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THE DETERMINANTS OF TECHNICAL EFFICIENCY OF LABOUR INTENSIVE MANUFACTURING FIRMS IN INDIA

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ABSTRACT

The paper examines factors that explain the technical efficiency of manufacturing firms in India using a stochastic frontier approach. The empirical analysis is based on data collected through field survey on different types of labour intensive manufacturing firms from six states in India. The study found that while technical efficiency is positively associated with experience of entrepreneur, size of the firm and export intensity of firms, it is negatively associated with constraints of doing business such as shortage of capital, lack of incentives from the government, non-availability of skilled manpower, harsh clearance and licence rules, poor infrastructure and heavy tax burden. The paper recommends the policy implication of improving the ease of doing business parameters that would enable the labour intensive manufacturing firms to enhance their technical efficiency.

Keywords: Technical efficiency, stochastic frontier, manufacturing firms, India

JEL Classification: D24, L60, O30

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1. Introduction

This paper makes an attempt of explaining the plausible determinants of technical efficiency in some of the selected labour intensive manufacturing industries in India. The issue of efficiency and productivity are critical particularly in the case of labour intensive industries in India in the wake of government's renewed focus on reviving the sector in order to create more employment opportunities. Existing studies suggest that labour intensive industries have been the prime source of employment generation in India (Trivedi et al., 2011). Industries such as textile and food (including beverages & tobacco) together accounted for about 41 per cent of jobs in the organised manufacturing sector during 2000-01 to 2008-09. The post-2004-05 data show that it is the low-productive small scale labour intensive enterprises that have generated substantial amount of employment in India (Mehrotra et al., 2014). Therefore, low value added and labour intensive industries which have high potential of employment generation, need to be given more attention and may possibly be linked to the mainstream agenda like 'Make in India' and 'Startup India' campaign by making them a critical part of the overall manufacturing policy of the country.

However, despite being the fulcrum of employment generation in India, labour intensive industries have not been given due attention and are facing numerous challenges from both financial and non-financial fronts. The sector faces many constraints like non-availability of trained skilled workers, infrastructure bottlenecks, low levels of investment, tedious labour rules and regulations, and non-competitive export orientation (Das et al., 2009). The post-reforms period (particularly 1990s) evidenced declining of total factor productivity growth of manufacturing sector (Trivedi et al., 2000; Srivastav and Sengupta, 2000; Balkrishnan et al., 2000; Ray, 2002; Chaudhuri, 2002; Goldar and Kumari, 2003; Goldar, 2004 and 2006; Das, 2004). The sector also faces a peculiar situation – while unorganised sector (largely containing labour intensive units) absorbs a whopping 85 per cent of employment but generates only 22 per cent of total output of the manufacturing sector (Mehrotra et al., 2012). Therefore, improving the productivity, efficiency and output contribution of the sector is critical.

Against the above backdrop, the present paper makes an attempt to assess the growth, employment, the constraints faced by the labour intensive sector, and finds out the possible determinants of efficiency through field survey and discussion which will help draw informed policy choices and make suitable policy suggestions.

The structure of the paper is as follows. Section 2 presents the review of literature on productivity and efficiency in manufacturing sector in general and labour intensive industries in particular, and also explores the literature on how the factors influence the productivity and efficiency. Section 3 gives the methodology and data used in the study. Section 4 covers the descriptive statistics of the survey data and empirical findings. Section 5 concludes the paper and offers policy suggestions.

