology being used in the firm. In theory, technological change leads to increase in wages as newer technologies introduced in firms require more skilled labour that, in turn, leads to higher remuneration paid to them. Thus, capital intensity is expected to be positively related to wages.

A firm that is endowed with higher own fixed assets is said to be able to pay higher wages. Fixed assets include land, building, plant and machinery, transport equipment, tools and other fixed assets. A firm that has its own land or building as well as its own capital in terms of machinery would have a greater capacity to generate more production without any disruption, and therefore, be able to pay their labour more wages. This study takes the value of own fixed assets of each firm which is expected to be positively related to wages.

Lastly, labour productivity is another variable that is controlled for. Labour productivity is calculated by dividing firm's deflated value of gross value added by the number of employees in each firm. The sector specific wholesale price index for manufactured products with 2004-05 as the base year has been used to deflate gross value added.

For the sake of comparability, wages and labour productivity have been deflated using sector specific wholesale price index. This is because the concept of wages is different for an employer and employee. Since the employees are more interested in knowing their purchasing power, the consumer prices are important for them (Sidhu, 2008) while for employers it is the producer prices that is important. Since our study is based on firm level wages, we have deflated wages by the wholesale, rather than consumer price index.

Whether a firm is situated in an urban area or rural is also taken as a dummy variable. Urban wages are expected to be greater than that of rural areas. However, firms in the unorganised manufacturing sector are spread almost uniformly across urban (55 per cent) and rural (45 percent) areas in the entire country. Considering this, the rural wages may not be construed to be less than that in urban areas.

At the district level, literacy rates have been included to control for human capital effects. Since the data pertains to firms, education levels of individual labour employed in firms is not known. However, level of education is an important aspect to control for while analysing wages. Given the data constraints, the district level literacy rates are the best alternative than to neglect it completely.

Since the data is a pooled cross section, time dummies have been included in the estimations to control for time effects. The industry fixed effects are controlled for by including industry dummies, while district fixed effects are controlled for by district dummies.

To differentiate between the effects of agglomeration economies across industries, industry dummies have been interacted with the regional agglomeration measure, that is, Herfindahl index.

4.2 Methodology

The data used in the study is a pooled cross section data for three time points, that is, 2000-01, 2005-06 and 2010-11. Since the cross sections (firms, in this case) differ across different years, the panel data estimation cannot be employed here. We estimate the equations using two-stage least squares (2SLS) methodology after correcting for the variance-covariance error matrix for heteroscedasticity.

As explained in the literature review section, wages and labour productivity are inter-related; thus, including labour productivity in the OLS equation would lead to endogeneity bias. Therefore, in the first stage, labour productivity is regressed on all exogenous variables in the system and the estimated value of labour productivity is then used as an instrument in the wage regression.

It is important to state that the wage equation that the study estimates is not a Mincerian type equation because the dataset (NSS Enterprise Survey) used here is a firm level data. The personal characteristics of individuals employed therein are not provided in the NSS enterprise survey, therefore, the estimations in the study would carry this limitation.

The final equation estimated in the study is given below:

$$LWAGEPC_{it} = \phi_1 + \phi_2 LogLP_{it} + \phi_3 KI_{it} + \phi_4 LOGASSET_{it} + \phi_5 LQ_{dt} + \phi_6 ORG_{dt} + \phi_7 UNORG_{dt} + \phi_8 urban + \phi_9 LITERACY_{dt} + \phi_{11} Year05_i + \phi_{12} Year10_i + \delta_{d=district} Districtdum + \lambda_{j=NIC2} Industry_t \text{ ------(1)}$$

where, *LogLP* is the estimated value of labour productivity using the following equation and the exogenous variables from equation 1 above:

$$LogLP_{it} = \sigma_0 + \sigma_1 LQ_{dt} + \sigma_2 ORG_{dt} + \sigma_3 UNORG_{dt} + \sigma_6 LWAGEPC_{it} + \sigma_7 OAME_{it} + \sigma_8 KI_{it} + \sigma_9 LITERACY_{dt} + \sigma_{10} DEP_{dt} + \sigma_{11} CRE_{dt} + \sigma_{12} TEL_{State,t} + \alpha_{d=district} Districtdum + _i + \lambda_{j=NIC2} Industry_t ------(2)$$

