What Does Increasing Labour Homogeneity Mean for Indian Manufacturing?

Paul, Bino and Patnaik, Unmesh and Sahu, Santosh Kumar and Awasthi, Mansi

School of Management and Labour Studies, Tata Institute of Social Sciences, Mumbai, Maharashtra, India, Centre for Climate Change and Sustainability Studies, School of Habitat Studies, Tata Institute of Social Sciences, Mumbai, Maharashtra, India, Department of Humanities and Social Sciences, Indian Institute of Technology, Madras, Chennai, Tamil Nadu, India, School of Management and Labour Studies, Tata Institute of Social Sciences, Mumbai, Maharashtra, India

What Does Increasing Labour Homogeneity Mean for Indian Manufacturing?*

Bino Paul G.D., Tata Institute of Social Sciences, Mumbai, Maharashtra, India, binopaul@gmail.com

Unmesh Patnaik, Tata Institute of Social Sciences, Mumbai, Maharashtra, India, unmeshpatnaik@gmail.com

Santosh Kumar Sahu, Department of Humanities and Social Sciences, Indian Institute of Technology, Madras, Chennai, Tamil Nadu, India, santosh@iitm.ac.in

Mansi Awasthi, Tata Institute of Social Sciences, Mumbai, Maharashtra, India, mansi.awasthi@gmail.com

In evaluating the economic system, share of wage in value added (labour share) assumes significance. We examine the trend of labour share in Indian manufacturing during 2001-14, by using the pooled plant level data. In the analysis, the heterogeneities with respect to factor share, factor ratio and magnitude of factors (labour and capital) are gauged, while the trend of elasticity of substitution is measured. With this context, we assess if the labour heterogeneity explains the variation in the total factor productivity, taking industry as a unit of analysis. Further, the analysis looks into the relationship between labour heterogeneity and productivity. Analysing the micro data on labour force, we gauge the determinants of wage from the vantage of supply. Cues from this analysis point to the need for social upgradation of Indian manufacturing in terms of decent employment relations and skill. This change may enable India to move from factor abundant system to a productivity-oriented economy in the milieu of steadfast substitution of labour by capital. The novelty of this paper is in pooling the plant level data across years, while industry level aggregation is resorted to examine the longitudinal dynamics. Quite important, insights emanating from the firm and industry-based data are juxtaposed with the micro data of labour supply to understand the supply side dimensions of wage, while envisioning the implications for the economy of manufacturing to upgrade to a productivity orientation.

JEL Codes: D24, J30, L60

1 Introduction

Over the last few decades manufacturing economy of India seems to have been going through an experience that exhibits characteristics of a visibly stagnant system in terms of share in

* The authors express their gratitude to N. S. Siddharthan, B. L. Pandit, B. N. Goldar and K. L. Krishna for their suggestions. An earlier version of the paper was presented at the 13th Annual Conference of the Forum for Global Knowledge Sharing, Tata Institute of Social Sciences, Mumbai.

gross domestic product (GDP) and employment. While the share of manufacturing in GDP over the last few years hovers around one-sixth, that of employment settles just above one-tenth (OECD 2014). Structure of this sort may not be a surprise if we discount the size of population in India. Quite importantly, the demand for goods and services in India has not just consistently been growing over the years but transforming from more wage-based goods towards a heterogeneous basket, creating the scope for more a diversified manufacturing system in India. This possibility seems to have gone into the political cognizance, culminating in interesting maxims like "*Make in India*"[1]. Irrespective of how the political discretion of envisaging converts to results, quite unequivocally, the manufacturing sector seems to have crucial role in the growth process and job creation of Indian economy. It is almost a stylized fact; that while the Indian macroeconomy has been consistently growing, barring a few cyclical disruptions, over last one and half decade, there appears to be no concomitant growth in wage employment, in particular the formal jobs. Intuitively, this phenomenon of jobless growth may have its reasons emanating from stagnation in Indian manufacturing along with other major determinants.

Although the manufacturing sector appears to be hardly flamboyant in terms of growth and employment creation, the data seem to support that the labour is being substituted by the capital, particularly in the organized manufacturing sector[2]. Against this context, we examine the dynamics of shares with respect to labour and capital in value added by the manufacturing (factor shares), in particular the pattern of heterogeneity. We posit that knowing the trend of heterogeneity provides useful cues about the direction of factor substitution in the production system. Homogeneity in the factor share of labour implies that labour standards tend to be synchronised across firms and industries. However, in the Indian context, increasing homogeneity in the share of labour points to more informalization of labour, considering the historically stable minute share of formal employment. We also examine the trend of heterogeneity of capital per labour, connecting us with the dynamics of factor intensities across industries over the years. From the point of view of resource allocation, variation in

[1] http://www.pmindia.gov.in/en/major_initiatives/make-in-india/ (accessed on 11th December, 2018).

[2] Organized manufacturing refers to the manufacturing activities being carried out by the incorporated units which fall within the ambit of Indian Factory Act, 1947. For detail see: https://indiacode.nic.in/ViewFileUploaded?path=AC_CEN_6_6_000010_194863_1517807319577/rulesindividualfile/&file=Model+Rules+Part+I+framed+under+the+Factories+Act%2C+1948.pdf (accessed on 11th December, 2018).

factor intensity tends to emanate from relative incentives implicit in the economic system, providing a scope to explore the elasticity of substitution across plant, across industry and over time. Another critical aspect in terms of relative magnitudes is the substitution between raw material and non-raw materials with respect to both indigenous and external sources. Delving into the patterns pertinent to intensity of substitution, for factors and material versus non material, would throw up substantive arguments on emerging scenarios of future of labour in Indian manufacturing. While factors and raw materials, being resources, form a structure of resources for the firm, what matters for gauging how the system fares in relation to resources and outcome is to examine the total factor productivity (TFP) of relevant units. Since the data we use is not longitudinal with respect to the micro decision unit "firm", although we have pooled nearly half a million observations spread over fourteen years, we form a panel of industries by aggregating firms to calculate the TFP that absorbs effects of cross-sectional factors and the dynamics of time. More importantly, we are concerned about if the TFP is influenced by heterogeneities with respect to the labour, the capital and other control variables at the unit level of production.

Presumably, labour share becoming homogenised while factor substitution is in favour of capital implies that the resource allocation will favour the factor that is relatively scarce in the structure. Upshot, this means that the system may have more incentives for the resource that is being substituted since the incremental product per marginal unit of factor tends to increase. Therefore, we examine the patterns pertinent to the determinants of wage in Indian manufacturing by using most recent cross-sectional micro data. From these exercises, we intend to examine the emergent patterns in relation to the manufacturing as a production system and connect between wage and the labour market. This may unravel interesting hints for envisaging plausible link between future of work, contribution of manufacturing in GDP and employment, human capital and decent employment.

In the context of ensuing joblessness and sluggish growth of wage economy in Indian manufacturing, this study may provide critical insights about the link between the dynamics of factor share, factor substitution and outcomes such as TFP. Presumably, substitution of labour by capital autonomously of direct association between wage and productivity may have mixed implications for a growing transition economy like India. If the displacement of labour by the capital has been consistently increasing without attaining desirable growth in human capital, absorbing the substituted labour to the decent employment / livelihood opportunities may turn out to be a herculean task. Once the substitution without skill and alternate decent opportunities becomes a trend, ensuing outcome such as long spell of unemployment or involuntary refrainment from the labour market tends to set trajectories of complex cumulative causation. Moreover, on the demand side, for the labour, mere substitution of labour by capital without creating core capabilities to the firm may hinder the dynamic efficiency of the industrial economy of India. Our analysis differs from the extant literature because of two main reasons: (i) an exhaustive database of manufacturing plants over more than a decade, (ii) combining the heterogeneity in factor shares, factor substitution, TFP and supply of labour.

The declining wages and emoluments share in gross value added (GVA) has been noted at least since 1970s in the extant literature on organized manufacturing in India (Kannan and Raveendran 2009; Virmani and Hashim 2009; Kapoor 2014; Abraham and Sasikumar 2017). While Virmani and Hashim (2009) estimated that the share of labour in value added had declined at the rate of 2.2 percent per year during 1973-2001, Abraham and Sasikumar (2017)[3] found the largest drop was in 2000-01 to 2011-12 by 24 percentage points since the 1980s. In the manufacturing sector, the wage share of workers in value added declined from approximately 27 percent in 1981-1982 to 21 percent in 1991-1992, and further to 12 percent by 2004-2005. Likewise, the share of wages for supervisors also declined from 14.5 percent in 1981-1982 to 12 percent by 1991-1992, and remained at that level up to 2004-2005 (Kannan and Raveendran 2009). This pattern of consistent decline appears to have continued during 2001-2012 as well (Kapoor 2016). Quite importantly during 1981-2005, the share of wages in value added has shown a consistent decline at the aggregate level as well as at the disaggregate level (Kannan and Raveendran 2009; Goldar 2014). For instance, the wage share declined in three prominent industries: food products and beverages, tobacco products, and textiles during the period 1980 to 2011–2012 (Kannan and Raveendran 2009; Abraham and Sasikumar 2017). The downward trend in the wage share in value added in the organized manufacturing is largely attributed to the reduced bargaining power of trade unions (Goldar and Aggarwal 2005); increasing capital intensity of production even in the labour intensive industries (Kapoor 2014; Goldar and Sadhukhan 2015; Abraham and Sasikumar 2017); increasing share of contract workers to total workers (Jha and Golder 2008; Abraham and

[3] The analysis was done for two measures, one being the drop in wage share in GVA and the other being the drop in emoluments share in GVA.

Sasikumar 2017); increase in the ratio of materials to wages (Goldar 2014) and labour saving technical change (Kannan and Raveendran 2009; Virmani and Hashim 2009).

As far as relative prices are concerned, Chandrasekhar (2008), views that the decline in the prices of capital relative to labour might have favoured the firms to augment the capital intensity. Moreover, as shown by Goldar (2013), increasing exports in the Indian manufacturing have had a depressing effect on the labour share in value added during the post-reform period (the year 1995 onwards). It appears that there have been incentives provided by the economic system for export and technology acquisition, thus deepening the capital intensity (Ghosh 1994). Quite importantly, during 1973-2001, the organized manufacturing had two counter patterns; while the labour share fell consistently, cost of labour increased steadily (Virmani and Hashim 2009). As argued by them these patterns might be the outcome of technical change and relatively inelastic demand for labour. The increasing capital intensity seems to have reduced the demand for labour and the changing composition of capital has created biases in the demand for labour; both together reduce the share of wages in value added (Abraham and Sasikumar 2017). Contrary to the pattern of consistent decline in labour share, the share of capital in value added had risen shown a discernible increase during the decades of 70s, 80s and 90s (Virmani and Hashim 2009). While one of the arguments for the progressive rise in capital intensity for the organized manufacturing is that this shift might have emanated from the process of technical change in the industry, Ghosh (1994) attributes the increase in real cost of labour as a reason for capital deepening. Positing that consistent rise in capital share tends to have implications for the future of work, Kapoor (2014) elucidates the linkage between increasing capital intensity in both capital- and labour-intensive industries on the employment generation. Not just that the labour was being consistently substituted by the capital, nature of employment relations also changed from the regular to the contractual, impacting the quality of the jobs available in the labour market due to increasing informalization of the labour.

Notably, during 2001-2011, except a few industries, capital intensity of production in Indian organized manufacturing grew (Kapoor 2014). Quite astonishingly, Hasan, Mitra and Sundaram (2013) observes that leaning of India’s manufacturing towards a capital intensive production seems to have been more than the prevalent rates in capital abundant economies like the United States, in particular 1989-1996. Based on the patterns pertinent to capital-labour ratios during 1989-2010, Goldar (2015) points towards the existence of three ostensibly different segments in Indian organized manufacturing in terms of capital intensity; labour intensive segment, low capital-intensive segment and high capital intensive segment. Nevertheless, during 1991-2010 the employment elasticity of manufacturing hovered around a meagre 0.05 (Sen and Das 2015). It is important to note that the share of contract workers in total organized manufacturing workers increased from 14 percent in 1989 to 34 percent in 2010 (Aggarwal 2013).

It appears the literature on elasticity of substitution also provides useful cues about consistent fall in the labour share in Indian organized manufacturing. During 1999-2008, elasticity of substitution for organized Indian manufacturing varied in the rage of 0.8 to 1.4 (Barua, Goldar and Sharma 2015). While the magnitude of substitution was relatively higher for labour intensive industries, capital-intensive industries exhibited elasticity of lower magnitude. However, measuring elasticity of substitution seems to be sensitive to the method. An interesting example is Goldar (2014) whose estimates, by using SMAC function turn out to be 0.73 while estimate based on constant elasticity of substitution (CES) function was 0.48 for the period 1981 to 2009. For the period 1973-2001, Virmani and Hashim (2009) estimated elasticity that varies in the range of 0.35 to 0.67. Gupta (2012) disaggregated the elasticity of substitution for skilled and unskilled workers, and found factor inputs were more substitutable with respect to the unskilled workers. The elasticity of substitution for unskilled workers was greater than one for seven out of ten categories of industry. Another critical insight emerging from literature is that, access and use of imported intermediate inputs favourably impacts the productivity of the firms. At the aggregate level in 2008-2012, the share of imported raw material has increased from 44 percent to 49 percent (Goldar 2014).

Moving over to TFP, Aggarwal and Sato (2013) estimated the increasing trend of TFP in entire manufacturing sector during the period 2000 to 2005 using Olley-Pakes (1996) decomposition. For the period 2000-2008, using the Levinsohn-Petrin (2003) model Sahu and Sharma (2016) estimate a positive TFP for all industries except one. A similar pattern was found by Majumdar and Mukherjee (2008) for the period 2000-2010. Two important studies, Ghosh (2003) and Virmani and Hashim (2011), capturing the trend of TFP over recent decades, point to the prevalence of positive growth in TFP for Indian manufacturing. Deb and Ray (2013) compare TFP growth in manufacturing for the pre- and post-reform period, for 1970-71 to 2007-08 using Data Envelopment Analysis. It was found that technological progress was the important component the growth rate and was 1.06 percent per year in prereform and 2.73 percent in post-reform for all-India. Although majority of states experienced accelerated productivity growth, few states experienced a decline in productivity after reforms. However, the regional variation in the rate of change in productivity diminished during the post-reform years. This was contested by Ghosh (2003) who suggest that productivity growth is not consistently higher after reforms than prior to reforms for 1981-2004. Factors such as firm size (Sathpathy, Chatterjee and Mahakud 2017), number of employees, wage-rate, and import penetration ratio positively affect TFP, while expenditure on R&D intensity exhibits a negative sign (Das 2011).