2. Review of Literature

In this section we have reviewed some of the important studies on productivity and efficiency of Indian manufacturing sector in general and labour intensive sector in particular. Some of the literature (Ahluwalia, 1991; Dholakia and Dholakia, 1994; Majumdar, 1996; Rao, 1996; and Trivedi et al., 2000) found that total factor productivity growth (TFPG) had declined till 1970s and improved in mid-1980s mainly due to trade and industrial reforms. On the other hand, Balkrishnan and Puspangadan (1994) reported that improvement in TFPG during the 1980s is because of a measurement issue where studies used a single deflation method instead of double deflation method. While studies such as Krishna and Mitra (1998), Unel (2003) and Tata Services Ltd. (2003) found an acceleration of TFPG in the 1990s, other studies like Trivedi et al. (2000), Srivastav and Sengupta (2000), Balkrishnan et al. (2000), Ray (2002), Goldar and Kumari (2003), Goldar (2004, 2006), Das (2004) found contrasting results i.e., a deceleration of TFPG in the 1990s; Mitra et al., (1998), in their study estimated technical efficiency for manufacturing industries across Indian states using frontier production framework and observed decreasing trend in the technical efficiency measures during the study period. Firm level study by Parameswaran (2002) for four major industry groups found that there is a decreasing trend in the efficiency levels in all the four industries for the period 1990 to 1997. He also pointed out that the reform measures do not favour improving technical efficiency in Indian manufacturing sector.

We have reviewed here some of the studies specific to labour intensive industries. Ali (2007) examined the total factor productivity and efficiency of food processing industry in India by using the Data Envelopment Analysis (DEA) method. The study found that TFP change is negligible and the increase in output of meat processing industry is basically due to increase in input use and capital investment. In the case of efficiency, using both Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) models, it was found that the average efficiency level is about 60 per cent. Hence, the paper suggested the potential of increasing scale efficiency in meat processing units to the extent of 40 per cent.

Das et al. (2009) examined the issue of declining labour intensity in India's organised manufacturing sector and the constraints of employment generation in labour-intensive sectors. They found a continuous decline in labour intensity across all the labour intensive industries, where labour-intensity ratio for all selected labour intensive industries declined from 0.72 in 1990-91 to 0.30 in 2003-04. It also reported that the labour-intensity ratio declined not only for capital intensive industries but for labour intensive industries as well in the post-reforms period.

Dimitriu and Slavu (2010) examined economic efficiency of food, beverages, tobacco, textile, apparel, wood, paper, leather, chemical, coke, petrol, rubber and plastic, non-metallic (minerals), basic metals, machinery and equipments, transport equipments, vehicles, and Other industries. They found that average efficiency has in fact declined in many of the broad industry groups for the unorganised sector from 1994-95 to 2000-01. Hence, the study made suggestions that government intervention is required to improve the productivity and efficiency of the unorganised sector.

In a recent study Trivedi et al. (2011) measured the TFPG of manufacturing sector using both parametric and non-parametric methods. The study found that TFPG were sensitive to the methodology used. For the period 1980-81 to 2003-04, they found that TFPG for all organised manufacturing sector was 0.92 per cent per annum, which was almost half of 1.81 per cent per annum obtained through using the production function approach. They also found that the competition to export (as captured by the growth of exports) also turned out to be positively associated with TFPG of the organised manufacturing sector.

Parida and Pradhan (2016) reported that India's economy grew by 8.4 per cent between 2004-05 and 2008-09, with manufacturing sector recording an outstanding growth rate of 9.3 per cent during the same period, and also maintained nearly the same growth rate between 2009-10 and 2011-12. However, the employment growth in manufacturing sector was rather slow during the same period. To understand the reasons of slow growth of employment in manufacturing sector, the study reported that the rate of decline of labour intensity is more pronounced in the case of labour intensive industries than all the manufacturing industries, indicating that labour intensive industries are embarking upon the modern technology at a greater degree as a substitute of labour in the production process.

From the above literature we find that although most of the studies have estimated productivity and efficiency of manufacturing sector but most of those have not taken into account the determinants of efficiency of labour

intensive manufacturing sector which is important from the policy point of view. Our motivation is to understand how these factors have played a role in achieving the firm efficiency and help us draw informed policy conclusions.

In view of this background, the present study aims at estimating technical efficiency and its determinants for Indian labour intensive manufacturing firms using the stochastic frontier method. The details of stochastic frontier approach are discussed in the next section.