In equation 1, dependent variable LWAGEPC is wage per capita of firm '*i*' and time '*t*'. LogLP is the log of labour productivity; KI is capital intensity calculated as the ratio of total capital of the firm to total labour employed; LQ is location quotient for the unorganised manufacturing sector at district '*d*', NIC 3-digit level; ORG is the Herfindahl index of diversity for organised manufacturing sector; UNORG is the district level industrial diversity in unorganised manufacturing sector; *urban* is the dummy variable with value one for the firm that is located in an urban area, and zero for firms in rural areas. LDISTGDP is the log of district GDP at time '*t*'. The social infrastructure variable is represented by LITERACY that is the district wise literacy rates for different periods in the estimation.

In equation 2, the district level financial infrastructure in terms of bank deposits (DEP) and the outstanding credit (CRE) of the scheduled commercial banks have been included to capture their effect on the labour productivity. The other variables at firm and district levels are already explained. Table 3 gives a summary description of the variables that are included in the empirical estimation with their data sources as well as the expected signs.

TABLE 3
DESCRIPTION OF VARIABLES USED IN EMPIRICAL ESTIMATIONS

Variables	Description	Data Source	Expected Sign
LogLP	Log Labour Productivity	NSS Unorganised Manufacturing Enterprise Survey (UMES)	Positive
LQ	Location Quotient	NSS UMES	Positive
ORG	Organised Employment	Annual Survey of Industries (ASI)	Negative
UNORG	Unorganised Employment	NSS UMES	Negative
LDISTGDP	Log District GDP	NITI Aayog	Positive
LOGASSET	Log of Owned Assets	NSS UMES	Positive
KI	Log Capital-Labour Ratio	NSS UMES	Positive
urban	Urban Dummy	NSS UMES	Positive

5 EMPIRICAL RESULTS

The results are based on estimations from equation 1 using 2-SLS regression methodology and the results are presented in Table 4. As explained earlier, the inter-relationship between wages and labour productivity leads to an endogeneity, and thus, using OLS would lead to a bias.

Labour productivity of a firm has a significantly positive coefficient. It indicates that firms with higher labour productivity are able to pay their labour higher wages. Although, there has been a growing gap between the levels of labour productivity and wages across the time period considered as observed in the literature, the impact of the former on the latter seems to be quite strong empirically.

The firm's own ability to pay higher wages in terms of the **owned assets** it possesses has a positive coefficient which is statistically significant. Therefore, a firm that has its own assets in the form of land, building, machines etc. has ability to pay to higher wages to its labour.

Capital intensity has a negative coefficient that implies that firms with capital intensive production techniques are not rewarding their labour with higher wages. This means either the technology being used does not entail higher skilled labour to be able to adapt to it, or given the nature of the unorganised sector the firm is not accountable to pay them higher wages owing to the abundant labour supply. This may also imply that higher capital intensity leads to a fall in demand for additional labour, thus pulling wages down. In the wake of the unorganised manufacturing sector being out of the purview of any labour regulations, wages tend to be even more volatile.

TABLE 4
ESTIMATION RESULTS FOR TWO-SLS REGRESSION

Dep. Variable: Log Firm Level Wages Per Capita	
Independent Variable	Coefficients
Log Labour Productivity	1.4*
Log Capital Intensity	-1.3*
Log Owned Assets	1.2*
Urban Dummy	-0.11*
Location Quotient	0.0005*
Organised Sector	-0.10
Literacy	0.01*
Year 2005	-0.50*
Year 2010	-2.5*
Constant	-7.2*
District Dummies	Yes
Individual Industry Dummies	Yes
Organised Sector Interacted Dummies	Yes
No. of Observations	57933
R-Squared	0.83

Note: Symbols *, ** and # denote 1%, 2% and 5% levels of significance, respectively.