2. Theory and the empirical setting

Over the last several decades, share of labour in value added for the organized manufacturing sector of India has fallen[4]. A variety of mechanisms have been proposed to explain declining labour shares; these can be separated into two categories. Some reduce the labour share solely by altering factor prices. Piketty (2014) views that declining labour shares resulted from increased capital accumulation, and Karabarbounis and Neiman (2014) argued that they stem from falling capital prices. Other mechanisms, such as automation and offshoring, would be viewed through the lens of an aggregate production function as a change in technology. Abraham and Sasikumar (2017) shows quantum and changing composition of capital, contractualization, increasing female share in permanent workers, and, substitution of workers with more days of work have a substantial effect on the drop in wage share in GVA during 2000-01 to 2011-12. As Hicks (1932) pointed out, the crucial factor in assessing the relevance of these mechanisms is the aggregate capital-labour elasticity of substitution, which shows how aggregate factor shares respond to changing factor prices. Obtaining the elasticity is difficult; Diamond, McFadden and Rodriguez (1978) proved that the elasticity cannot be identified from time series data on output, inputs, and marginal products alone. Instead, identification requires factor price movements that are independent of the bias of technical change. Economists have thus explored two different approaches in estimating elasticity. The

[4] Study conducted by Abraham and Sasikumar (2017) of ILO explains that during 1980–2012, the share of total emoluments to workers declined from 51.1 percent to 27.9 percent and the share of wages declined from 33 percent to 13 per cent. Correspondingly, there has been a steady increase of profit share in GVA. Throughout this period, there was a decline in the share of emoluments and wages, with much of the drop concentrated in the periods 1980-1990 and 2000-2012.

first approach uses the aggregate time series and places strong parametric assumptions on the aggregate production function and bias of technical change for identification. The most common assumptions are that there has been no bias or a constant bias over time. The second approach uses micro production data with more plausibly exogenous variation in factor prices, and yields micro capital-labour elasticity of substitution.

In identifying the changing patterns of labour share, our major firm-level outcome variable is payment to labour as a share of value added that can be written as:

$$(1) \qquad LS_{i,t} = \frac{w_{i,t} N_{i,t}}{VA_{i,t}}$$

where, $w_{i,t} N_{i,t}$ is labour compensation of firm *i* at time *t*, which is the product of the firm-level average wage rate $\left(w_{i,t}\right)$ and the number of employee $\left(N_{i,t}\right)$[5] and $\left(VA_{i,t}\right)$ is a measure of value added using the production approach[6].

We consider an economy inhabited by firms that vary according to their capital intensities, technological capabilities, multiunit status[7], quality certification(s) (International Organization for Standardization) and productivity. In this economy there is a firm *i* in industry *s* in period *t* that uses a industry-specific constant returns to scale production function that converts labour $\left(N_{i,t}\right)$, capital $\left(K_{i,t}\right)$ and materials $\left(M_{i,t}\right)$ into an output $\left(Q_{i,t}\right)$:

$$(2) \qquad Q_{i,t} = w_{i,t} \left[a_s \left(N_{i,t}\right)^{\frac{\sigma_s - 1}{\sigma_s}} + \left(1 - a_s\right)\left(K_{i,t}\right)^{\frac{\sigma_s - 1}{\sigma_s}} \right]^{\frac{\alpha_s \sigma_s}{\sigma_s - 1}} \left(M_{i,t}\right)^{1-\alpha_s}$$

Each firm is differentiated by its productivity. The parameters of the sectoral production function include the weight on labour versus capital in factor inputs, as, where $0 < a_s < 1$; the

5 Labour is the product of the head count of employees multiplied by the differences in human capital across Indian states. The results do not change even if we use the unadjusted values of the number of employees.
6 This approach computes value added from gross output minus operating costs.
7 A firm with multiple unit of production. Closely examining the data from the Annual Survey of Industries gives this information that there are firms with more than one unit of production.

industry-specific elasticity of substitution between capital and labour, σ_s, where 0 ≤ σ_s < +∞; and relative weight between the factor inputs (i.e., labour and capital) and intermediate inputs, α_s; where $0 < \alpha_s < 1$. Each firm faces a perfectly elastic supply of labour, capital and materials at input prices $\left(w_{i,t}\right);\left(r_{i,t}\right)$; and $\left(p_{i,t}\right)$, respectively. And, each firm faces a downward sloping demand curve for its product and heterogeneous in their mark-ups due to the technological capabilities, quality certification and multiunit status.

Empirically, we show how the aggregate elasticity of substitution can be computed from the plant-level elasticity. In response to a wage decrease/increase, plants substitute towards capital. Capital-intensive plants gain market share from the labour-intensive plants. Therefore, the degree of heterogeneity in capital intensities determines the relative importance of within-plant substitution and reallocation. Under this framework, we build the aggregate capital-labour elasticity from the plant level components. We begin with a simplified environment in which we describe the basic mechanism and intuition. We proceed to enrich the model with sufficient detail to take the model to the data by incorporating materials and allowing for heterogeneity across industries. Consider a large set of plants *I* whose production functions share a common, constant elasticity of substitution between capital and labour σ. A plant produces output Y_i from capital K_i and labour L_i using the following CES production function:

$$(3) \qquad Y_i = \left[\left(A_i K_i\right)^{\frac{\sigma-1}{\sigma}} + \left(B_i N_i\right)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}$$

Productivity differences among plants are factor augmenting: A_i is *i*'s capital-augmenting productivity and B_i *i*'s labour-augmenting productivity. This is the baseline model of a CES production function from where we start the approach. We extend the baseline framework by allowing heterogeneity across industries and using a production structure in which plant use materials in addition to capital and labour. We assume that each plant's production function has a nested CES structure. Given this nested structure of the CES production function, we further assume that plant *i* in industry *n* produces with the production function that is specific to that particular plant. Hence, we can calculate the industry elasticity of substitution and aggregate substitution between capital and labour.

The extent of heterogeneity in both capital and labour intensities are measured by the heterogeneity index, which determine the relative importance of within plant substitution and reallocation. The empirical results of this heterogeneity are rather negligible. Quite important, a cost weighted measure of capital and labour shares may generate more plant level heterogeneity than un-weighted measures. Therefore, we use weighted measures of heterogeneity at the plant level. In addition, as for both the cases of labour and capital the shares are less than one, their variance is smaller than their standard deviation. A similar approach is taken for the labour heterogeneity. The heterogeneity index for capital is measured as followed:

(4) $$k_h = \mathrm{var}(ks_{\text{cost-weightd}})$$

Using a non-linear specification, we calculate the plant level elasticity of substitution using:

(5) $$\log \frac{rK_{ni}}{wN_{ni}} = (\sigma_n - 1)\log w_{ni}^{STN} + \vec{C} + \varepsilon_{ni}$$

where w_{ni}^{STN} is the wage for the industry classified for at digits of National Industrial Classification (NIC) for a particular state. We run regression with respect to each year, considering that the factors of production tend to be mobile leaving very little scope for specific advantages for the firm in resource allocation. Further, all regression includes industry fixed effects, age fixed effects, multi-unit status indicators[8], welfare indicator[9] and technology indicator with the standard errors being clustered at the industry level. We estimate the plant level elasticity of substitution using cross-sectional wage differentials across locations (states) in India. Therefore, the question is whether these wage differences

8 In this case as few firms have multiple units in operation, we have created the variance between firms with multiple units and the rest. This is a weight given to firms with multiple operating units. A higher weight is given for firms where they have multiple operating units for production.

9 Annual survey of industries gives information on the various welfare measures taken at the unit/firm level. We have added all benefits related to the welfare measures by the units/firms and created a variance between them. As in the case of the multiple unit status, a higher value is attached with firms with higher degree of welfare measures for the employees.

are exogenous to non-neutral productivity differences. To address such endogeneity problem, we use a version of Bartik (1991) instrument for labour demand.

Once the elasticity of substitutions is estimated using different specifications, we next estimate the TFP. Here, moving from unit level yearly data, we create aggregate level panel data for two reasons. The first is to capture the time varying TFP changes at aggregate level and the second to account for the appropriate econometric specification in estimation of TFP. We use five specifications apart from the standard CES one. From each of the estimations, we arrive at the growth in TFP. Once the TFPs are calculated the next approach is to arrive at the determinants of TFP. In this case we use different model specifications such as (1) a base model consisting of heterogeneity in capital and labour; (2) model with technology and International Organisation for Standardization (ISO) certification; (3) model with technology and multiunit; and (4) a full specification taking all the above variables. To check consistency in estimation of production function(s), we use different specifications such as the Olley and Pakes (1996), Levinsohn and Petrin (2003), Wooldridge (2009), modified Wooldridge (2009) and, Ackerberg, Caves and Frazer (2015).

We begin with the OLS type estimation and move on to panel data estimation with two-way fixed effects. The results of the two-way fixed effects are accepted based on the model efficiency and gives us the result at the short-run. But the question still remains about the relationship of capital and labour heterogeneity in the long run. In explaining this relationship, we estimate the time-series properties of the panel data (test for stationarity). This prepares us to use the dynamic-OLS (DOLS) framework. As relationship between the labour and capital heterogeneity are also established at long run, we next move on to explain determinants of labour heterogeneity using TFP as one of the explanatory variables. In this case a Tobit type percentile distribution of labour heterogeneity is estimated. Further, we are interested in the pattern and behaviour of labour heterogeneity with respect to labour share and labour productivity. We use Feasible Generalized Least Squares (FGLS) Estimator using the following functional form:

(6) $$l_h = f(l_s, l_p)$$

where l_h represents the labour heterogeneity; l_s represents the labour share and, l_p represents the labour productivity.

Going back to our previous discussion on factor shares of labour and capital, share of labour in value added appears to have fallen consistently in Indian manufacturing. This pattern may seem to have strong linkage with change in employment relations towards more informalization while business models have been tilting towards more fragmented forms of production (OECD, 2014). As Muralidharan, Paul and Murti (2014) during 1998-2010, real wages in Indian manufacturing hardly grew, and internal labour market within the production generated wage disparity between formal and informal employment. Further the paper shows that the enforcement of minimum wage in Indian manufacturing suffers from coordination failures. Quite important, entry wage in Indian manufacturing appears to be discernibly low. Another major finding of this paper is that, using static and dynamic panel frames, real wage-productivity elasticity is quite negligible, hovering around 0.1. Drawing cues from Piketty (2014), consistent decline in wage share may have macroeconomic implications such as fuelling the acceleration of income inequality as well as sustainability of equitable growth. Against this backdrop, it will be interesting to examine the determinants of wage in India. To gauge the determinants of wage for Indian manufacturing, we specify the following model:

$$(7) \qquad Wage = f\left(age, edu, emp, size, controls\right)$$

where *age* refers to the age of the employee, the variable *edu* depicts the educational attainment in three streams (general, technical and vocational education), *emp* captures the employment relationship (general features, nature of job contract, occupational hierarchy), *size* refers to the size of the firm with respect to employment and *controls* represent the other control variables used in the estimation.

3 Data and variables

We use two data sets: Annual Survey of Industry (ASI) and National Sample Survey (NSS) micro data on employment, published by the Central Statistical Organization, Government of India. While the first database is used for estimating factor heterogeneity, elasticity of substitution and total factor productivity, the second database forms the base for estimating the wage function. ASI contains firm level data on output, raw material, capital and labour, factor payments and characteristics of the firm such as ownership and nature of enterprise. This data is updated annually, by the Industrial Statistics division of Central Statistical Organization, Government of India. This survey enjoys the legal mandate of The Collection of Statistics Act (2008) which is the revised version of The Collection of Statistics Act, 1953. As per this legal mandate, the government is empowered to collect the statistics on any theme from any industrial or commercial concern. The reference period for this survey is the financial year that stretches from the April to the March of a particular year. The survey covers all factories registered under section 2(m)(i) and 2(m)(ii) of the Indian Factories Act, 1948, manufacturing establishments under the *bidi* (tobacco wrapped in leaves) and *cigar* (a cylinder of tobacco rolled in tobacco leaves for smoking) workers (Conditions of Employment Act, 1966) and all electricity undertakings not registered with the Central Electricity Authority. Those firms that have to comply with this mandate submit the statistical returns and the balance sheet. Prior to the survey, the Central Statistical Organization updates the list of the firms who are eligible to participate in the survey, known as ASI frame[10]. The research design of the data collection is a mix of census of industrial units and a stratified random sampling. While the system of census is applicable to the units that are located in certain notified regions, for the rest, the survey is done based on a stratification scheme that combines state, district, sector (rural or urban) and industrial activity. The unit of analysis in ASI is the factory as defined by Indian Factories Act, 1948. We capture the data for a temporal stretch from 2000-2001 to 2013-2014. This is a bundle of cross-sectional data for every year over a span of 14 years. Although the same unit may feature across years, there is no unique identifier to ascertain whether the same unit repeats over the years. Therefore, our compilation over this temporal stretch is a pooled data. However, the data is aggregated at industry level for some level of analysis. Across the time span, however, classification of industries, known as NIC is not the same. There were three classifications “NIC 1998”, “NIC 2004” and “NIC 2008” during our temporal reference frame. To overcome the problem of comparability between these classifications, we resort to a concordance exercise that brings comparability across these classifications.

This database consists of 14 blocks. Each block contains data specific to a particular context. For example, block A is specific to the identification of the factories, while block B contains

10 For detail see http://www.csoisw.gov.in/cms/cms/Files/5.pdf

data on the characteristics of the enterprise. Block C and D capture data on fixed assets and working capital respectively. Block E is pertinent to the data on labour whereas block F provides data on other expenses. Block G contains data on other outputs or receipts. The next block (H) provides data on indigenous input items consumed, while block I contains data on imported input items consumed. We have excluded the remaining blocks from the analysis. We merged blocks A to I by using a common key that is serial number provided to the factories. After merging diverse blocks, we created the cross-sectional database pertinent to a particular year. In the next step, we pooled the entire cross-sectional merged units to form the pooled database for our analysis, aggregating more than 0.4 million units. Subsequently, we transform all continuous variables that are measured in monetary values into real values by using relevant deflators.

The second data source used in the study is the NSS 68th round on employment and unemployment, conducted by the National Sample Survey office, Ministry of Statistics and Programme Implementation, Government of India. This data is an outcome of the cross-sectional survey conducted during 2011-2012. The results of the survey were declared in the year 2014. The survey collects data on household characteristics, demographic features, employment status, and nature of employment relation, wage and nature of activities being pursued by the households. The sampling design used in this survey is a stratified multi stage design. The survey is divided into two stages: the first phase and the second phase. While in the first phase, spatial units are identified as the first stage sampling units (FSU), household is the ultimate stage. This process is applicable to both the rural and the urban stratum. In determining the sample size with respect to the first stage sampling units, weights are derived from the census.

The database consists of eight blocks. The first two blocks deal with identification of the sample households and particulars of field operation respectively. Block 3 and 4 contain data on household characteristics and demographic features of household members respectively. Block 5 and 6 capture the labour market characteristics of the members of the household. While block 7 is pertinent to data on persons who are engaged in unpaid domestic chores, the block 8 provides data on household consumption expenditure. We merge first six blocks for the analysis. In order to merge these blocks, in the absence of a common key we use a combination of four key variables (first stage sampling code, first stage sampling unit group number, second stage stratum number and sample household number). While the number of households in the sample is more than 0.1 million, the household roaster contains approximately 0.4 million persons. Although this database captures diverse activities in the labour market, we limit our analysis to the regular wage employment in the manufacturing. Therefore, we exclude persons who are unemployed, not in the labour force, self employed and casually employed. Due to this our coverage of the sample trims down to slightly less than 6,000 employed persons.

