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Factors affecting Total Factor Productivity: Firm-level Evidence from Manufacturing Sector of Bangladesh

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Abstract

Firms' productivity is vital for economic growth as it allows firms to produce output more efficiently. In other words, the rise in firms' productivity ensures a higher amount of output with the same level of inputs. For a country like Bangladesh, the manufacturing sector is very crucial to achieve a sustainable economic growth in the near future. Keeping this in mind, the current paper aims to explore the factors affecting the productivity of manufacturing firms. We have used the data from World Bank Enterprise Survey for our study. The objective of this paper is to examine the determinants of the firm-level total factor productivity of manufacturing firms. In addition, we have also explored the effects of adoption of ICT, export orientation and several institutional variables on total factor productivity. We have found that firm size, output share of the respective firms and managerial experiences positively affect firm-level TFP (total factor productivity). We have also discerned that both adoption of ICT and increase in the export intensity surges the productivity of manufacturing firms. Lastly, from a close inspection of several institutional variables, we have concluded that access to finance and lack of electricity affect firm-level TFP adversely.

JEL Codes: D24, L60, O4, O14, O1, F10

Keywords: Total Factor Productivity, Manufacturing Firm, Information and Communication Technology, Export Intensity, Major Obstacles to Firms.

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1.0 Introduction

According to the endogenous growth theory, economic growth mainly emanates from factor accumulation and factor productivity. There is no denying the fact that one of the main sources of economic growth is the rise in productivity. Increases in productivity allow firms to produce a greater quantity of output with the same level of inputs and thus lead to a higher growth. Generally, productivity could mean labor productivity, which denotes output per worker per unit of time. However, for the current study, we have emphasized more on total factor productivity. At the firm level, total factor productivity growth demonstrates that firms use their resources efficiently and thereby lead to lower cost of production. As a result, firms are able to remain competitive by lowering the price of its product and at the same time maximizing their profit. Hence, firms' productivity is an important indicator of firms' performance both at local and foreign level.

The manufacturing sector of Bangladesh contributes almost 18% of the GDP and it alone employs 15% of the total employment of the country (2013)[1]. The value of export of manufacturing sector has increased to US$ 25947 million in 2013[2] which used to be US$ 6085 million in 2003. In addition, the share of manufacturing export in total export has become more than 85% in recent years. Hence, the manufacturing sector is crucial for the country to achieve a sustainable economic growth. Moreover, if any firm wants to get success in penetrating the international market, it has to remain efficient to achieve a competitive edge over its rival firms. This has led to a surge in the field of studies aimed at explaining firm-level productivity focusing on the manufacturing sector of Bangladesh.

A number of studies have confirmed that several characteristics of firms such as firm size, age, managerial experience, output share of firms etc. do affect firm-level productivity. In addition, numerous other factors may also affect the productivity of manufacturing firms. One such important factor is ICT (Information and Communications Technology). Most economic theories advocate that with the adoption of ICT, firms experience a fall in cost. In addition, it improves both quantity and quality of the production process thereby raising the productivity. Many studies have recognized ICT to be a key source of productivity growth of firms including SMEs (Rahman and Chowdhury 2016). Moreover, export market orientation may also affect firms' productivity

[1] World Development Indicators, World Bank (2015).

[2] According to estimates provided by Export Promotion Bureau, Ministry of Commerce and Statistics Department, Bangladesh Bank

positively. This is due to the fact that entering the foreign market can create scopes for firms to transfer new knowledge and technologies, which may lead to higher productivity. Literature also endorsed that several institutional constraints may affect firms' productivity adversely.

Against this backdrop, this paper has explored the possible factors that may affect firm-level productivity by concentrating on the manufacturing firms of Bangladesh. In particular, this paper aims to address the following set of research questions: (1) What characteristics of firm determine the productivity of manufacturing firms? (2) Do ICT adoption (Information and Communications Technology) and export intensity lead to higher productivity of manufacturing firms? (3) Do institutional constraints affect the productivity of manufacturing firms adversely?

To address the above-stated research questions, we have organized the rest of the paper as follows: Section II contains the review of literature in this arena; Section III discusses the data and methodology; Section IV contains the results of bivariate and multivariate econometric analysis, and finally, Section V suggests the conclusion and policy implications.