Firms located in **urban areas** are also found to be paying lesser wages per capita than the firms in rural areas. This corresponds to the observation in the earlier sections that the rural wages in the recent years have come at par with urban wages in the unorganised manufacturing sector.

The **diversity of larger industries** within a district has helped firms in unorganised manufacturing to fare better in terms of wages. Most of the industries have shown a negative coefficient in the interaction terms, such as food products, beverages, coke and petroleum, pharmaceuticals, rubber and plastic, basic metals, fabricated metals, electronic and electrical, transport and other manufacturing industries. The agglomeration economies arising from industrial diversity has enabled smaller firms in unorganised manufacturing sector to experience pecuniary gains.

District GDP has a positive and statistically significant effect on firm wages. Thus, local demand represented by the variable has an important bearing on the firms' wages in unorganised manufacturing sector.

6 CONCLUSION

The study has analysed the effects of industrial agglomeration on firm level wages in the unorganised manufacturing sector. An instrument variable estimation using two-stage least squares has been used in the study as the inter-relationship between wages and labour productivity is a source of endogeneity.

Wages of hired workers in the Directory manufacturing enterprises (DMEs) and Non-Directory enterprises (NDMEs), for which this study has been done, are positively affected by the agglomeration economies in a number of industries. Industrial diversity has shown a positive effect for a number of industries.

Given that industrial agglomeration has a positive effect on the wages in many industries, a targeted approach towards enabling smaller firms to set up establishments in existing agglomerations should be initiated. The National Manufacturing Policy (NMP) launched in 2011 has envisaged National Investment and Manufacturing Zones (NIMZs) that will catalyse the manufacturing growth by directing investments to provide world class infrastructure for creating manufacturing hubs across the country. The effort would help the manufacturing sector to realise the full benefits of agglomeration.

Formation of clusters, however, is based on regional dynamics such as local skills, culture, geographical influences such as climate etc., apart from economic factors such as infrastructure and market demand. Thus, the state governments should understand the

importance of region specific cluster formation and take dynamic initiatives in terms of providing financial and technical assistance to the industries to develop therein. Till now, only Andhra Pradesh, Gujarat, Kerala, Madhya Pradesh and Tamil Nadu have taken cluster development initiatives. There is further need for other states to form policies to enhance cluster development in their regions. The proposed NIMZs would be step in this direction.

However, industrial agglomerations have been associated with the associated congestion costs, rise in cost of living and also income inequality (Tripathi, 2013). Therefore, a balance between the proliferation of firms in a region and a sustainable infrastructure to accommodate them should be borne in mind while formulating policies for the manufacturing sector as a whole.

REFERENCES

Amiti, M., and L. Cameron. (2007). "Economic Geography and Wages". *The Review of Economics and Statistics.* 89(1):15-29.

Chakravorty, S., and S. Lall (2007). *Made in India: The Economic Geography and Political Economy of Industrialization*. USA: Oxford University Press.

Ciccone, A., and R.E. Hall. (1996). "Productivity and the Density of Economic Activity". *American Economic Review*. 86(1): 54-70.

Combes, P. P., G. Duranton, and L. Gobillon (2008a). "Spatial Wage Disparities: Sorting Matters!". *Journal of Urban Economics.* 63(2): 723-742.

Combes, P.-P., G. Duranton, L. Gobillon, and S. Roux. (2008b). "Estimating Agglomeration Economies with History, Geology, and Worker Effects". CEPR Discussion Papers 6728.

Eberts, R.W. (1981). "An Empirical Investigation of Intra Urban Wage Gradients". *Journal of Urban Economics.* 10(1): 50-60.

Fingleton, B., and S. Longhi. (2013). "The Effects of Agglomeration on Wages: Evidence from the Micro-Level". *Journal of Regional Science.* 53(3): 443-463.