From the first data set, we analyse patterns with respect to heterogeneities in factor share and factor intensity, trend of elasticity of substitution and determinants of total factor productivity. The variables used in the analysis are described in table I.

(Table I)

Based on the second database i.e. NSS 68th round, we gauge the determinants of the wage. The variables used in the analysis are described in table II.

(Table II)

4 Results and discussions

Heterogeneity of Labour and Capital

Quite apparently, for the organized manufacturing in India, share of labour income in net value added (NVA) declined consistently during 2000-14, while the share of capital in NVA also dwindled over the years but not in a consistent manner (figures I and II). Presumably, these two not so similar patterns point to diverse trajectories of factor shares with respect to capital and labour. This pattern entails to be understood by examining how homogenous/ heterogeneous is labour and capital. It is clear from the patterns presented in figures III to X, with respect to the labour, large chunk of industries hover around relatively lower degree of heterogeneity in wage share, while heterogeneity with respect to number of workers appears a little more dispersed. When we plot heterogeneity of wage share over time, the index of heterogeneity declines in a consistent manner, conveying that share of labour income became more homogeneous during the period of study. Nevertheless, same the phenomenon of homogenisation doesn't appear to be valid for heterogeneity with respect to number of workers.

(Figure I and II about here)

(Figure III and IV about here)

Contrary to the pattern of majority of industries reporting low degree of heterogeneity in share of labour income, share of capital in NVA shows a dispersed pattern across industries. It is noteworthy that heterogeneity with respect to share of capital in NVA appears to be relatively dispersed, not conveying a trend of consistent change. Comparing the inter-temporal trends of heterogeneity with respect to factor shares of labour and capital, while the former is turning out to be discernibly homogeneous, the latter remains relatively heterogeneous. This phenomenon of increasing homogeneity of factor share with respect to the labour seems to coincide with growing informalization of labour force in Indian manufacturing. Drawing cues from the extant literature and data, it is unequivocally clear that share of contract labour grew over last one and half decades. Next, we examine the heterogeneity of capital per labour over the years and across the industries. During the period of study, heterogeneity of capital per labour increased in a consistent manner although all of the industries except electricity and gas settled around perceptibly lower degree of capital-labour heterogeneity (figures IX and X).

(Figure V and VI)

(Figure VII and VIII)

(Figure IX and X)

Substitution between Labour and Capital

As shown in figure XI and XII, elasticity of substitution during the period of study varies from negative unity to positive unity for the majority of industries. However, the elasticity with respect to electricity, water and gas supply is exceptionally high. More importantly, plotting elasticity of substitution over the years generates a pattern of consistent rise from less than 0.5 to 1.5. Nevertheless, when we plot the temporal movement of elasticity with respect to industries, broadly three patterns emerge: (i) stagnant trend, (ii) pattern of discrete spike of decline, (iii) pattern of sluggish growth. These heterogeneous patterns resemble an inverted U-shaped curve for aggregate elasticity of substitution over the years. Compared to the pattern of consistent increase, the inverted U appears to be relatively more immune to noises in the data. Delving deeper into the inverted U shape, what emerges is that the elasticity of substitution tends to go up until the year 2010, albeit a few less discernible drops. However, post 2010, the magnitude of elasticity is on a consistent drop. This non-linear pattern entails substantive understanding about the interaction between policy instruments and business environment.

(Figure XI and XII)

(Figure XIII)

We chose six econometric specifications to examine the pattern of elasticity of substitution. The first specification estimates a separate plant elasticity of substitution for each industry, and then averages them using the cross-industry weights. The second specification estimates single elasticity of substitution for the entire sector. The third specification estimates the plant elasticity of substitution using fixed effects for the NIC at two digits. The fourth specification estimates the plant elasticity of substitution using the state fixed effects. The fifth specification estimates the elasticity substitution in an instrumental variable (IV) framework, using Bartik labour demand instrument. The sixth specification estimates the plant elasticity of substitution through IV, using imported capital. All the estimates point to that elasticity of substitution changes over the years in a cyclic pattern. Moreover, across these models the magnitude of elasticity reached the peak during 2008-2010, while the lowest value was reported during 2000-2001. What these inferences indicate is that during 2000-2010, the elasticity of substitution between capital and labour seemed to have increased. In other words, interpreting the increase in elasticity of substitution, we put forth that capital was consistently substituting the labour during 2000-2010. Drawing cues from descriptive and inferential analysis of elasticity of substitution, we conclude that the employment in organized manufacturing in India appears to have been swayed by the growth in capital during the period of analysis. While this change is more visible during 2000-2010, the latter phase shows not so perceptible pattern of change.

(Table III)

(Figure XIV)

An interesting pattern that emerges from the plot of elasticity of substitution between raw materials and non-raw materials is that, with respect to indigenous sources, the coefficient appears to have consistently increased from 0.08 (in the year 2000) to 0.17 (in the year 2009), despite discernible fluctuations during 2010-2013 (table IV). Contrary to this pattern, with respect to imported materials, the coefficient of elasticity delineates a consistent decline from 0.29 (in the year 2000) to 0.17 (in the year 2012). What these patterns imply is that when it comes to indigenous sources, firms tilt resource allocation towards raw materials over non-raw materials, while the reverse seems to be valid with respect to the substitution of foreign trade.

Presumably, there may be incentives in favour of having more capital goods from abroad than sourcing raw materials from these sources, while there seems to be discernible incentives to source raw materials from the domestic economy. Although this pattern is seemingly inadequate to surmise that this scenario represents something closer to the school of underdevelopment that talks about structural relation between core and peripheral economies in the context of the world trade, we see potential in doubting that whether the Indian manufacturing system has been evolving to a system of sustained capabilities in terms of technologies.

(Table IV)

(Figure XV)

(Table V)

Further, we estimate the elasticity of substitution that is posited as a constant over the years and across the plants with respect to each industry. For this, we use the model of CES production function. The model has three parameters: intercept, shares with respect to factors of production and the power to which factors are raised to. Quite important, constant elasticity of substitution is defined as the ratio of one divided by sum of one and the substitution parameter. The estimated constant elasticity of substitution with respect to industries varies in the range of 0.95 (agro-based Industries) to 2.1 (electricity). Higher the elasticity of substitution, greater is the sensitivity of capital per labour to relative factor prices. It may be inferred from the result that across industries the phenomenon of labour being substituted by the capital remains a salient feature. Barring two industries (agro-based

Industries and manufacturing related services), all industries report coefficients more than unity, hovering around a median of 1.5.

While estimates with respect to constant elasticity of substitution indicate labour being substituted by capital across industries during the period of analysis, it is important to ascertain the nature of efficiency in relation to factors of production. To gauge efficiency in the production system as a whole, aggregating all the industries across times, we plot isocost frontiers on a biplane surface of capital and labour (figure 10). The isocost frontier depicts that irrespective of capital per labour ratios cost remains the same. On a frontier, there tends to be numerous points (representing distinct processes) that cost the same. Putting different frontiers in an order, further a frontier away from the origin it will cost more, while closer the frontier is to the origin it costs less. In other words, frontiers that cost less will be more efficient than those cost more. Quite clearly, 90th percentile plants are on the higher isocost frontier, conveying lower magnitude of cost efficiency. On the other hand, just 10th percentile are on the higher efficiency frontier (the curve lying closest to the origin). Connecting the pattern of cost efficiency and constant elasticity of substitution hints that labour being substituted by the capital at the plant level doesn't necessarily lead to convergence of efficiency levels in the economic system.

(Figure XVI)

Determinants of Total Factor Productivity and Labour Heterogeneity

As brought out in previous sections, the capital was substituting the labour over the years and across industries during the period of analysis, albeit variation in the intensity of substitution. Not only inferential analytics points to this pattern, something closer to this also emerges from the descriptive analysis of indicators pertinent to labour and capital. Homogenising income accruing to labour versus heterogenisng the capital share points to the consistent substitution of labour by capital. This phenomenon seems to have emanated from complex interaction between endogenous factors in the system and exogenous forces that have possibly emerged from policies. These changes either at plant level or industry level tends to generate changes that are likely to be manifest in more representative indices such as TFP. More succinctly, it is important to ask if TFP is sensitive to heterogeneities with respect to capital and labour. Foremost, as shown in table VI, TFP, for the period of analysis, varies across industries, and is sensitive to the methods. While we calculate TFP by using five different methods, our discussion relies more on the ACF 2015. As per the estimates based on this method, TFP varies between 2.38 (construction related manufacturing) and 3.17 (other manufacturing related services).

(Table VI)

We gauge if heterogeneities with respect to capital and labour significantly impacts TFP. We use a panel data wherein plants are aggregated to industry (NIC, 2008 1 digit) over the years (2008-2013). Thus, we get 248 observations, treating industry as the unit of analysis. Our analysis begins with a pooled regression, estimating five different econometric specifications (results are presented in appendix A.1). While heterogeneities with respect to labour and capital are common to these models, they are distinguished on the basis of inclusion of three variables: (i) software capital intensity, (ii) ISO certification and (iii) multiple plant locations. In all these models, TFP remains as the dependent variable. Moreover, the fifth specification absorbs all independent variables. What emerges from this exercise is that across these models neither labour heterogeneity nor capital heterogeneity significantly impact TFP. However, this result appears to be not immune to the impact of specificity of each industry, motivating us to use a fixed effect frame for the regression. We apply the fixed effect regression to all five econometric specification described in the preceding paragraph.

Quite interestingly, as depicted in table VII, with regards to the first model, while TFP tends to be inversely proportional to labour heterogeneity, there appears to be a direct relation between TFP and capital heterogeneity. The same inference is valid for model two and four, as well. However, for other specifications there is no statistically significant relation between TFP and factor heterogeneities. More intuitively, this exercise is closer to capturing patterns from short run perspective owing to no explicit treatment of the dynamics.

(Table VII)

Therefore, the ensuing question is if we change our analysis to a dynamic mode, will results change? Next, we apply dynamic OLS (DOLS) to all five econometric specifications (table VIII). What converges, across all these specifications, is the inverse relationship between TFP and labour heterogeneity. Nevertheless, only with respect models one and four, the relation between TFP and capital heterogeneity is statistically significant, showing a positive sign. Therefore, drawing cues from short run as well as long run frames of analysis, we conclude that there is an inverse relationship between TFP and labour heterogeneity. These results mean that there are inherent advantages that are prevalent at the industry level for substituting labour by capital. Presumably, conclusion of this sort indicates that labour getting displaced by capital seems to bring certain economies that may pave way for increasing returns. For an industry as well as for a plant, any endeavour towards increasing TFP may facilitate a context for differential growth that translates to the prospect of creation of capabilities and competitive advantage in a dynamic and open economic system.

It is noteworthy that, in the DOLS, with respect to model five, weights for ISO certification and having plants at multiple locations report positive coefficients. This reiterates our earlier conclusion that proclivity towards higher TFP may emanate from the motivation to move ahead in the competition through enhancing the resources since ISO appears to be a good proxy for organisational efficiency through knowledge management processes, while having multiple plants may create economies of scale and scope, in particular in the context of growing trend towards contract manufacturing. Moreover, we put four combinations of pair of variables to the test of equality: labour heterogeneity and capital heterogeneity, labour heterogeneity and ISO certification, labour heterogeneity and multiple unit and labour heterogeneity and software capital intensity. The null hypothesis of this test is that jointly variables in these pairs are not different from zero. We reject these null hypotheses based on the calculated chi-square values, therefore, validating our all previous inferences.

(Table VIII)

It will be interesting if we let the centre of gravity to move from the lowest percentile to the highest percentile, allowing us to validate the results across the length and breadth of the distribution with respect to the dependent variable. For this, we use a tobit regression specification. Now, we turn attention to heterogeneity in terms of the size of labour, which is regressed on share of wage in value added, capital share in value added, software capital intensity, export intensity, weight for ISO certification, weight for location of multiple plants and TFP. Quite important, across these econometric specifications, heterogeneity of labour in term of sizes is directly proportional to share of wage in net value added. However, except for highest percentile, coefficient with respect to share of capital in net value added turns out to be statistically insignificant. For the 95th percentile, share of capital in net value added, negatively impacts labour heterogeneity. The same inference is applicable to software capital intensity as well. For this variable, at 95th percentile, the coefficient turns out to be negative.

Again, for export intensity, only with respect to 95th percentile, coefficient is statistically significant (positive). However, coefficient with respect to weight for ISO remains statistically significant (positive) across all specifications except for the highest percentile.

(Table IX)

As far as TFP is concerned, with respect to percentiles 50, 75 and 90, coefficients are statistically significant, reporting positive signs. Apparently, what emerges from the direct relation between share of wage in net value added and heterogeneity in terms of size of labour is that a distributional rift in favour of labour class appears to cause more dispersion in size of employment in Indian manufacturing. However, more allocation for capital seems to cause more homogeneity in labour, reiterating our conclusion regarding the stylized fact of labour being substituted by capital in Indian manufacturing. Amongst the variables, except labour share in net value added, what seems more ominous in terms of statistical significance is weight for ISO; it sways heterogeneity of labour in terms of size positively. Intuitively, this appears to say that ISO as an indicator of capability seems to provide differential advantage to the firm and thus paving way for context of heterogenising the labour absorption.

What Factors Shape Wage in Indian Manufacturing?

While previous analysis threw up a pattern of consistently rising homogeneity with respect to labour (share of wage in net value added) over the years, it would be interesting to examine if labour share influences labour heterogeneity (in terms of factor share) along with the proportionate change in labour productivity. What appears from table X, is across industries, over the years, labour heterogeneity is positively proportional to labour share, while labour productivity shows a feeble relation with labour heterogeneity.

(Table X)

What this result means is that lower the factor share of labour, higher will be the labour homogeneity. Our preceding discussion has unravelled that the labour being substituted by capital in Indian manufacturing during 2000-2013, while the labour is turning out to be more homogenous in nature. Drawing cues from the recent evidence (Murlidharan, Paul and Murti 2014), post the year 2000, real wage for workers in manufacturing appears to be stagnant, while employment relation is tilting towards flexible contracts, increasingly employing contract workers. Moreover, the pattern of stagnant real wage and in-formalization of labour seems to emerge as a salient feature of Indian manufacturing. Quite important, one of the principal indicators that link the system of production with the aggregate economy is the wage. It's macroeconomic significance, is vital since the wage contributes to the consumption in the economy, that tends to trigger off a spiral of value adding activities. In the context of consistent pattern of homogenisation of factor share with respect to labour, it is worth exploring what are the factors that sway the wages by analysing micro data that captures information from a supply side.