3. Methodology and Sample Selection

3.1 Stochastic production function and efficiency measurement

Much has been debated in the literature on measuring the efficiency and productivity (Battese and Coelli, 1992 and 1995; Coelli et al., 1998; Coelli et al., 2005). Although the terms productivity and efficiency are used interchangeably in the literature, they are conceptually different (Coelli et al., 2005). While productivity is commonly defined as a ratio of a volume measure of output to a volume measure of input used, efficiency on the other hand implies maximum amount of output achieved from a current level of technology and given a fixed amount of inputs (OECD Manual, 2001: 11). Out of the different approaches used to measure efficiency, stochastic frontier approach has found wide acceptance for both agriculture and industry sector (Battese and Coelli, 1992; Coelli and Battese, 1996) because of their consistency with theory and relative ease of estimation.

In this paper we use the stochastic frontier production function to estimate the efficiency of labour intensive manufacturing industries. We use number of workers and capital stock as independent variables and total value of output as dependent variable. To estimate capital stock the study uses the perpetual inventory method as given below.

$$K_t = (1-\delta)K_{t-1} + I_{t-1} \qquad (1)$$

Where K_t is the current year capital stock, I_{t-1} is gross investment in the previous year, δ refers to the rate of depreciation (assumed constant over time) and K_{t-1} is the previous year or initial capital stock. As suggested by Unel (2003), we use 5 per cent depreciation rate of capital. Thus, to estimate capital stock series we need variables such as (i) a time series of investment, (ii) information on the initial capital stock at the time when the investment time series starts, and (iii) information on the rate of depreciation of the existing capital stock. Out of these indicators,

information on initial capital stock is usually not available. Hall and Jones (1999) used the following formula to calculate the initial capital stock.

$$K_{t-1} = \frac{I_t}{\delta + g_{output}} \quad (2)$$

Where K_{t-1} implies the initial capital stock, I_t refers to the level of gross investment in the current period; g_{output} represents the rate of growth in output and δ is the depreciation rate. We derive capital stock by using equations (1) and (2).

In line with the model proposed by Battese and Coelli (1995), this study estimates the technical efficiency by employing the stochastic frontier production approach. Here, we have taken two independent variables – labour and capital – to estimate the CD production frontier. The estimated model is specified below.

$$Y_i = f(X_i;\beta) + \varepsilon_i \quad \text{i=1, 2,.....n} \quad (3)$$

Where Y_i denotes value of output, and X_i denotes vectors of variables such as the value of capital stock and total number of workers. Here, we use natural log for value of output, value of capital stock and total number of workers. β is vector of coefficient of production function and the error term ε_i is decomposed into two parts:

$$\varepsilon_i = V_i - U_i \quad (4)$$

Where V_i is the symmetric disturbances assumed to be identically, independently and normally distributed as $N(0,\sigma_v^2)$, given the stochastic structure of the frontier. The second component U_i is a one-sided error term that is independent of V_i and is normally distributed as $(0,\sigma_u^2)$, allowing the actual production to shortfall below the frontier but without attributing to all shortfalls in output from the frontier as inefficiency.

The industry-specific technical efficiency is defined in terms of observed output (Y_i) to the corresponding frontier output ($\overset{*}{Y}_i$) using the available technology derived, which is defined as follows:

$$TE_i = \frac{Y_i}{\overset{*}{Y}_i} = \frac{E(Y_i \mid u_i, X_i)}{E(Y_i \mid u_i = 0, X_i)} = E[\exp(-U_i)/\varepsilon_i] \quad (5)$$

TE takes values within the interval (0, 1), where 1 indicates a fully efficient industry.

The determinants of technical efficiency based on stochastic production functions are derived in the two-stage estimation procedure in which first the stochastic production function is estimated, from which efficiency

scores are derived, then in the second stage the derived efficiency scores are regressed on explanatory variables using ordinary least square (OLS) technique. The estimated model is defined as

$$TE_i = Z_i\delta \qquad (6)$$

Where Z is a vector of observable explanatory variables and δ is a vector of unknown parameters. Some of the explanatory variables used in this study are years of experience of entrepreneurs, size of the firm, shortage of capital, lack of incentives from the government, harsh clearance and license rules, poor infrastructure facilities, labour laws and regulations, lack of availability of raw materials, tax burden etc. The data on these variables are collected for some of the specific labour intensive industries across different states. The detailed sample selection method of the study is discussed below.