2.0 Literature Review

Firm-level productivity has been a major issue in the field of research related to international economics. With the rise in global trade, understanding productivity at the firm-level has gained much attention. There is a number of empirical studies determining the factors affecting firm-level productivity. Those studies focused on several factors affecting productivity i.e. financial constraint, firm size, the age of firms, ownership, management skill, business environment, corporate governance, export behavior, innovative activities, and so on.

Several empirical studies proved that larger firms are more productive, especially in case of manufacturing firms. Using survey data of manufacturing firms in Bangladesh, Fernandes (2010) found that firm size and total factor productivity have negative association while firm age and total factor productivity showed U-shaped relationship. In case of Canada, Baldwin (1997) found that large manufacturing firms are more productive than the small firms, as the former are more inclined to invest in R&D (Research & Development) and innovative activities. There also exists quite a number of empirical evidence which ensured that the use of Information and Communications Technology (ICT) are positively related to total factor productivity (Cardona et al. 2013).

A study by Beck et al. (2005) confirmed that financial constraints or obstacles have a detrimental effect on firm's growth and as well as on productivity. Kaldor (1970) put forward the traditional export-led-growth hypothesis. The hypothesis claims that additional external demand would allow firms to reap economies of scale and thus lead to higher productivity. In another study by Loecker (2007) provided evidence in favor of learning by exporting hypothesis using a firm-level data of manufacturing sector of Slovenia. He found a strong and significant causality between firms' productivity and participation in the export market. Coe and Helpman (1995), Eaton and Kortum (1997), and Keller (2004) using country and industry-level data found support to the hypothesis of achieving productivity growth through the export promotion. These studies argued that trade with foreign countries increases the exchange of technology and knowledge, which in turn resulted in higher productivity. In another study by Castellani (2002), it has been claimed that there exists a strong positive association between productivity and export intensity. It was quite evident from a study by Delgado et al. (2002) that exporting firms are more productive than the non-exporting firms. They also claimed that the presence of self-selection bias where more productive firms are more likely to enter the export market. However, they provided evidence in favor of the learning-by-exporting hypothesis only in the case of younger firms.

However, quite a number of studies have also found no evidence in the favor of the positive effect of exporting activities on productivity. Bernard and Jensen (1999) confirmed that the effect of export on productivity for American firms is ambiguous. Hung et al. (2004) carried out a similar kind of study and confirmed that export orientation may not necessarily stimulate productivity in the case of United States. Fu (2004), based on a panel data of manufacturing firms of China found no significant impact of export intensity on firms' productivity.

On the other hand, Kunt and Maksimovic (2002), from firm-level data of 74 countries, showed that financial and legal obstacles could adversely affect firm's growth and productivity. It is also evident that infrastructure facilities such as power supply also play a pivotal role in enhancing the productivity of firms in many developing countries (World Bank 1994).

For the case of Bangladesh economy, a very few studies have been carried out which were done on a small sample size. Moreover, they did not opt for comprehensive econometrics analysis. In this regard, the present study is based on a large sample size of manufacturing firms of Bangladesh. As far as the empirical analysis is concerned, we have controlled for the industry fixed effects with LSDV (Least Square Dummy Variable) estimator while estimating the regression coefficients. In addition, we came out with a set of determinants of productivity that have not been investigated in the previous studies.

3.0 Methodology

This paper attempts to determine the factors affecting total factor productivity of manufacturing firms of Bangladesh using firm-level data. For this purpose, we have to estimate firms' productivity index. Since all of our analysis is dependent on this index, the estimation of firms' productivity must have to be robust. Following the several literatures, for example, the study of Mengistae and Pattillo (2002), we have estimated the productivity by the technology parameter of the Cobb-Douglas production function as described in the following.