In order to gauge the determinants of wage, we posit that wage is a function of age, age square, human capital, size of the firm, employment relation and other control variables. As presented in table XI, there appears to be a quadratic relation between wage and age since coefficient with respect to age is positive while that for age square is negative, almost resembling a Mincerian specification. Next, we link human capital and wage. To capture the diversity of human capital, we divide the human capital into three: (i) general education, (ii) technical education and (iii) vocational training. With regards to general education, treating matriculation (10 years of schooling) as the reference category, there appears to be negative coefficients for levels of schooling that are below matriculation, while positive coefficients tend to go up as level of education increases for the post-matriculation levels. Quite evidently, higher education levels (post graduate and graduate) report highest and second highest coefficients respectively. For technical education, compared to the base category (no technical education), categories that represent different levels of technical education report positive coefficients. The third component of human capital, vocational training, while it is critical for a manufacturing system that relies on productivity, shows a mixed relation with wage. While, compared to the reference category no formal vocational training, coefficient with respect to informal vocational education through systems like hereditary learning is statistically insignificant, coefficient for formal education is positive.

Next, we look at the relation between size of the firm and wage. Here, size of the firm is represented by the number of workers employed, treating the number of workers in the range of 1-5 as the reference category. As we change from the reference category to the alternate categories, all resultant coefficients appear positive. This pattern throws interesting cues about the relation between firm size and wage. While firms may pursue profit either through integrating or fragmenting the production, relying on our results, we may argue that pursuit of profit through an integration route appears to favourably impact wages.

Now, we turn to the question whether employment relation impacts wages. To capture the concept of employment relation, we look into its general features, nature of job contract and occupational hierarchy. Broadly, with regard to general features of employment relation, we cover the following variables: whether employment is permanent, if it is full time, does labour have membership in union, and is employment formal. As reported in table XI, being permanent appears to be advantageous for the labour, showing a positive coefficient. The same is the case for full time employment. Membership in trade union has a direct relation with wage. Moreover, in comparison with employment that sans any social security entitlements (namely, informal employment), formal employment translates to gain for the labour in terms of wage (positive coefficient). Having a written job contract or not is another dimension of employment relation. This variable's relation with wage is a mixed one. Compared to the reference category, only the category of written job contract with more than three years appears to positively influence wage. As expected, wage appears to be responsive to occupational hierarchy. The coefficients with respect to managerial, professional, technical and clerical staff appear to be significantly higher than that of service staff, craft and related workers and labour engaged in plant operations, while all these categories report positive coefficients in comparison to the base category of elementary occupation. Quite unequivocally, this pattern resembles the traditional segmentation between blue collar and white collar workers in the context of internal labour markets.

While viewing wage as an outcome of household, personal, labour market and employment relation characteristics, albeit not so convincing evidence for strong relation between real wage and average product of the labour, wage remains as an influential connect between firms, labour market and the economic system. Given that manufacturing in India has been in sustained stagnation for last few decades[11], an important question is whether consistent substitution of labour by capital alone puts momentum of growth to the manufacturing. Drawing cues from our results, wage is discernibly impacted by progressive changes in

[11] Siddharthan, N. S., (2014), Stagnant Manufacturing: Governance and Policy Slack (Ed.), http://esocialsciences.org/eSS_essay/eSS_eSSay_Stagnant_Manufacturing.aspx

human capital, basic traits of decent employment relations and implicit mobility within occupational hierarchy.

(Table XI)

If we posit that sustained growth in real wage emanates from positive changes in the manufacturing sector, what is implicit in the positive relation between wage and human capital is that qualitative and quantitative change in skill formation tends to result in premium in favour of that labour. Moreover, significant improvements in the employment relation that does not compromise with the decency of work may generate positive payoffs in favour of labour, thus prospectively impacting the productivity. It appears from the results that moving from a fragmented manufacturing system to an integrated one tends to trigger off incentives in favour of the labour.

5 Conclusion and policy suggestions

From our descriptive and inferential analysis, we gauged the following: (i) heterogeneity in share of factor in value added, (ii) elasticities of substitution with respect to factors and material and non-material, (iii) total factor productivity, (iv) total factor productivity as a function of heterogeneity of factor share in value added and other control variables and (v) wage function from the supply side. Quite clearly, our analysis reveals that, at the plant level, homogeneity with respect to share of labour income has been steadily increasing over the years, albeit the recent cyclicity, while the heterogeneity of the capital doesn't throw up a definite pattern. Over the years, as the plant level data reveals, barring a few recent years, the labour being substituted by capital emerges as a discernible pattern, quite reflected in elasticity of substitution. Moreover, with respect to the domestic trade, what appears to be more perceptible is substitution of raw material over non-raw material, while the reverse is held good for foreign trade. While heterogeneity of labour share in value added emerges as significant explanatory variable that accounts for variation in total factor productivity at the industry level, the same is not valid for the heterogeneity with respect to capital share in value added. Coming to the supply side, wage appears to be directly influenced by human capital, size of the firm, employment relation leaning towards decent work and mobility within occupational structure.

Connecting these findings, we conclude that capital substituting labour at the plant level is not just the question of economic or allocative efficiency since the flexibility implicit in substitution doesn’t appear to resonate sustainable positive dynamics in indigenous capability building, particularly in technology and human capital formation. It appears that having more capital over labour doesn’t necessarily generate dynamic efficiencies in all the constituents of the production system. It is noteworthy that foreign trade is more explored for non raw materials by the industrial economy over the years, although the system could have allocated more resources indigenous research and development while its backward linkage with the economic system tilts towards having primary resources such as raw materials or cheap labour. On the other hand, envisaging a production system with dynamic capabilities while not averse to appropriate options for factor substitution requires firms to invest in human capital formation and research and development.

References

Aggarwal, Aradhna, and Takahiro Sato. "Firm Dynamics and Productivity Growth in Indian Manufacturing: Evidence from Plant Level Panel Dataset." *Research Institute for Economics and Business Administration, Discussion Paper Series DP2011-07, Kobe University* (2011).

Ackerberg, Daniel A., Kevin Caves, and Garth Frazer. "Identification properties of recent production function estimators." *Econometrica* 83.6 (2015), 2411-2451.

Barua, Alokesh, Bishwanath Goldar, and Himani Sharma. *The Role of Technological Conditions of Production in Explaining India's Manufacturing Growth, 1998-00 to 2007-08: Some Policy Perspectives*. No. 15-04. Centre for International Trade and Development, Jawaharlal Nehru University, New Delhi, India, 2015.

Das, Ram Upendra. "Productivity in the Era of Trade and Investment Liberalization in India." (2011).

Deb, Arnab K., and Subhash C. Ray. *Economic reforms and total factor productivity growth of Indian manufacturing: An inter-state analysis*. No. 2013-04. University of Connecticut, Department of Economics, 2013.

Diamond, Peter, Daniel McFadden, and Miguel Rodriguez, “Measurement of the Elasticity of Factor Substitution and Bias of Technical Change," in Melvyn Fuss and Daniel McFadden, eds., Production Economics: A Dual Approach to Theory and Applications, 1978, chapter 5.

Ghosh, Saibal. "Do economic reforms matter for manufacturing productivity? Evidence from the Indian experience." *Economic Modelling* 31 (2013), 723-733.

Goldar, Bishwanath. "Trade liberalisation and labour demand elasticity in Indian manufacturing." *Economic and Political Weekly* (2009), 51-57.

Goldar, Bishwanath. "WAGES AND WAGE SHARE IN INDIA DURING THE POST-REFORM PERIOD." *Indian Journal of Labour Economics* 56.1 (2013).

Goldar, Bishwanath. "Productivity in Indian Manufacturing in the Post-Reform Period: A Review of Studies." *Productivity in Indian Manufacturing*. Routledge India, 2014. 99-129.

Goldar, Bishwanath, and Suresh Chand Aggarwal. "Trade liberalization and price-cost margin in Indian industries." *The Developing Economies* 43.3 (2005), 346-373.

Goldar, Bishwanath and Amit Sadhukhan. *Employment and wages in Indian manufacturing: Post-reform performance*. International Labour Organisation: Geneva, 2015.

Gupta, Nitin. *Impact of Elasticities of Substitution, Technical Change, and Labour Regulations on Labour Welfare in Indian Industries*. No. 2012-10. The Australian National University, Australia South Asia Research Centre, 2012.

Hasan, Rana, Devashish Mitra, and Asha Sundaram. "What explains the high capital intensity of Indian manufacturing?." *Indian Growth and Development Review* 6.2 (2013), 212-241.

Jha, Praveen, and Sakti Golder. *Labour market regulation and economic performance: A critical review of arguments and some plausible lessons for India*. No. 2008-01. International Labour Office, 2008.

Kannan, K. P., and G. Raveendran. "Growth sans employment: A quarter century of jobless growth in India's organised manufacturing." *Economic and Political Weekly* (2009), 80-91.

Kapoor, Radhicka. "Technology, Jobs and Inequality." February 2016. *Indian Council for Research on International Economic Relations.* Working Paper. 24 October 2018.

Kapoor, Radhicka. "Creating jobs in India's organised manufacturing sector." *The Indian Journal of Labour Economics* 58.3 (2015), 349-375.

Karabarbounis, Loukas, and Brent Neiman. "The global decline of the labor share." *The Quarterly journal of economics* 129.1 (2013), 61-103.

Kathuria, Vinish, Rajesh SN Raj, and Kunal Sen. *Productivity measurement in Indian manufacturing: A comparison of alternative methods*. Institute for Development Policy and Management, 2012.

Kien, Tran Nhuan, and Yoon Heo. "Impacts of trade liberalization on employment in Vietnam: a system generalized method of moments estimation." *The Developing Economies*47.1 (2009), 81-103.

Levinsohn, James, and Amil Petrin. "Estimating production functions using inputs to control for unobservables." *The review of economic studies* 70.2 (2003), 317-341.

Mincer, Jacob. "Human capital and economic growth." National Bureau of Economic Research, Working Paper No. 803. (1981).

Mitra, Arup, Chandan Sharma, and Marie-Ange Véganzonès-Varoudakis. "Estimating impact of infrastructure on productivity and efficiency of Indian manufacturing." *Applied Economics Letters* 19.8 (2012), 779-783.

Muralidharan, T., Bino Paul, and Ashutosh Murti. "Should real wages of workers go up in Indian manufacturing." *Economic and Political Weekly* 49.30 (2014), 153-162.

Nagaraj, Rayaprolu. "Fall in organised manufacturing employment: A brief note." *Economic and Political Weekly* (2004), 3387-3390.

OECD. "OECD Economic Surveys India." November 2014. 18 December 2018.

Olley, G. Steven, and Ariel Pakes. *The dynamics of productivity in the telecommunications equipment industry*. No. w3977. National Bureau of Economic Research, 1992.

Pedroni, Peter. "Purchasing power parity tests in cointegrated panels." *Review of Economics and Statistics* 83.4 (2001), 727-731.

Piketty, Thomas, Capital in the Twenty-First Century, Belknap Press, 2014.

Robinson, Peter M. "Root-N-consistent semiparametric regression." *Econometrica: Journal of the Econometric Society* (1988), 931-954.

Sahu, Santosh Kumar, and Himani Sharma. "Productivity, Energy Intensity and Output: A Unit Level Analysis of the Indian Manufacturing Sector." *Journal of Quantitative Economics* 14.2 (2016), 283-300.

Satpathy, Lopamudra D., Bani Chatterjee, and Jitendra Mahakud. "Firm Characteristics and Total Factor Productivity: Evidence from Indian Manufacturing Firms." *Margin: The Journal of Applied Economic Research* 11.1 (2017), 77-98.

Sivadasan, Jagadeesh. "Barriers to competition and productivity: Evidence from India." *The BE Journal of Economic Analysis & Policy* 9.1 (2009).

Topalova, Petia, and Amit Khandelwal. "Trade liberalization and firm productivity: The case of India." *Review of economics and statistics* 93.3 (2011), 995-1009.

Virmani, Arvind, and Danish A. Hashim. "Factor employment, sources and sustainability of output growth: Analysis of Indian manufacturing." *Ministry of Finance, Government of India, Working Paper* 3 (2009), 21.

Wooldridge, Jeffrey M. "On estimating firm-level production functions using proxy variables to control for unobservables." *Economics Letters* 104.3 (2009), 112-114.

TABLE I: VARIABLES USED IN THE ANALYSIS (DATABASE: ANNUAL SURVEY OF INDUSTRIES, DURATION: 2000-2013)

	Definition
Labour Share	Share of wage in value added
Heterogeneity of Labour Share	Cost weighted variance of labour share
Capital Share	Share of factor payment capital in value added
Heterogeneity of Capital Share	Cost weighted variance of capital share
Elasticity of Substitution (labour and capital)	Ratio of proportionate change in factor intensity to proportionate change in factor prices
Elasticity of Substitution (raw material and non raw material)	Ratio of proportionate change in materials to non-raw material
Total Factor Productivity	Proportionate change in output net of proportionate change in factors of production
Software Capital Intensity	Share of expenditure on software in gross assets
ISO	International Organization for Standardization; Dummy =1 if plant has ISO certification
Multi Unit	Dummy = 1 if having plants in multiple locations
Labour Productivity	Value added per labour in natural logarithm

TABLE II: VARIABLES USED IN THE ANALYSIS (DATABASE: NATIONAL SAMPLE SURVEY 68TH ROUND, PERIOD: 2011-2012)

	Definition
Age	Age measured in number of years
Human Capital: General Education	Attained Level of Education (8 levels): Not literate, Just literate, Primary (Attainment of four years of education), Middle (Attainment of seven years of education), Secondary (Attainment of ten years of education), Higher Secondary (Attainment of twelve years of education), Graduate (Attainment of minimum three years under graduate education post higher secondary), Post Graduate (Graduate level education post attainment of university degree)
Human Capital: Technical Education	Attainment of technical education (4 levels): Non-attainment of technical education, Attainment of graduate level technical education, Attainment of diploma level technical education, Attainment of post graduate diploma level technical education
Human Capital: Vocational Training	Attainment of Vocational Training (3 levels): Non-attainment of vocational training, Attainment of formal vocational training, Attainment of informal vocational training
Size	Size of the firm (5 levels): Not known, Number of workers in the range 1-5, Number of workers in the range 6-9, Number of workers in the range 10-19, Number of workers 20 and above
Employment Relations: General Features	Nature of Employment (Dummy =1 if permanent, otherwise temporary)
Employment Relations: General Features	Full Time Employment (Dummy =1 for full time employment, otherwise part time)
Employment Relations: General Features	Membership in Union (Dummy =1 for membership otherwise no membership)
Employment Relations: General Features	Type of Employment (Dummy = 1 if job is formal, otherwise informal)
Employment Relations: Written Job Contract	4 categories: No written job contract, Written job contract (1 year and less), Written job contract (More than an year but up to 3 years), Written job contract (More than 3 years)
Employment Relations: Occupational Hierarchy	8 categories: Managerial, Professional, Technicians, Clerical, Service Professional, Craft and related works, Plant operators and Elementary Occupation (as per National Classification of Occupation, 2004)
Sex	Dummy = 1 for female; otherwise 0
Area of Residence	Dummy =1 for urban, otherwise rural
State Dummy	Codes with respect to states in India

TABLE III: PLANT CAPITAL-LABOUR SUBSTITUTION ELASTICITY (M1-M5) AND AN AUGMENTED MODEL FOR IMPORTED TECHNOLOGY (M6)

	Separate OLS	Pooled OLS	NIC FE	State FE	Bartik Instrument	Imported Technology
	M1	M2	M3	M4	M5	M6
2000	0.179	0.285	0.236	0.247	0.140	-0.134
2001	0.305	0.273	0.222	0.236	0.124	-0.155
2002	0.308	0.310	0.252	0.253	0.150	-0.120
2003	0.365	0.322	0.261	0.269	0.192	-0.081
2004	0.270	0.321	0.267	0.261	0.194	-0.046
2005	0.326	0.308	0.257	0.252	0.192	-0.071
2006	0.317	0.288	0.250	0.243	0.170	-0.087
2007	0.194	0.294	0.248	0.236	0.178	-0.085
2008	0.502	0.402	0.339	0.299	0.306	-0.004
2009	0.334	0.416	0.358	0.328	0.326	-0.002
2010	0.264	0.415	0.351	0.321	0.336	0.027
2011	0.298	0.362	0.297	0.261	0.301	0.024
2012	0.324	0.409	0.354	0.324	0.335	0.007
2013	0.260	0.358	0.298	0.268	0.294	0.012
Min	0.179	0.273	0.222	0.236	0.124	-0.155
Average	0.303	0.340	0.285	0.271	0.231	-0.051
Max	0.502	0.416	0.358	0.328	0.336	0.027

Note. Each model is weighted against frequency distribution of each NIC classification(s). The table presents six specifications. The first specification estimates a separate plant elasticity of substitution for each industry, and then averages them using cross industry weights used for aggregation. The second specification estimates a single common elasticity of substitution for the entire sector. The third specification estimates the plant elasticity of substitution using fixed effects for the NIC at two digit and the fourth specification estimates the plant elasticity of substitution using the state fixed effects. The fifth specification estimates the elasticity substitution in an IV framework, using Bartik labour demand instruments. The sixth specification estimates the plant elasticity of substitution through IV, defining imported capital. Further, all regression includes industry fixed effects, age fixed effects, multi-unit status indicator, welfare indicator and technology indicator. Standard errors are clustered at the industry level.