3.2. Sample Selection and Data

The primary survey that was conducted in 2014-15 covered five labour intensive industries based on purposive sampling method. The total sample size consisted of 320 firms across different states namely Gujarat, Haryana, Punjab, Tamil Nadu, Uttar Pradesh, and Delhi & NCR. Table 1 provides the sample size of the number of firms covered under five labour

Table 1: Types of Firms by State

State	Textile	Apparel	Footwear	Furniture	Sports goods	Total
Gujarat	33 (66.0)			30 (34.9)		63 (19.7)
Haryana	17 (34.0)					17 (5.3)
Punjab		30 (50.0)			32 (50.0)	62 (19.4)
Tamil Nadu		30 (50.0)	28 (46.7)			58 (18.1)
Uttar Pradesh			32 (53.3)	32 (37.2)	32 (50.0)	96 (30.0)
Delhi				24 (27.9)		24 (7.5)
Total	50 (100.0)	60 (100.0)	60 (100.0)	86 (100.0)	64 (100.0)	320 (100.0)

Source: Authors' calculation

intensive industries. In the case of textile industry, 33 firms from Gujarat and 17 firms from Haryana were covered. In total, 50 firms were surveyed for textile sector. For apparel sector, total 60 firms were covered and out of which, 50 per cent was covered – each from Tamil Nadu and Punjab. The sample size for footwear industry was 60, out of which, 53.3 per cent of firms were covered from Uttar Pradesh and the rest of the firms were from Tamil Nadu. In the case of furniture industry, 86 firms i.e. 30 firms from Gujarat, 32 firms from Uttar Pradesh and 24 firms from Delhi & NCR were covered. The survey covered 64 industries from sports, out of which, 50 per cent were surveyed – each from Punjab and Uttar Pradesh.

4. Data Analysis

In this section we discuss first the basic profile of each sample firm that includes firm size, types of firms, ownership, exports and turnover, employment structure, labour intensity and major constraints faced by firms in doing business etc. using the descriptive statistics. And then we use econometric tools to anlayse the factors that determine the efficiency level of the selected labour intensive manufacturing firms.

4.1. Descriptive Statistics

Basic descriptive statistics of all the selected firms are reported in Table 2. The table shows that out of the total 320 firms, maximum percentage (nearly 87 per cent) of firms are registered and the rest are unregistered. Across the firms, except furniture industry (58.14 per cent), in all other cases the percentage of registered firms is more than 90 per cent. The size of the firm has been defined into three categories by using the total turnover of the firm which varies from one category to other. The data show that sample size covers mostly small and medium firms with coverage of 50.9 and 38.1 per cent respectively. Across different industries, more than 50 per cent small firms are from apparel, footwear and furniture. The percentage of large firms is invariably less in the case of all industries. Gender-wise, the sample shows that more than 99 per cent of firms are owned by male members and the average age of owners is 50 years. An overwhelmingly 68.14 per cent of firm owners reported that they would like to expand their business in the next couple of years.

As far as employment size and its composition are concerned, the data show that on an average 117 workers were working in all sample firms at the time of survey. Average number of workers engaged in textile firms is highest (182 workers) followed by apparel firms (180) and footwear firms (168) (Table 3). The least number of workers are engaged in furniture

Table 2: Profile of Firms

Variable	Textile	Apparel	Footwear	Furniture	Sports goods	Total
Registered Firms (%)	98.00	93.33	98.33	58.14	98.44	86.56
Firm Sizes in 2014 (%)*						
- Small	34.7	54.2	58.3	62.1	42.9	50.9
- Medium	53.1	35.6	25.0	31.0	47.6	38.1
- Large	12.2	10.2	16.7	6.9	9.5	11.1
Male Owners (%)	97.96	100.0	100.0	98.84	100.0	99.37
Average Age of Owners	49.0	49.0	53.0	45.0	57.0	50.0
Plan to expand business in the next couple of years, Yes (%)	54.00	90.00	63.33	58.82	75.81	68.14