To estimate the productivity index, we assume that the production technology of firms can be represented by Cobb-Douglas production function.

$$\log of\ Y_i = \alpha_i + \beta_L \log of\ L_i + \beta_K \log of\ K_i + \varepsilon_i$$

Here Y_i is the output of firm 'i' which is measured as firm's total sales in a particular year, whereas, L_i and K_i represents the labor and capital inputs respectively of the corresponding firm. 'ε_i' is an idiosyncratic error which is not correlated with the factors of production (i.e. labor, capital) and assumed to be distributed normally with zero mean and constant variance. The parameter α_i represents total factor productivity. We also assume that α_i is firm-specific and not correlated with factor inputs. We have estimated this firm-specific factor and use this as an index to capture firm's productivity. As we have assumed that α_i is not correlated with the factor inputs, the estimation of the above regression is simple. However, some industry-specific factors may affect firms' productivity as well as be correlated with factor inputs. This could result in biased estimation of the parameters of the regression model. To overcome this, we have included industry dummies to control for the industry-specific factors.

For the analyses and estimation purposes, we have used the dataset of "*The World Bank, Enterprise Survey-Bangladesh" for 2007 and 2013.* It is worth mentioning that we have classified the firms under the survey into several industries. Table 1 shows the industry classification. From the estimated regressions, we got the estimated value of 'β_L' and 'β_K', which represent the output elasticity of labor and capital respectively. Then we have estimated the total factor productivity index by the Solow residuals. It is important to note that the estimation of firm-level total factor productivity by Solow residuals may also include labor skill and capital innovation.

Table 1: Distribution of firms in the survey by industry classification

Industry description	2007 (%)	2013 (%)
Food	18.04	13.80
Garments	19.98	16.77
Leather	19.69	8.98
Textiles	10.18	10.07
Machinery & equipment	5.92	2.20
Chemicals	12.61	9.99
Electronics/electrical	5.82	1.61
Non-metallic minerals	0.00	5.93
Other manufacturing	7.76	30.65
Total	**100.00**	**100.00**

Source: The World Bank, Enterprise Survey-Bangladesh, 2007 and 2013

Initially, we have explored the factors affecting firms' productivity. For that, we have estimated a regression model of firms' productivity with a log of firms' productivity as the dependent variable. In literature review section, we have discussed that there are several factors, which may have an influence on firms' productivity. For example, firms that are operating in the market for a longer period could have better knowledge about the market and it may help them to be more productive. Review of literature also confirmed that firm size is an important determinant of firms' productivity. We have used the total number of employees including the top managers to measure the firm size. Again, we have included the experience of top managers in the regression model, as they are mainly responsible for production decisions. We can argue that firms with more experienced managers are more productive. Firms with larger output share in the industry may have better access to resources and production technology, which in turn might result in higher productivity. In this context, we have included output share of the respective firm operating in the particular industry in the regression model. We have included an ICT dummy to determine the effect of ICT on firms' productivity. The ICT dummy is equal to '1' if the respective firm has an internet connection and '0' otherwise.

To assess how export orientation affects firms' productivity, we have included an export orientation dummy in the model. Earlier literature endorsed that there may be simultaneity between export orientation and firms' productivity. More specifically, it implies that while export orientation may affect the productivity of the respective firms, firms' productivity level could also influence export orientation. The first one relates to the notion of 'learning by exporting' hypothesis. This suggests that after entering the export market, firms are able to

acquire new knowledge and adopt new expertise. Thereby, eventually leading to higher level of productivity. Again, the second one relates to the fact that more productive firms are more likely to participate in export markets. Most of the literature defined this phenomenon as 'self-selection' of the more productive firms. This implies that we have to think of a simultaneous equation model as described in the following.

$$productivity_i = \alpha + \beta\, export\_orientation_i + \gamma\, Z_i ----(1)$$
$$export\_orientation_i = \theta + \delta\, productivity_i + \vartheta X_i ----(2)$$