TABLE IV : ELASTICITY OF SUBSTITUTION BETWEEN MATERIALS AND NON-MATERIALS

	Domestic Materials (Local content)	Imported Materials (No-local content)
2000	0.082 (0.033)	0.292 (0.053)
2001	0.081 (0.032)	0.271 (0.042)
2002	0.101 (0.033)	0.293 (0.044)
2003	0.103 (0.029)	0.273 (0.043)
2004	0.109 (0.027)	0.277 (0.053)
2005	0.112 (0.030)	0.277 (0.062)
2006	0.121 (0.029)	0.243 (0.050)
2007	0.132 (0.030)	0.260 (0.049)
2008	0.151 (0.025)	0.197 (0.044)
2009	0.171 (0.017)	0.199 (0.042)
2010	0.157 (0.017)	0.198 (0.048)
2011	0.077 (0.024)	0.183 (0.053)
2012	0.125 (0.018)	0.169 (0.050)
2013	0.047 (0.026)	0.177 (0.055)
Min	0.047	0.169
Average	0.112	0.236
Max	0.171	0.293

Note. Standard errors are presented in the parentheses. Standard errors are clustered at the two-digit NIC level. All regression includes industry fixed effects, age fixed effects, multi-unit status indicator, welfare indicator and technology indicator.

TABLE V : CES PRODUCTION FUNCTION AND ELASTICITY OF SUBSTITUTION

	b_0	SE	ρ	SE	δ	SE	Elasticity	SE	R^2
Full Sample	11.821	0.007	-0.172	0.002	0.195	0.002	1.208	0.003	0.78
Agriculture	11.845	0.926	0.058	0.199	0.439	0.310	0.946	0.178	0.71
Mining	11.573	0.068	-0.170	0.021	0.241	0.021	1.205	0.031	0.68
Food Products	11.925	0.014	-0.128	0.004	0.235	0.004	1.147	0.006	0.72
Textiles	12.447	0.021	-0.343	0.010	0.057	0.003	1.522	0.023	0.74
Wood	12.173	0.032	-0.402	0.016	0.074	0.006	1.673	0.046	0.79
Pulp and Paper	12.260	0.031	-0.303	0.012	0.076	0.006	1.435	0.025	0.83
Coke and Refinery	12.824	0.072	-0.392	0.029	0.050	0.010	1.645	0.077	0.82
Chemicals	11.606	0.019	-0.111	0.005	0.272	0.006	1.124	0.006	0.82
Rubber	12.323	0.039	-0.277	0.013	0.095	0.007	1.383	0.024	0.83
Other Non-metals	10.405	0.023	-0.234	0.007	0.242	0.007	1.306	0.012	0.82
Basic Metals	12.310	0.025	-0.243	0.008	0.133	0.006	1.322	0.013	0.82
Machinery	12.487	0.025	-0.253	0.010	0.097	0.005	1.338	0.018	0.84
Electrical	12.521	0.032	-0.189	0.012	0.128	0.008	1.233	0.018	0.78
Transport	12.539	0.036	-0.335	0.015	0.063	0.006	1.504	0.034	0.86
Manufacture-recycling	12.260	0.044	-0.197	0.018	0.152	0.013	1.245	0.028	0.77
Electricity	13.045	0.097	-0.526	0.048	0.007	0.003	2.110	0.214	0.83
Construction	12.609	0.069	-0.432	0.046	0.024	0.008	1.760	0.142	0.74
Trade	12.545	0.082	-0.339	0.079	0.038	0.016	1.514	0.180	0.78
Other Services	12.761	1.406	0.040	0.388	0.227	0.448	0.961	0.358	0.41

TABLE VI: TFP GROWTH USING DIFFERENT METHODS

	OP 1996	LP 2003	WRDG 2009	ROB 2009	ACF 2015
Agriculture service activities	1.324	1.374	0.486	1.960	2.709
Basic Metals	1.248	1.279	0.339	1.875	2.675
Chemicals	1.341	1.372	0.386	1.994	2.833
Coke, Refined Petro	1.376	1.399	0.423	2.006	2.839
Construction	1.013	1.035	0.125	1.602	2.378
Electrical	1.325	1.377	0.438	1.994	2.786
Electricity, Gas	1.550	1.492	0.368	2.103	3.088
Food Products	1.277	1.313	0.387	1.904	2.690
Machinery	1.196	1.247	0.316	1.857	2.642
Manufacturing recycling	1.298	1.352	0.442	1.955	2.721
Mining and Quarrying	1.174	1.278	0.419	1.902	2.610
Other Non-Metal	1.090	1.137	0.262	1.712	2.451
Other Services	1.753	1.767	0.811	2.354	3.173
Pulp, Paper	1.101	1.131	0.205	1.717	2.505
Rubber and Plastic	1.161	1.183	0.239	1.771	2.577
Textiles	1.121	1.157	0.181	1.778	2.607
Trade	1.347	1.420	0.501	2.046	2.814
Transport Equipment	1.193	1.238	0.267	1.867	2.689
Wood and Product	1.155	1.196	0.339	1.752	2.477
Full Sample	1.252	1.288	0.349	1.888	2.685

TABLE VII: TWO-WAY FIXED EFFECTS (ROBUST SE) - TFP

	Base Model	Model with technology	Model with technology and ISO	Model with technology and multiunit	Full Model
	(1)	(2)	(3)	(4)	(5)
Labour heterogeneity	-3.135**	-3.477**	-2.451	-3.437**	-2.456
	(1.382)	(1.610)	(1.489)	(1.597)	(1.498)
Capital heterogeneity	0.346*	0.364*	0.246	0.364*	0.244
	(0.180)	(0.181)	(0.201)	(0.181)	(0.200)
Software capital intensity		2.230	2.698	2.243	2.698
		(1.668)	(1.737)	(1.672)	(1.739)
Weight for ISO			0.603		0.609
			(0.537)		(0.512)
Weight for multiunit				0.150	-0.0578
				(0.507)	(0.303)
Constant	1.887***	1.849***	1.813***	1.842***	1.816***
	(0.00119)	(0.0279)	(0.0496)	(0.0411)	(0.0590)
Observations	248	248	248	248	248
R-squared	0.005	0.022	0.067	0.023	0.067
Number of industries	19	19	19	19	19

Note. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

TABLE VIII: RESULTS OF DOLS - TFP

	Base Model	Model with technology	Model with technology and ISO	Model with technology and multiunit	Full Model
	(1)	(2)	(3)	(4)	(5)
Labour heterogeneity	-73.82***	-64.58***	-33.07***	-101.4***	-63.89***
	(6.308)	(6.313)	(4.556)	(5.441)	(4.306)
Capital heterogeneity	1.316*	1.099	0.282	1.029*	0.291
	(0.714)	(0.714)	(0.514)	(0.615)	(0.486)
Software capital intensity		-3.529	-2.582	-3.913	-2.962
		(2.927)	(2.107)	(2.523)	(1.995)
Weight for ISO			1.232***		1.125***
			(0.245)		(0.245)
Weight for multiunit				1.513*	1.244*
				(0.849)	(0.708)
Observations	160	160	160	160	160
R-squared	0.082	0.146	0.611	0.246	0.693
Number of industries	16	16	16	16	16
Test for equality					
Labour heterogeneity and capital heterogeneity		Chi2	220.23***	Jointly different to 0	
Labour heterogeneity and ISO			256.58***		
Labour heterogeneity and multiunit			223.25***		
Labour heterogeneity and software capital intensity			224.77***		

Note. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

TABLE IX: DETERMINANTS OF LABOUR HETEROGENEITY: PERCENTILES DISTRIBUTIONS

	P(1)	P(5)	P(10)	P(25)	P(50)	P(75)	P(90)	P(95)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Labour share (wage)	0.9654***	1.0370***	1.1165***	1.3371***	2.5008***	3.5978***	7.1480***	10.6787***
	(0.1511)	(0.1623)	(0.1712)	(0.1956)	(0.3625)	(0.5507)	(1.2752)	(0.8523)
Capital share	0.0000	-0.0057	-0.0076	-0.0017	-0.0605	0.0088	-0.0030	-0.6800***
	(0.0180)	(0.0195)	(0.0214)	(0.0262)	(0.0536)	(0.0790)	(0.1419)	(0.1397)
Software-capital intensity	-0.0057	-0.0285	-0.0238	-0.0332	-0.0723	-0.0499	-0.1464	-1.5080***
	(0.0135)	(0.0203)	(0.0213)	(0.0275)	(0.0580)	(0.0929)	(0.2082)	(0.4432)
Export intensity	0.00001	0.00001	0.00003	0.00005	0.0001	-0.0001	0.0001	0.0006**
	(0.00003)	(0.00003)	(0.00003)	(0.00004)	(0.00007)	(0.0002)	(0.0003)	(0.0003)
Weight for ISO	0.0098***	0.0101***	0.0097***	0.0072*	0.0116*	0.0225*	0.0760***	0.0276
	(0.0034)	(0.0035)	(0.0037)	(0.0043)	(0.0061)	(0.0129)	(0.0253)	(0.0307)
Weight for multiunit	-0.0011	0.0004	-0.0026	-0.0008	0.0082	0.0191	0.0196	0.0969
	(0.0046)	(0.0050)	(0.0063)	(0.0070)	(0.0112)	(0.0164)	(0.0567)	(0.0715)
TFP_{ACF_2015}	0.0015	0.0011	0.0011	0.0015	0.0056**	0.0096**	0.0183**	-0.0146
	(0.0010)	(0.0011)	(0.0013)	(0.0015)	(0.0022)	(0.0041)	(0.0089)	(0.0195)
Constant	-0.0065***	-0.0058**	-0.0062**	-0.0083**	-0.0217***	-0.0394***	-0.0807***	-0.0297
	(0.0024)	(0.0026)	(0.0029)	(0.0033)	(0.0050)	(0.0091)	(0.0211)	(0.0318)
Sigma_u	0.0002	0.0003	0.0005	0.0008**	0.0030***	0.0042***	0.0082***	0.0267***
	(0.0005)	(0.0004)	(0.0004)	(0.0004)	(0.0009)	(0.0014)	(0.0031)	(0.0080)
Sigma_e	0.0026***	0.0026***	0.0027***	0.0029***	0.0032***	0.0041***	0.0054***	0.0027***
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0004)	(0.0011)	(0.0008)
Observations	248	248	248	248	248	248	248	248
Number of industries	19	19	19	19	19	19	19	19

TABLE X: ESTIMATION RESULTS FOR LABOUR HETEROGENEITY, LABOUR SHARE AND LABOUR PRODUCTIVITY

	FGLS Labour heterogeneity
Labour Share	0.272***
	(0.0434)
Ln labour productivity	0.000105**
	(4.94e-05)
Constant	-0.00215***
	(0.000717)
Observations	248
Number of industries	19

Note. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

TABLE XI: DETERMINANTS OF WAGE FOR INDIAN MANUFACTURING

	Ln(Wage)
Age	0.033*** (0.005)
Age Square	-0.000*** (0.000)
Human Capital: General Education (Reference Category: Secondary Level of Education)	
Not Literate	-0.188*** (0.028)
Just Literate	-0.077*** (0.027)
Education Level Primary	-0.061** (0.024)
Education Level Middle	-0.059*** (0.021)
Education Level Higher Secondary	0.078*** (0.025)
Education Level Graduate	0.288*** (0.030)
Education Level Post Graduate	0.521*** (0.048)
Human Capital: Technical Education (Reference Category: No Technical Education)	
Technical Education Graduate Level	0.215*** (0.056)
Technical Education Diploma Level	0.100***(0.032)
Technical Education Post Graduate Diploma Level	0.201*** (0.064)
Human Capital: Vocational Training (Reference Category: No Vocational Training)	
Formal Vocational Training	0.072*** (0.026)
Informal Vocational Training	0.011 (0.017)
Size of the firm (Reference Category: 1-5 Workers)	
No. of Workers (6-9)	0.054** (0.026)
No. of Workers (10 and above)	0.137*** (0.026)
No. of Workers (20 and above)	0.129*** (0.023)
No. of Workers (not known)	0.118*** (0.033)
Employment Relation: General Features	
Nature of Employment (Permanent) (Reference Category: Temporary)	0.030** (0.015)
Full Time Employment (Reference Category: Part Time)	0.281** (0.118)
Membership in Union (Reference Category: No Membership)	0.074*** (0.017)
Type of Employment (Formal) (Reference Category: Informal Employment)	0.178*** (0.019)
Employment Relation: Written Job Contract (Reference Category: No Written Job Contract)	
Written Job Contract (1 Year and Less)	-0.054 (0.043)
Written Job Contract (In between 1-3 Years)	-0.022 (0.050)
Written Job Contract (More than 3 Years)	0.184*** (0.023)
Employment Relation: Occupational Hierarchy (Reference Category: Elementary Occupation)	
Nature of Occupation (Managerial)	0.807*** (0.050)
Nature of Occupation (Professional)	0.553*** (0.040)
Nature of Occupation (Technicians / Associate Professional)	0.456*** (0.040)
Nature of Occupation (Clerical)	0.242*** (0.033)
Nature of Occupation (Service Professional)	0.162*** (0.042)
Nature of Occupation (Craft and Related Workers)	0.116*** (0.021)
Nature of Occupation (Plant Operations)	0.174*** (0.022)
Dummy for Sex (Female)	-0.401*** (0.024)
Dummy for Area of Residence (Urban)	0.127*** (0.015)
State Dummy	Yes
Industry Dummy (NIC 2 Digit)	Yes
Social Category Dummy	Yes
Constant	5.673*** (0.149)
Observations	5,875
R-squared	0.570

Note: Robust Standard Errors in parentheses; ***p<0.01; **p<0.05. Source: Author(s) Computation based National Sample Survey 68th Round Unit Records.