* Textile: Small (<6 crore), Medium (6-30 crore) and Large (>30 crore)
Apparel: Small (<6 crore), Medium (6-30 crore) and Large (>30 crore)
Footwear: Small (<10 crore), Medium (10-30 crore) and Large (>30 crore)
Furniture: Small (<0.5 crore), Medium (0.5-1 crore) and Large (>1 crore)
Sports goods: Small (<5 crore), Medium (5-30 crore) and Large (>30 crore)
Source: Authors' calculation

industry, which is quite obvious as this industry represents mostly small firms with low turnover and small size of workforce. In the case of workforce composition, maximum number of workers fall in the category of skilled workers (49.13 per cent) followed by helpers (28.95 per cent). The reason for higher number of helpers, as expressed by the firm owners, is that helpers are usually contractual labourers with low wages and it is easier to hire and fire contractual labourers as per the demand of the firms. Since helpers usually worked with technicians/skilled workers they gradually learned the technical work and became capable of doing the work that has been carried out by technicians/skilled workers. The survey results also show that maximum number of skilled workers are employed in apparel industry (63.15 per cent) followed by footwear industry (51.04 per cent). Further, while textile industry hires maximum number of helpers (45.92 per cent), apparel industry on the other hand hires least number of helpers accounting to only 19.17 per cent.

To understand the depth of labour intensity of each sample firm, we have calculated the Man-Machine ratio which explains the number of labourers engaged per unit of machine. The data on compound annual

Table 3: Firm-wise Employment Composition

Variable	Textile	Apparel	Footwear	Furniture	Sports goods	Total
	Average					
Avg. number of workers engaged	182	180	168	9	107	117
	Per cent					
Managers	4.10	5.26	5.75	19.97	8.20	9.71
Technicians	6.15	8.89	9.61	7.88	5.65	7.68
Skilled workers	40.03	63.15	51.04	44.73	47.24	49.13
helpers	45.92	19.17	26.70	25.71	31.31	28.95
Other workers	3.80	3.53	6.90	1.71	6.04	4.22

Source: Authors' calculation

growth rate of employment and number of machine, and man-machine ratio for the starting and survey year of each firm are reported in Table 4.

Table 4: Man-machine ratio of Labour Intensive firms

Variable	Textile	Apparel	Footwear	Furniture	Sports goods	Total
Compounded annual growth rate of employment	7.39	12.50	9.36	10.89	6.76	9.54
Compounded annual growth rate of machine	8.26	11.68	8.81	18.20	10.43	11.89
Man-Machine ratio at starting year	4.66	1.60	3.58	2.02	3.76	3.01
Man-Machine ratio during the survey year (2014)	4.02	1.36	3.15	1.89	3.14	2.62

Source: Authors' calculation

It is found that while the compound annual growth rate of employment has increased by 9.54 per cent between the starting and the survey years for all firms, the number of machines on the other hand has increased at a higher rate by 11.89 per cent during the same period. This in turn has reduced the man-machine ratio from 3.01 during the starting year to 2.62 during the survey year. Across industries, the man-machine ratio in the starting year is relatively high in the case of textile industry (4.66) followed by sports goods (3.76), footwear (3.58), furniture (2.02) and apparel (1.60). But it has declined considerably between the two data points in the case of textile and sports goods industries as compared to other labour intensive industries.

Besides the employment situation, the study also analyses the output/ turnover and export performance of various firms over a short period of time. It is found that total turnover has increased in all labour intensive industries during 2012-13 and 2013-14 (Table 5). In the case of exports, the percentage of exports to total turnover has increased continuously only for two industries i.e. textile and apparel. In the case of footwear and sports goods industries, exports as percentage of total turnover has increased marginally during 2012-13 but declined during 2013-14. In contrast, total exports as percentage of total turnover has declined during 2012-13 and then remains at the same level during 2013-14 for furniture industry.