Here Z_i and X_i represents other exogenous factors that affect firms' productivity and export orientation respectively. In such cases, we cannot estimate equation 1 directly without considering equation 2. Although, there is sufficient evidence that exporting firms are more productive than non-exporting firms, the issue of the direction of the causality between export and productivity still remain undecided. While in the contexts of more advanced countries, most studies find evidence that the productivity gain is due to a self-selection process. A number of recent studies on less developed countries tend to endorse the learning effect. For a country like Bangladesh, it is more plausible to argue that firms first enter the export market regardless of the level of their productivity. Firms learn new skill and technique, while competing with foreign firms and become more productive. Hence, under such assumption, we can estimate equation 1 directly without taking into account the export orientation equation (equation 2). We take the log of productivity as the dependent variable while estimating equation 1 (productivity index was estimated from the Cobb-Douglas framework as described earlier). We have used a dummy to capture the export orientation of a firm. The export intensity dummy takes the value of '1' if the firm exports 25% or more of its total output and '0' otherwise. If we find the coefficient of export orientation dummy to be positive and significant, we can say that the firms with export share of 25% or more are likely to have higher productivity levels compared to that of other firms. This implies export orientation promote productivity. Other exogenous variables include firm size, firm age, the experience of top management and firm's share in total output of the industry.

Towards the end of our analysis, we tried to ascertain, how different institutional constraints affect firms' productivity. Table 2 represents the institutional variables, which firms identified as major obstacles for the year 2007 and 2013.

Table 2: Institutional constraints that are the biggest obstacles reported by the firms

Obstacles	2007 (%)	2013 (%)
Access to finance	32.23	17.77
Access to land	5.69	2.73
Business licensing and permits	0.91	0.74
Corruption	5.28	5.68
Crime, theft, and disorder	0.08	0.96
Customs and trade registration	0.66	1.77
Electricity	42.54	27.06
Labor regulations	0.00	0.66
Political instability	10.22	38.72
Tax administration	0.58	0.52
Tax rates	1.48	2.36
Transport	0.33	1.03
Total	100	100

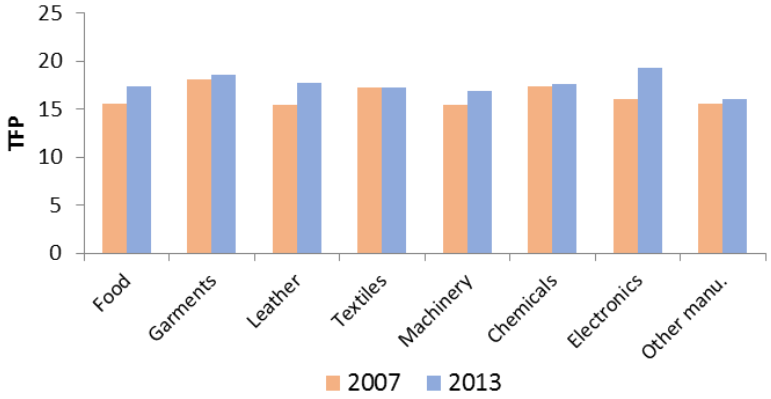
Source: The World Bank, Enterprise Survey-Bangladesh, 2007 and 2013

From Table 2 we can see that in both years the access to finance and the electricity are major obstacles as reported by the managers. It clearly shows that in 2013 both of these obstacles faced by firms under survey became less severe. However, this is may be because the political instability became a major obstacle in 2013. After political instability, access to finance and electricity still remained the biggest obstacles faced by the firms in 2013. Therefore, we have only concentrated on these two institutional constraints. To capture the access to finance constraint, we have included the 'access to finance' dummy in the regression model, which is equal to '1' if the respective firm reports access to finance as major or severe obstacle. Again, to measure the electricity constraint, we have used the average number of power failure in a month.

4.0 Data Analysis and Regression Results

This section contains the analysis of data and results from multivariate econometric exercises. Figure 1 depicts the TFP of manufacturing firms by types of industry. We can see that compared to 2007 the productivity of firms under each of the industry classification has increased in 2013, especially in case of firms belonging to the electronics industry. This is due to the fact that during this period electronic companies (i.e. Walton and Jamuna Group) have been able to acquire modern and state of the art technology, which result in higher productivity.