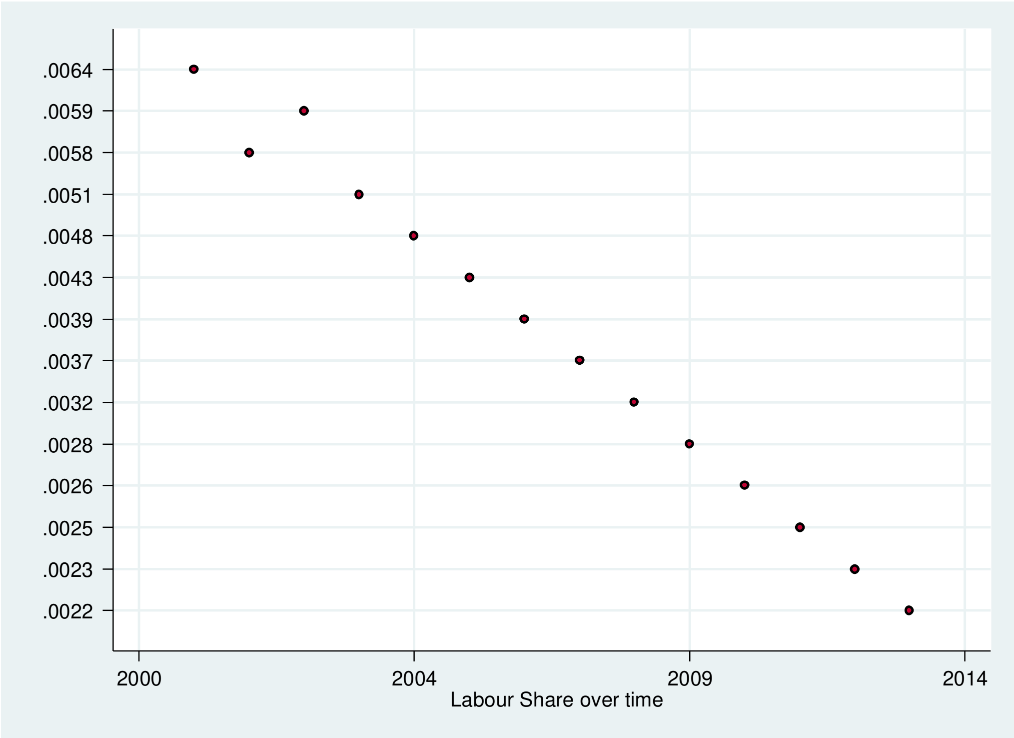

FIGURE I: Labour share over time
Source: Authors representation from ASI unit level data (various ASI rounds)

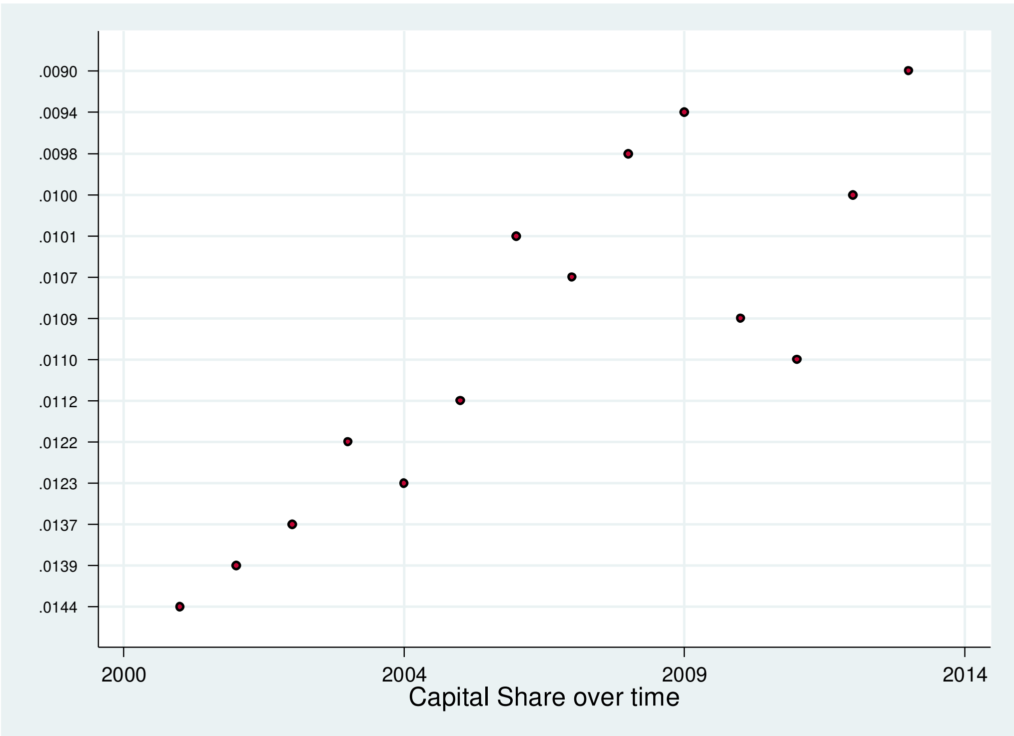

FIGURE II: Capital share over time
Source: Authors representation from ASI unit level data (various ASI rounds)

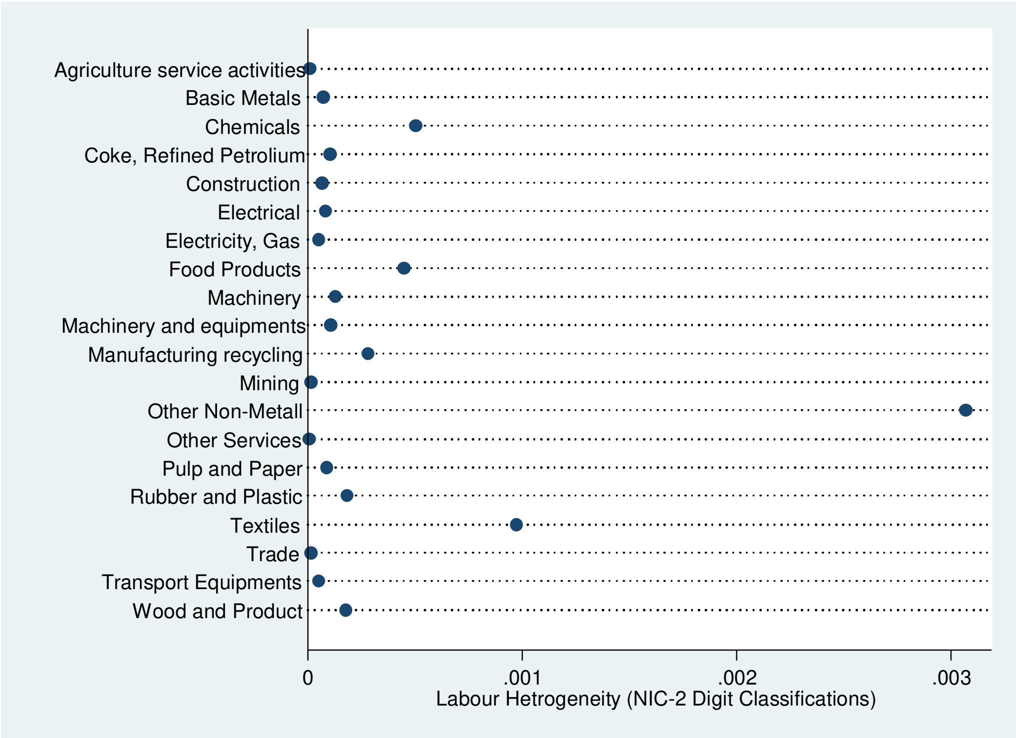

FIGURE III: Labour heterogeneity over NIC (wage) [2000-2013]
Source: Authors representation from ASI unit level data (various ASI rounds)

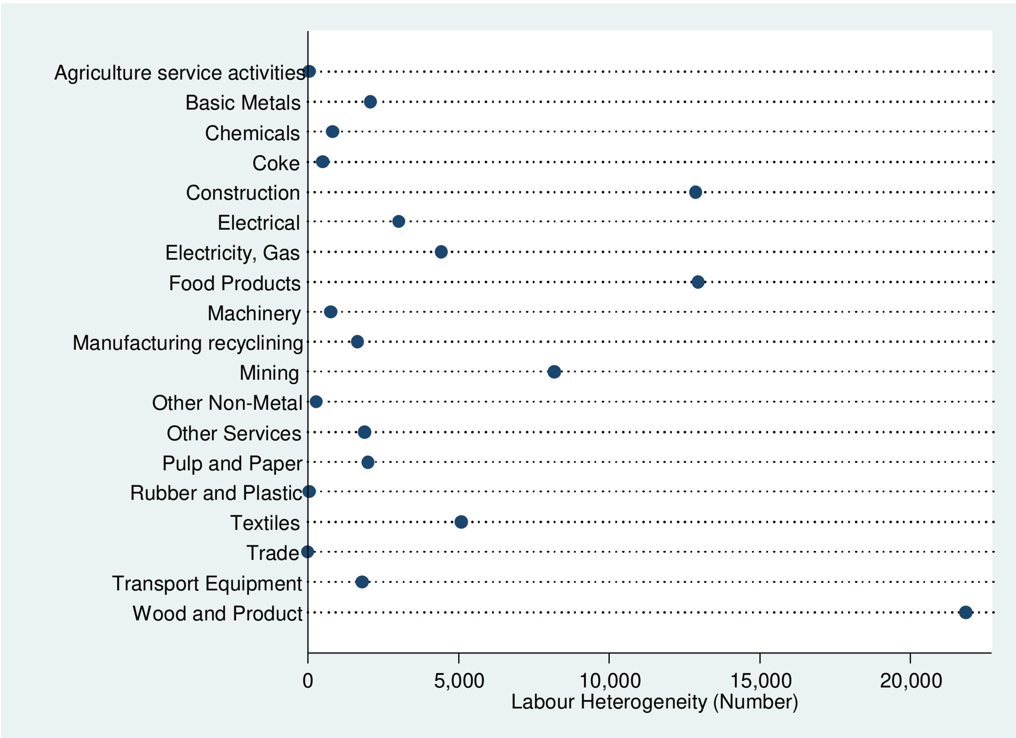

FIGURE IV: Labour heterogeneity over NIC (number of workers) [2000-2013]
Source: Authors representation from ASI unit level data (various ASI rounds)

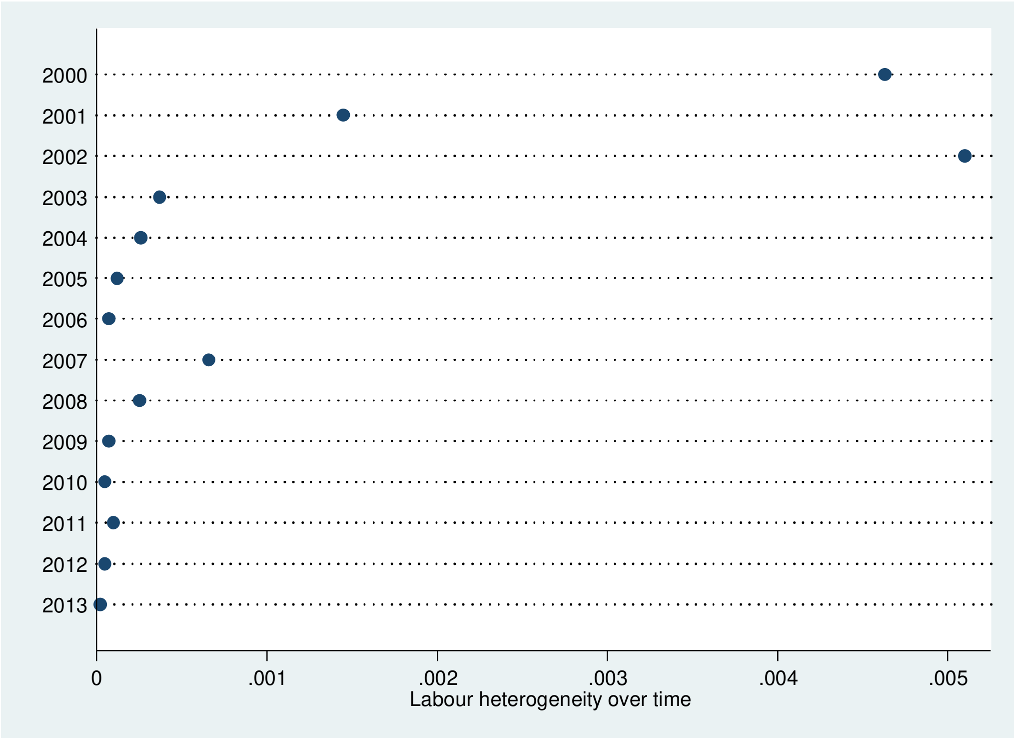

FIGURE V: Labour heterogeneity over time (wage)
Source: Authors representation from ASI unit level data (various ASI rounds)