Table 5: Total Turnover and Export of Labour Intensive Firms

Variable	Textile	Apparel	Footwear	Furniture	Sports goods	Total
	Average					
Total turnover in 2014 (Lakh Rs.)	1510.0	1460.0	1890.0	39.8	1220.0	1220.0
Total turnover in 2013 (Lakh Rs.)	1310.0	1050.0	1670.0	36.2	984.0	998.0
Total turnover in 2012 (Lakh Rs.)	1250.0	994.0	1420.0	35.5	920.0	902.0
Exports as per cent of turnover in 2014	58.78	88.25	61.67	50.00	54.17	63.94
Exports as per cent of turnover in 2013	34.67	85.11	62.44	50.00	54.66	62.43
Exports as per cent of turnover in 2012	26.50	80.02	61.39	55.00	52.45	60.38

Source: Authors' calculation

In line with the existing studies, the present study also tries to capture various constraints (financial and non-financial) faced by the labour intensive firms in doing business in India. It is important to highlight those here as they play a major role in determining the growth of productivity and efficiency of each firm. Since the impact of each factor is not uniform across all firms due to variation of size of the firm and types of activities, it is necessary to analyse the responses of each firm across the selected labour intensive industries. It is found that around 82 per cent of firms reported lack of skilled manpower availability as the major constraints in textile industry (Table 6). The other two major constraints faced by textile industry are lack of incentive from the government and heavy tax burden. For apparel industry, the major constraints are lack of skilled manpower availability, poor infrastructure facility and heavy tax burden. In the case of footwear industry, shortage of capital, harsh clearance and license rules and heavy tax burden are the major hindrances in doing business. For furniture industry, problems reported are lack of incentives from the government (tax concession, financial support etc.), heavy tax burden and

Table 6: Perception of Firms on Major Constraints faced in doing Business (%)

Constraints	Textile	Apparel	Footwear	Furniture	Sports goods
Shortage of capital (Money)	46.00	41.67	76.67	44.19	20.31
Lack of incentives from the government (tax concession, financial support etc.)	60.00	46.67	75.00	74.42	48.44
Lack of skilled manpower availability	82.00	93.33	56.67	59.30	76.56
Harsh clearance and license rules	30.00	51.67	66.67	34.88	18.75
Poor infrastructure facilities (including electricity)	42.00	68.33	35.00	47.67	93.75
Labour Laws and Regulations	42.00	45.00	38.33	38.37	42.36
Lack of availability of raw materials	32.00	30.00	61.67	40.70	45.31
Heavy tax burden	58.00	60.00	66.67	80.23	40.63

Source: Authors' calculation

lack of skilled manpower availability. Sports goods industry reported poor infrastructure facilities and lack of skilled manpower availability as two major problems. Other problems that affect the businesses of sports goods industry to a great extent are lack of incentives from the government, stringent labour laws and regulations, and heavy tax burden etc.

Overall, the survey results point to the fact that maximum number of firms fall under small size category and owned by male members. In terms of performance, the average turnover of selected firms has improved over the years. Export as percentage of turnover has also registered a positive growth but only in the case of textile and apparel industries. In the case of problems faced by firms in doing business, majority of them reported that lack of availability of skilled manpower, lack of subsidies/tax incentives from the government, heavy tax burden, and poor infrastructure facilities are factors that affect business and their performance. In order to capture the impact of these factors on efficiency of firms, in the next sub-section we analyse the determinants of efficiency empirically.

4.5. Econometric Analysis

In this section, first, we estimate the parameters of Cobb-Douglas (CD) production function using stochastic frontier method. Then we predict the technical efficiency of firms from the selected five industry groups. And finally, we estimate the determinants of technical efficiency using ordinary least square (OLS) method. Table 7 reports the results of estimated production function. The results show that elasticities of both labour and capital are positive and statistically significant at 1 per cent level. But the elasticity of labour is found more than the elasticity of capital. Hence, it suggests that labour plays a major role than capital in the production process of the labour intensive firms. In the next step, we predict the technical efficiency

Table 7: Estimated Production Function

Variables	Coef.	Std. Err.
Dependent variable: *ln (output)*		
ln (Number of labour employed)	0.927***	0.051
ln(capital stock)	0.166***	0.032
Constant	11.739***	0.447
Number of observations		270
Wald chi2(2)		1050.30***

Note: *** significant at 1% level
Source: Authors' calculation

parameters of each industry from the estimated production function. Table 8 presents the results of mean technical efficiency of each industry. Technical efficiency shows that maximum possible output can be produced with a given amount of inputs. We find that sport goods and apparel industries are more technically efficient and furniture industry is least technically efficient. The average technical level of all industries is 57.7 per cent.