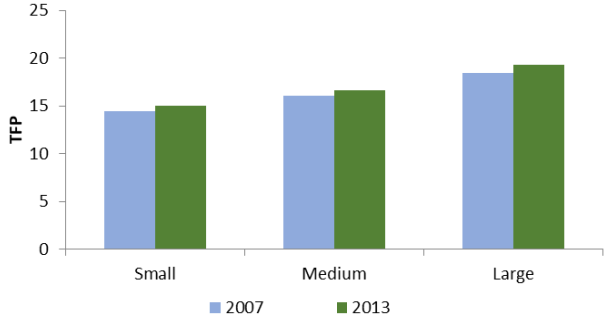
Figure 1: Difference in TFP (Total Factor Productivity) by industry types



Source: Authors' calculations based on The World Bank, Enterprise Survey-Bangladesh, 2007 and 2013

Figure 2 embodies the TFP of manufacturing firms by firm size. We can conclude that in both years the TFP of larger firms is relatively higher as compared to that of the smaller firms. The reason for this could be that larger manufacturing firms can take advantage of economies of scale and ensure more efficient use of resources.

Figure 2: Difference in TFP (Total Factor Productivity) by firm size

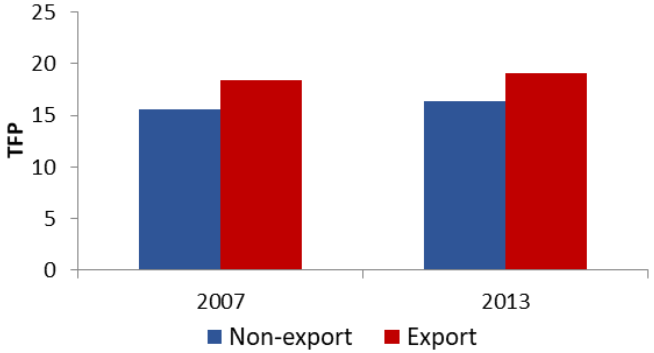


Source: Authors' calculations based on The World Bank, Enterprise Survey-Bangladesh, 2007 and 2013

Figure 3 represents the differences in TFPs for exporting and non-exporting firms. From the figure, we can see that the TFP is higher for export-oriented firms as exporting firms may get a better access to new knowledge and

technology. In addition, for both exporting and non-exporting firms, we can say that TFPs are higher in 2013 as compared to that of 2007.

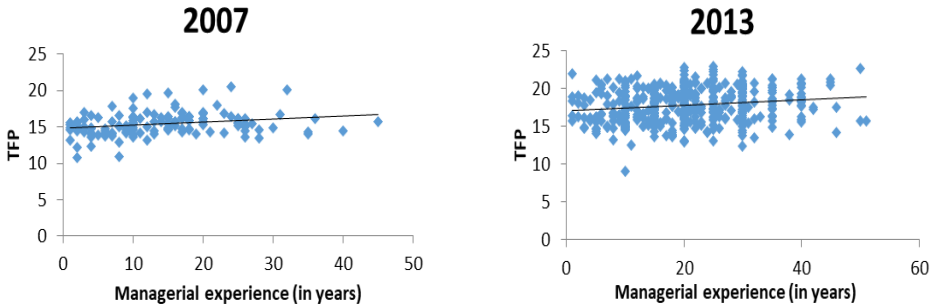
Figure 3: Difference in TFP (Total Factor Productivity) by exporting and non-exporting firm



Source: Authors' calculations based on The World Bank, Enterprise Survey-Bangladesh, 2007 and 2013

Figure 4 displays the scatter plot of TFP against the managerial experience, which is measured by the years of experience of the top managers. In both years, we can see that firms with higher level of TFP are associated with higher level of managerial experience. As we know that, the top managers of the respective firms take major production decisions. Therefore, if top managers have greater experience then they can ensure better use of resources which results in higher TFP.

Figure 4: TFP (Total Factor Productivity) and managerial experience



Source: Authors' calculations based on The World Bank, Enterprise Survey-Bangladesh, 2007 and 2013

Table 3 depicts the distribution of responses by firms regarding the severity of 'access to finance' constraint for 2007 and 2013[3]. In 2007, most firms considered financial obstacles as minor obstacles. However, in 2013 most firms reported access to finance as a moderate level obstacle. To capture the effect of access to finance constraint on TFP of manufacturing firms we have included an 'access to finance' dummy, which is equal to '1' if firm reports access to finance more than moderate level obstacle and '0' otherwise.