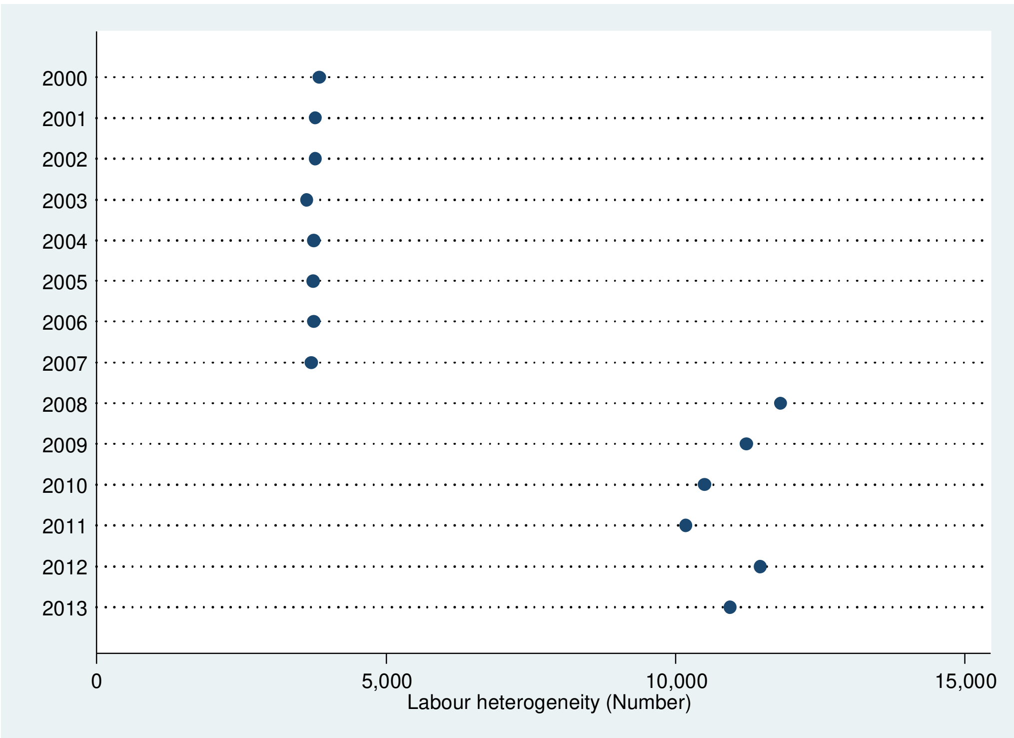

FIGURE VI: Labour heterogeneity over time (Workers)
Source: Authors representation from ASI unit level data (various ASI rounds)

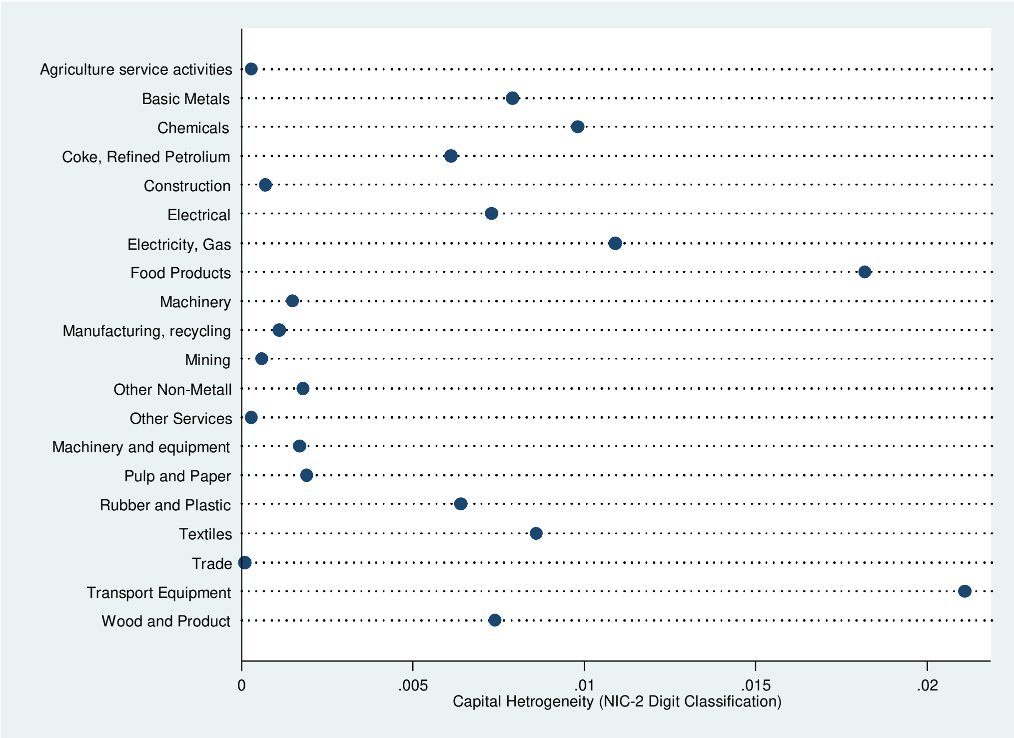

FIGURE VII: Capital heterogeneity over NIC [2000-2013]
Source: Authors representation from ASI unit level data (various ASI rounds)

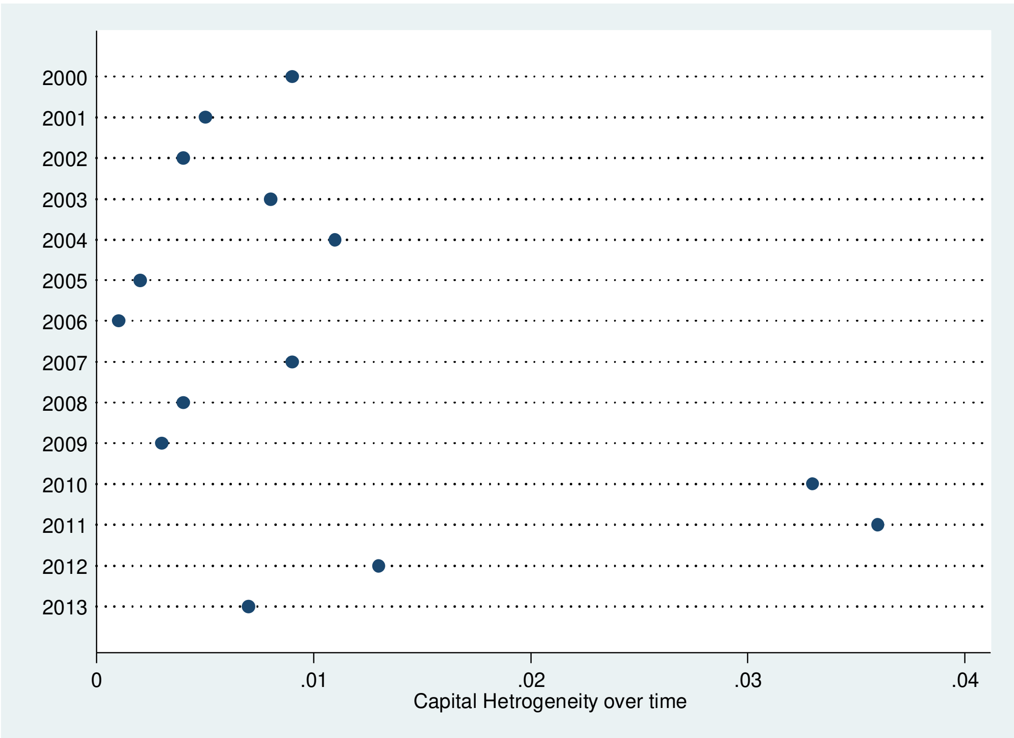

FIGURE VIII: Capital heterogeneity over time [2000-2013]
Source: Authors representation from ASI unit level data (various ASI rounds)

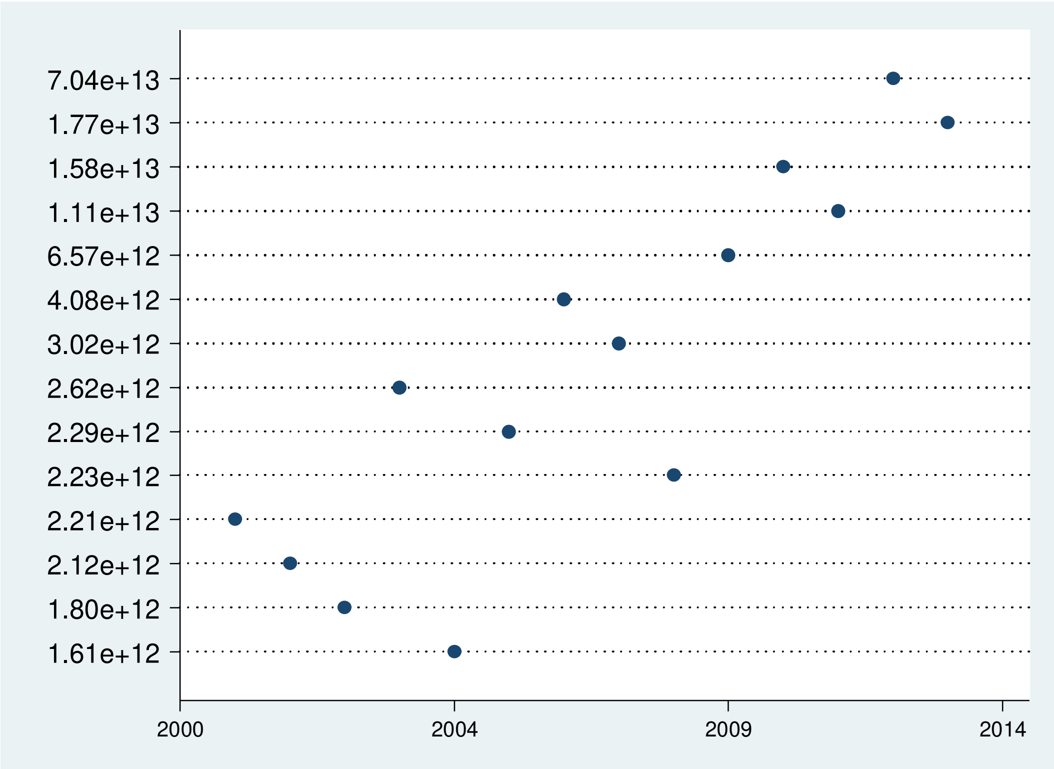

FIGURE IX: Capital-labour heterogeneity over time
Source: Authors representation from ASI unit level data (various ASI rounds)

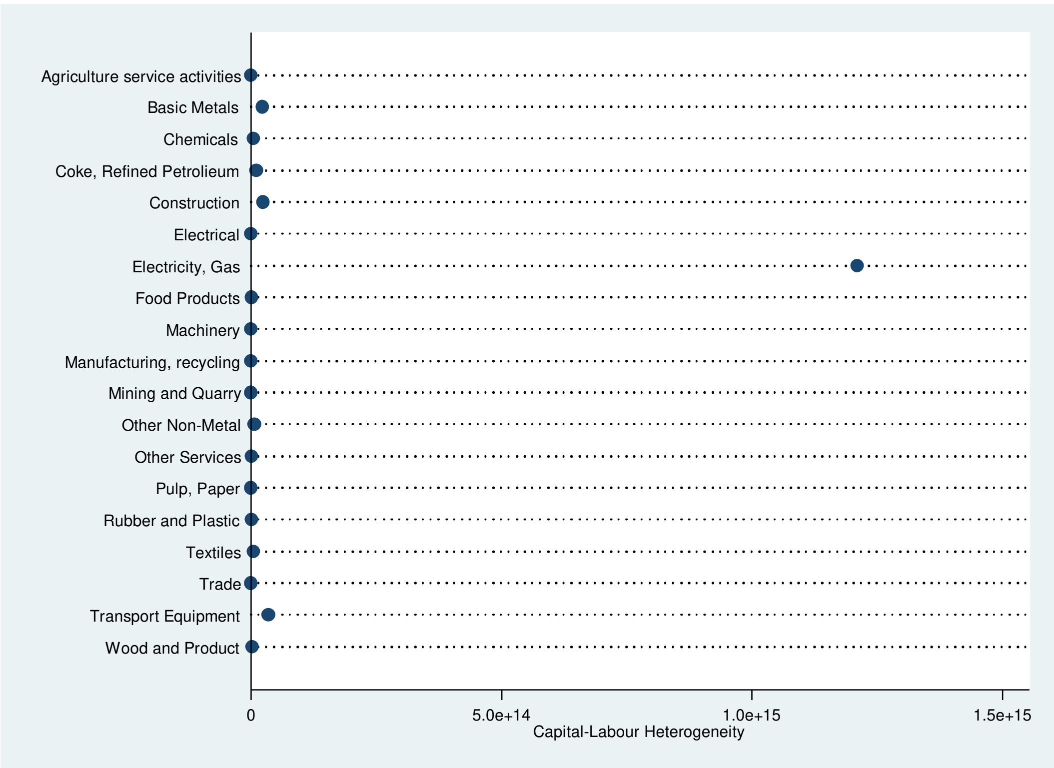

FIGURE X: Capital-labour heterogeneity by NIC
Source: Authors representation from ASI unit level data (various ASI rounds)

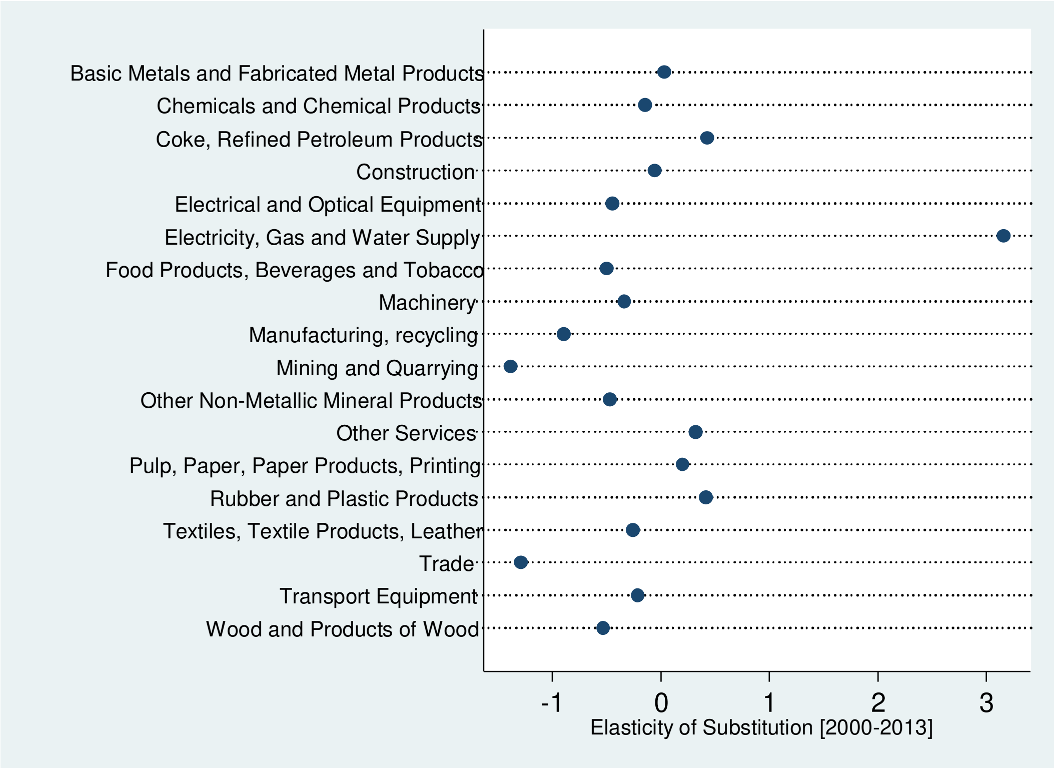

FIGURE XI: Plant elasticity of substitution by NIC
Source: Authors representation from ASI unit level data (various ASI rounds)