Fu, S., and S.L. Ross. (2013). "Wage Premia in Employment Clusters: How Important is Worker Heterogeneity?". *Journal of Labor Economics, University of Chicago.* 31(2): 271-304.

Graham, D.J., and H. Y. Kim. (2008). "An Empirical Analytical Framework for Agglomeration Economies". *The Annals of Regional Science.* 42(2): 267-289.

Graham, D.J., and P.C. Melo. (2009). "Agglomeration Economies and Labour Productivity: Evidence from Longitudinal Worker Data for GB's Travel-To-Work Areas". (SERC Discussion Paper 31). *Spatial Economics Research Centre, London School of Economics and Political Science.*

Ihlanfeldt, K.R. (1992). "Intra-Urban Wage Gradients: Evidence by Race, Gender, Occupational Class, and Sector." *Journal of Urban Economics.* 32(1): 70-91.

International Labour Organisation, Global Wage Report 2014-15.

Madden, J.F. (1985). "Urban Wage Gradients: Empirical Evidence". *Journal of Urban Economics.* 18(3): 291-301.

Matano, A., and P. Naticchioni. (2013). "What Drives the Urban Wage Premium? Evidence along the Wage Distribution." *The Institute for the Study of Labor, (IZA), Discussion Paper Series No. 7811*.

McMillen, D.P., and L.D. Singell, Jr. (1992). "Work Location, Residence Location, and the Urban Wage Gradient". *Journal of Urban Economics*. 32(2): 195-213.

Mincer, J.A. (1974). "Schooling, Experience, and Earnings". *NBER Books*.

Mion, G., and P. Naticchioni. (2005). "Urbanization Externalities, Market Potential and Spatial Sorting of Skills and Firms". *CEPR Discussion Papers 5172. Centre for Economic Performance, London School of Economics and Political Science.*

Mishel, L., and K.-F. Gee (2012). "Why aren't Workers Benefiting from Labour Productivity Growth in the United States?" *International Productivity Monitor*. 23: 31.

Mitra, A. (2014). "Agglomeration Economies and Wellbeing: Evidence from India". *Athens Journal of Health*. 1(1): 23-36.

Moses, L.N. (1962). "Towards a Theory of Intra-Urban Wage Differentials and their Influence on Travel Patterns". *Papers of the Regional Science Association*. 9(1): 52-63.

NSSO, Unorganised Manufacturing Sector Survey, 56th Round. 2000-01.

NSSO, Unorganised Manufacturing Sector Survey, 62nd Round. 2005-06.

NSSO, Unorganised Manufacturing Sector Survey, 67th Round. 2010-11.

Paul, B.G.D. (2014). "Wages and Labour Productivity". *Stagnant Manufacturing: Governance and Policy Slack*. 88-106.

Segal, M. (1960). *Wages in the Metropolis*. Cambridge, Massachusetts: Harvard University Press.

Shapiro, C. and J. Stiglitz (1984). "Equilibrium Unemployment as a Worker Discipline Device". *American Economic Review*, 74(2), 433-444.

Sidhu, H. (2008). "Wage Disparity and Determinants of Wages in the Indian Industry". *The Indian Journal of Labour Economics.* 51(2): 249-261.

Sood, A., P. Nath, and S. Ghosh. (2014). "Deregulating Capital, Regulating Labour: The Dynamics in the Manufacturing Sector in India". *Economic and Political Weekly*. XLIX (26-27): 58-68.

Timothy, D., and W.C. Wheaton. (2001). "Intra-Urban Wage Variation, Employment Location, and Commuting Times". *Journal of Urban Economics*. 50(2): 338-366.

Tirado, D.A., J. Pons Novell, and E. Paluzie. (2003). "Industrial Agglomerations and Wage Gradients: The Spanish Economy in the Interwar Period". *Universitat de Barcelona Working Papers in Economics*, 01/03.

Tripathi, S. (2013). "Is Urban Economic Growth Inclusive in India?". *Margin: The Journal of Applied Economic Research*, *7*(4), 507-539.