Table 3: Distribution of responses by firms according to severity of obstacles in 2007

	2007 Financial obstacles (%)	2013 Financial obstacles (%)
No obstacle(0)	16	15
Minor obstacle(1)	33	23
Moderate obstacle(2)	26	37
Major obstacle(3)	17	15
Very severe obstacle(4)	8	10
Total	**100**	**100**

Source: Authors' calculations based on The World Bank, Enterprise Survey-Bangladesh, 2007 and 2013

Table 4 and 5 show the summary statistics of variables used in the regression estimations for 2007 and 2013. On the average, log of total factor productivity in 2007 is 16.56 and it rises to 17.14 in 2013. The average firm size increases from 259 employees in 2007 to 271 employees in 2013. In case of firms' age, in 2007 the average age of firms surveyed is around 17 years whereas in 2013 it is around 20 years. We can also deduce that the average top management experience of firms increased from 14 years in 2007 to 20 years in 2013. In 2007, 33 percent of firms have exports more than 25% of its output whereas it fell to 28% in 2013. Moreover, the tables also suggest that on an average, 49 percent of the firms have access to internet connections in 2007. However, in 2013 it slightly dipped to 47 percent.

Table 4: Summary statistics of variables (2007)

Variables	Obs.	Mean	SD	Min	Max
Log of Total factor productivity*	841	16.56	2.24	10.76	22.57
Firm size (no. of employees)	841	259.28	632.75	4	11000
Firm age (in years)	841	17.19	13.16	2	120
Output share (%)	841	0.74	2.13	0.0009	36.96
Management experience (in years)	841	14.43	8.65	0	50
Export intensity Dummy**	841	0.33	0.47	0	1
ICT (Information and Communications Technology) Dummy***	841	0.49	0.50	0	1
Electricity (Number of power outages per month)	829	92.58	44.08	1	300
Access to finance dummy****	839	0.39	0.49	0	1

Source: Authors' calculations based on The World Bank, Enterprise Survey-Bangladesh, 2007 and 2013

Note: * Estimated using the Cobb Douglas framework. ** Equal to '1' if the firm exports more than 25% of its output or '0' otherwise. ***Equal to '1' if firm has internet connection or '0' otherwise. **** Equal to '1' of firm reports access to finance as more than a moderate obstacle or '0' otherwise.

In terms of institutional variables, the average number of power outages per month faced by a firm in 2007 was 92 and this reduced to 78 in 2013. Finally, for the access to finance dummy, the mean was 0.39 in 2007, which implies that 39 percent of the firms have reported access to finance as more than a moderate obstacle. However, in 2013 the mean of 'access to finance' dummy reduced to 0.25, implying 25 percent of the firms have reported financial obstacle as more than a moderate obstacle. It seems that, on an average firms in 2013 experienced less difficulty in case of acquiring finance.

Table 5: Summary statistics of variables (2013)

Variables	Obs.	Mean	SD	Min	Max
Log of Total factor productivity*	865	17.14	2.30	9.03	26.01
Firm size (no. of employees)	865	271.33	725.50	4	10000
Firm age (in years)	865	20.32	13.17	1	124
Output share (%)	865	0.92	4.25	0.000716	78.91
Management experience (in years)	865	20.10	10.26	1	60
Export intensity Dummy**	865	0.28	0.45	0	1
Internet connection Dummy***	865	0.47	0.50	0	1
Electricity (Number of power outages per month)	575	77.68	40.71	1	270
Access to finance dummy****	864	0.25	0.43	0	1

Source: Authors' calculations based on The World Bank, Enterprise Survey-Bangladesh, 2007 and 2013

Note: * Estimated using the Cobb Douglas framework. ** Equal to '1' if the firm exports more than 25% of its output or '0' otherwise. ***Equal to '1' if firm has internet connection or '0' otherwise. **** Equal to '1' of firm reports access to finance as more than a moderate obstacle or '0' otherwise.

[3] Constraint or obstacle to firms is measured in terms of 'liker scale'. Specifically, the managers are asked to give a score from '0' to '4' to describe the level of obstacle faced by the firm, where '0' implies no obstacle, '1' implies minor obstacle, '2' implies moderate obstacle, '3' implies major obstacle and '4' implies very severe obstacle.