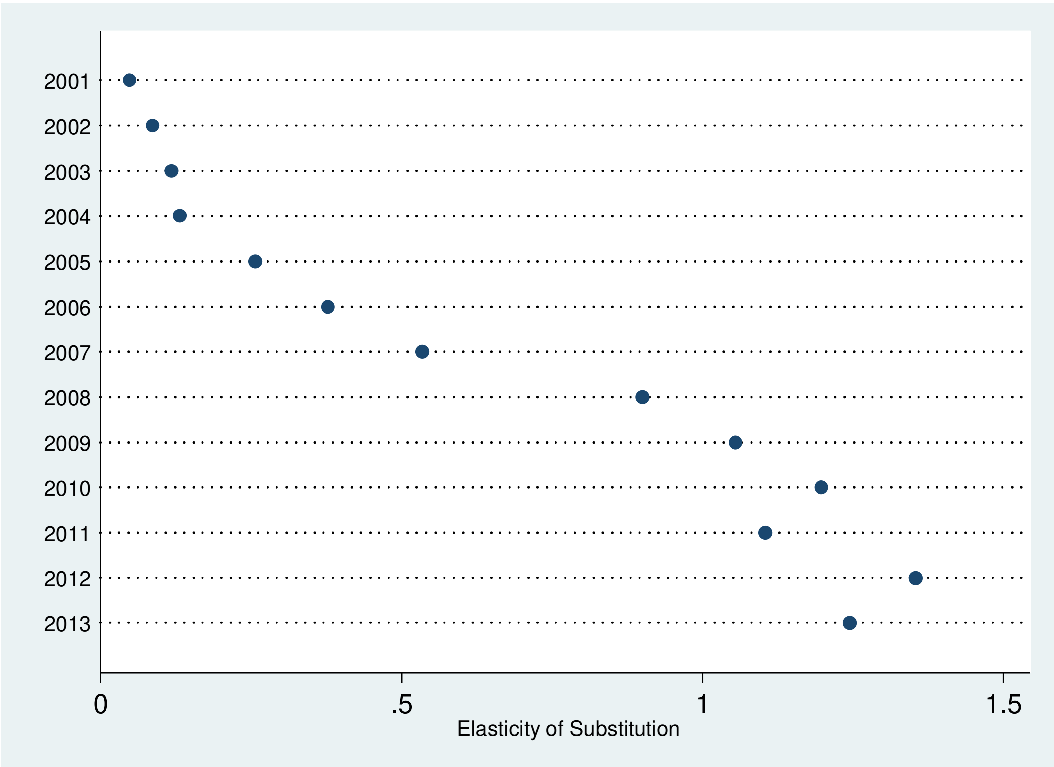

FIGURE XII: Plant elasticity of substitution by year
Source: Authors representation from ASI unit level data (various ASI rounds)

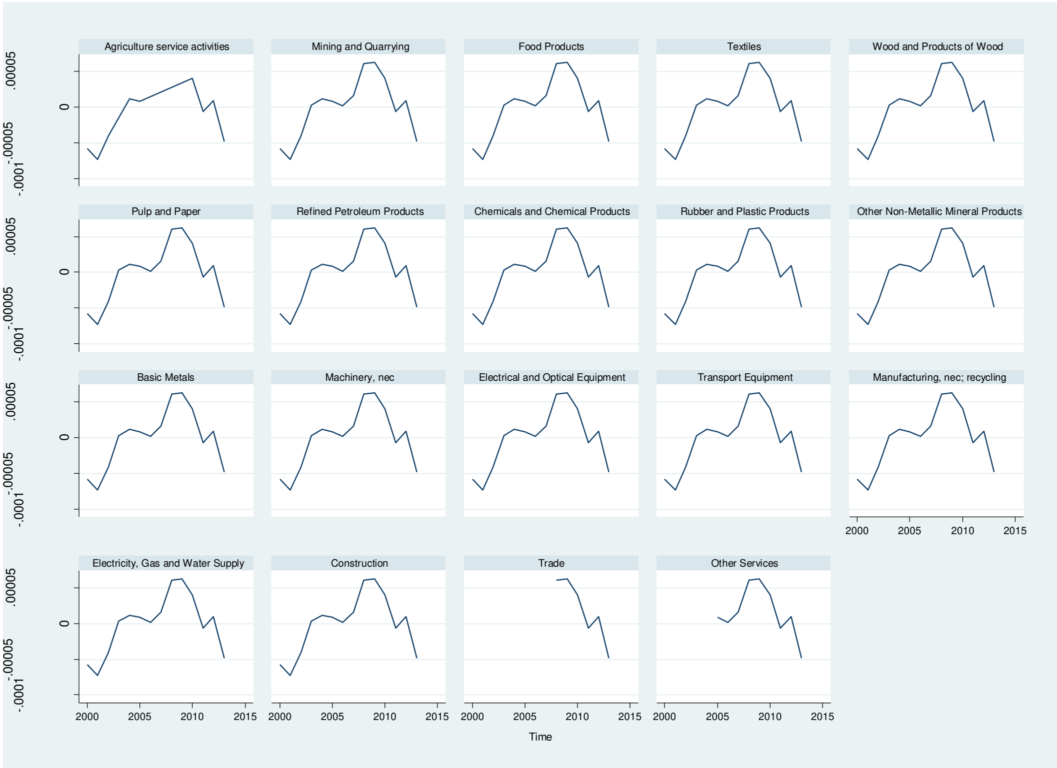

FIGURE XIII: Elasticities of substitutions by industries

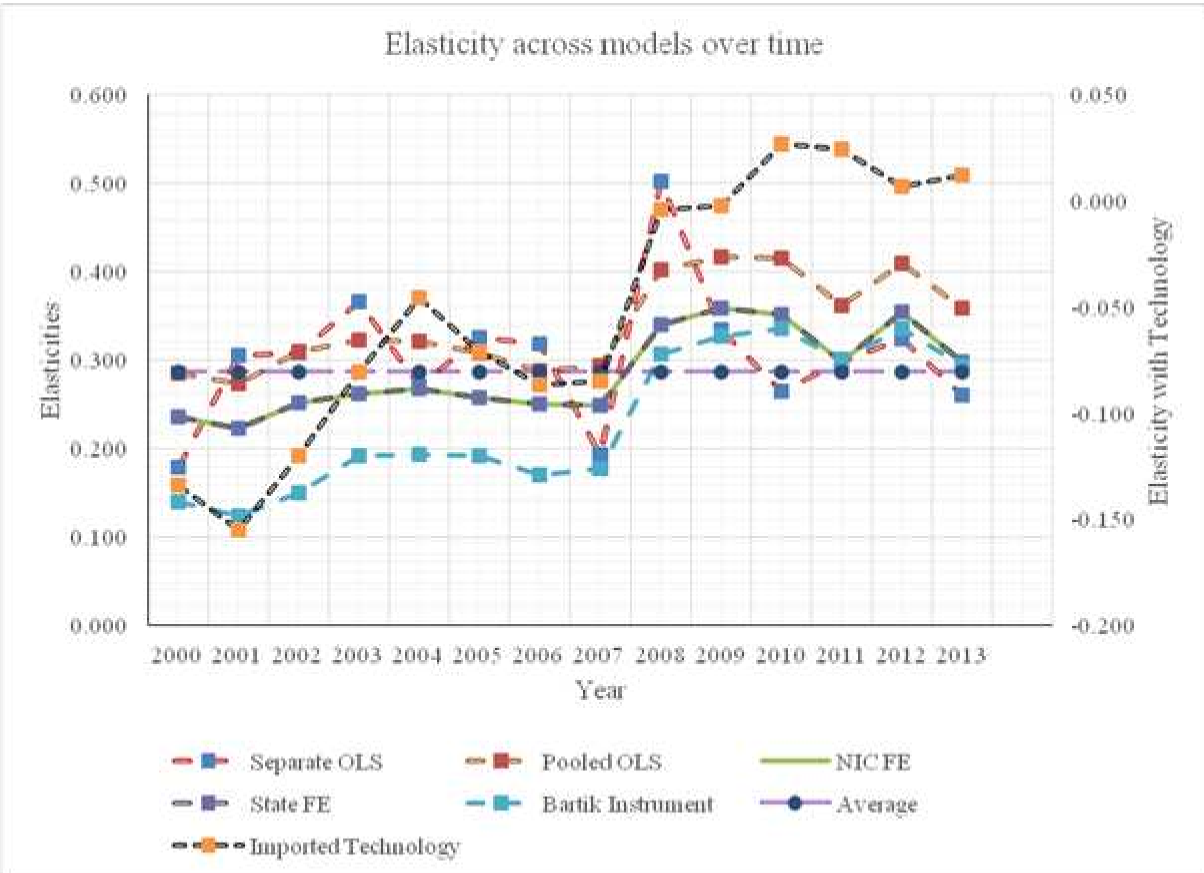

FIGURE XIV: Plant capital-labour substitution elasticity across models over time
Source: Authors calculations from ASI unit level data (various rounds)

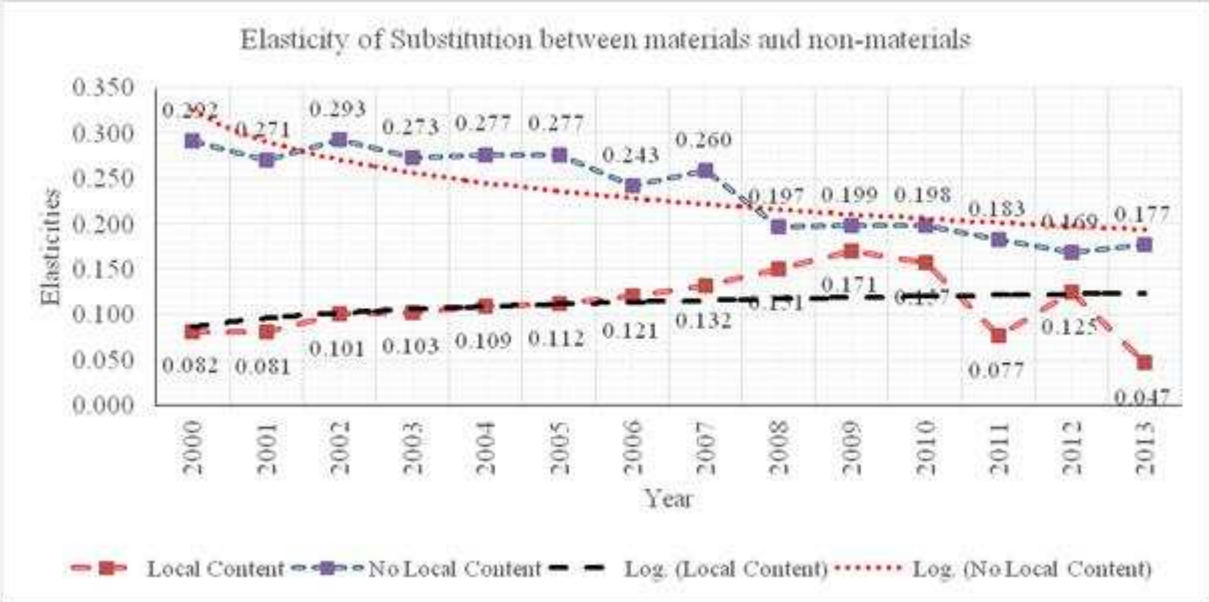

FIGURE XV:Elasticity of substitution between materials and non-materials
Source: Authors calculations from ASI unit level data (various rounds).

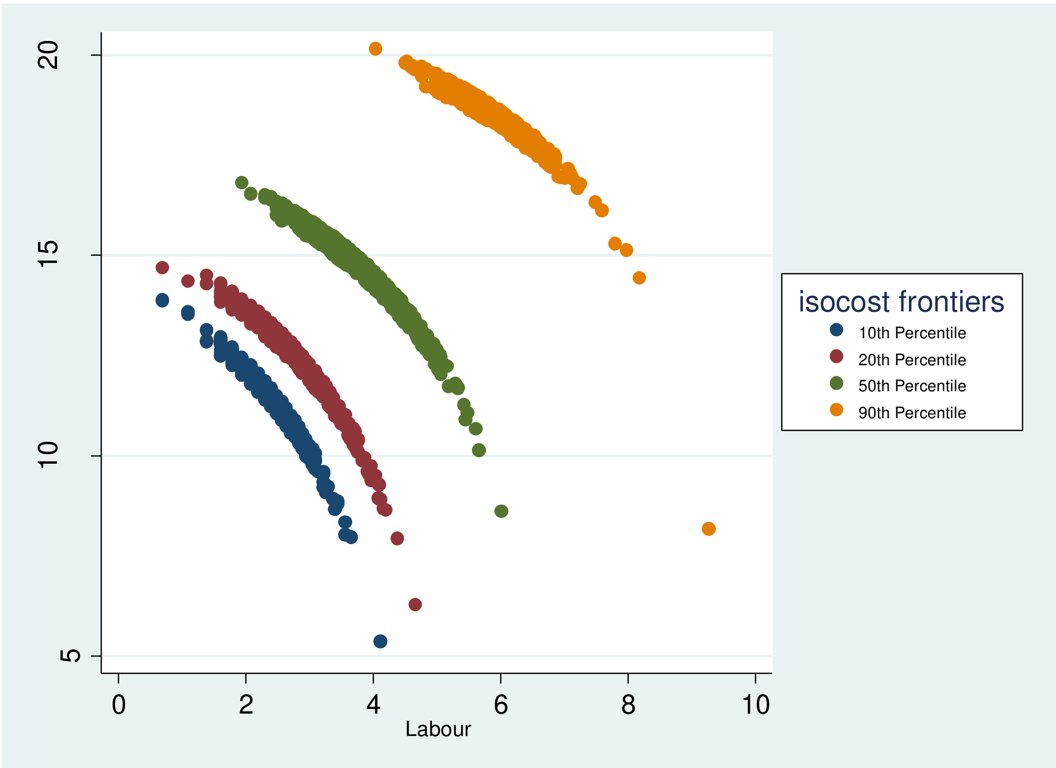

FIGURE XVI: Isocost frontiers: capital and labour

APPENDIX: TABLE A.1

OLS ROBUST STANDARD ERROR ESTIMATION - TFP

Variables	Base Model	Model with technology	Model with technology and ISO	Model with technology and multiunit	Full Model
	(1)	(2)	(3)	(4)	(5)
Labour heterogeneity	-7.982	-7.980	-6.415	-7.936	-6.451
	(30.50)	(30.23)	(22.65)	(30.41)	(22.52)
Capital heterogeneity	0.422	0.403	0.201	0.403	0.200
	(0.600)	(0.601)	(0.625)	(0.603)	(0.624)
Software capital intensity		-0.501	-0.0770	-0.495	-0.0810
		(4.538)	(4.424)	(4.574)	(4.432)
Weight for ISO			0.850***		0.855***
			(0.228)		(0.217)
Weight for multiunit				0.0661	-0.0660
				(0.437)	(0.342)
Constant	1.888***	1.897***	1.850***	1.893***	1.853***
	(0.0169)	(0.0749)	(0.0781)	(0.0784)	(0.0810)
Observations	248	248	248	248	248
R-squared	0.012	0.012	0.065	0.013	0.065
Fixed Effects	No	No	No	No	No

Note. Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1