Table 8: Technical Efficiency by Enterprises

Types of enterprises	Technical efficiency
Textile	0.556
Apparel	0.584
Footwear	0.550
Furniture	0.509
Sports goods	0.672
Total	0.577

Source: Authors' calculation

In the final step, using the derived efficiency parameter of the selected industries, the study estimates the efficiency equation as a function of certain explanatory variables. Table 9 shows the results of determinants of technical efficiency of the selected manufacturing firms.

Table 9: Determinants of Technical Efficiency

Variables	Coef.	Std. Err.
Dependent variable: *Technical efficiency*		
ln (Age of entrepreneur)	0.053***	0.021
ln (Size of the firm)	0.034*	0.020
Shortage of capital (Money)	-0.044***	0.015
Lack of incentives from the government (tax concession, financial support etc.)	-0.030*	0.016
Lack of skilled manpower availability	-0.033**	0.015
Harsh clearance and license rules	-0.035**	0.014
Poor infrastructure facilities (including electricity)	-0.031**	0.014
Stringent Labour Laws and Regulations	0.006	0.015
Lack of availability of raw materials	0.019	0.015
Heavy tax burden	-0.029**	0.015
Total exports (as % of total turnover)	0.001***	0.000
Constant	0.454***	0.082
Number of observations		270
F-statistic		7.25***

Note: *** significant at 1% level, ** significant at 5% level and * significant at 10% level.
Source: Authors' calculation

We found that the variable 'older entrepreneurs' is statistically significant and it has positive impact on technical efficiency of labour intensive firms. Other important factors that have positive impact on technical efficiency are size of the firm and higher exports share in total turnover. Our results support the findings of the previous studies that the higher the size of firm, the more is the efficient allocation of resources (Jovanovic, 1982; Malerba, 1992). The results of this study also support the findings of the previous studies that an exporting firm is more efficient than a non-exporting firm (Díaz-Mayans and Rosario, 2014). The reason could be that large firms or firms that are export oriented are usually equipped with better knowledge and technology and invest more in R&D, which in turn help them in using the given resource more efficiently. The estimated results also show that there are certain constraints that affect the technical efficiency of firms. These are shortage of capital, harsh clearance and regulation system, heavy tax burden, poor infrastructure facilities and lack of skilled manpower availability. Therefore, in order to improve the efficiency level of labour intensive firms, there is a need for providing a better regulation and financial framework to the labour intensive industries in India.

5. Conclusions

This paper examines the determinants of technical efficiency in the labour intensive manufacturing firms in India using the field survey data. The survey includes five labour intensive industries – textile, apparel, footwear, furniture and sports goods – with total sample size of 320 firms based on purposive sampling techniques. The study used stochastic frontier analysis to compute the technical efficiency and then tried to find out the impact of various factors that influence the efficiency scores of individual firm by using the OLS technique.

The survey results suggest that most of the labour intensive firms are small in size and nearly 99 per cent of the firms are owned by male members. The man-machine ratio which indicates labour or capital intensity position of a firm has declined for all cases, thereby suggesting that labour intensive firms are probably using more capital intensive technology over the period. All the labour intensive firms have reported that the share of exports is more than 50 per cent of their total turnover during 2014-15 and it has increased over the previous periods especially in the case of textile and apparel. Labour intensive industries use exports as the means of their growth model due to comparative cost advantages. Lack of skilled manpower availability, shortage of capital, harsh clearance and regulation, heavy tax burden and poor infrastructure facilities are some of the major

constraints faced by all labour intensive industries. The econometric results of the study suggests that factors like size of the firm, experience of firm owner and exports contribution are some of the important factors that positively influence the technical efficiency of the firm. On the other hand, major constraints like poor infrastructure facilities, lack of skill manpower availability, heavy tax burden and lack of incentives from the government are found negatively impacting the technical efficiency of the firm. As suggested by the firm owners, a cohesive and business friendly tax regime and good infrastructure facilities will encourage the industry to grow and eventually help improve the productivity and efficiency of the industry.

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