In order to determine the factors affecting the productivity of manufacturing firms in Bangladesh, we estimated cross-section regressions with the log of TFP[4] as the dependent variable for both 2007 and 2013. We resort to the same model for both years concerned, where we have used several factors such as firm size, firm age, firm output share and the experience of the management of firms as the determinants of the total factor productivity of firms. According to Table 6 and 7, the regression results suggest that firm size has a positive and significant effect on productivity in both 2007 and 2013. In other words, we can say that larger firms are more productive. However, regression results have confirmed that firm age does not affect the firm-level total factor productivity for both years concerned.

The firm output share has a positive and significant effect on productivity for both 2007 and 2013 respectively. For 2007, one percentage point increase in firm output share leads to a rise in firms' productivity by 33.9 percent, while for 2013 such productivity rises by 13.2 percent. We have found a positive association between firm-level total productivity and experience of top management. In particular, if management experience increases by one year, productivity is likely to rise by 2.5 percent in 2007 and 2.1 percent in 2013.

To ascertain the effect of ICT adoption, we have included ICT dummy along with the other control variables as shown in Table 6 and 7. It is no surprise to observe that firms with internet connections are more productive than firms with no internet connection for both 2007 and 2013. In fact, the effect of ICT adoption on firm-level TFP is quite large. For example, as for 2013 we can say that firms with internet connection are 237 percent more productive than that of firms with no internet connection.

[4] TFP calculation is given in the methodology section.

Table 6: Effect of different obstacles on TFP (2007)

	Original model	Effect of ICT	Effect of export orientation	Effect of access to finance	Effect of power failure
	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
Firm size	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Firm age	-0.001 (0.005)	0.003 (0.004)	0.007 (0.005)	-0.003 (0.005)	-0.000 (0.005)
Output share	0.339*** (0.096)	0.249*** (0.074)	0.344*** (0.092)	0.329*** (0.094)	0.337*** (0.098)
Management experience	0.025*** (0.008)	0.016*** (0.006)	0.019*** (0.007)	0.027*** (0.008)	0.024*** (0.008)
ICT dummy (=1 if firm has internet connection)		2.640*** (0.138)			
Export intensity dummy (=1 if firm exports 25% or more of its total output)			2.358*** (0.153)		
Access to finance dummy (=1 if firm reports access to finance as more than a moderate obstacle				-0.574*** (0.175)	
Electricity (Number of power outages per month)					-0.003** (0.001)
Constant	15.64*** (0.161)	14.612*** (0.096)	14.934*** (0.108)	16.133*** (0.222)	15.941*** (0.214)
Number of observations	838	838	838	838	826
F	14.29	261.204	212.244	21.18	11.783
R-square	0.353	0.651	0.573	0.366	0.342

Note: *** p<0.01, ** p<0.05, * p<0.1

We have also run another set of regressions for estimating the effect of export intensity and other forms of obstacles on firms' productivity by controlling the same factors that we have discussed earlier. In this case, our aim is to determine the effect of export intensity of firms on productivity and we have found that higher export intensity has a positive and significant effect on productivity for both 2007 and 2013 as represented in Table 6 and 7. For 2007, we have found that firm with export more than 25 percent of its output has productivity which is 235.8 percent higher than that of the remaining firms. Such productivity difference, however, reduces in 2013 with 210 percent higher productivity of the firms with higher export intensity than that of the other firms.

Table 7: Effect of different obstacles on TFP (2013)

	Original model	Effect of ICT	Effect of export orientation	Effect of access to finance	Effect of power failure
	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
Firm size	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.002*** (0.000)
Firm age	-0.0001 (0.006)	-0.007 (0.005)	0.004 (0.006)	-0.000 (0.006)	-0.000 (0.007)
Output share	0.132*** (0.035)	0.108*** (0.026)	0.135*** (0.035)	0.130*** (0.035)	0.080 (0.069)
Management experience	0.021*** (0.007)	0.019*** (0.006)	0.017*** (0.007)	0.021*** (0.007)	0.017** (0.008)
ICT dummy (=1 if firm has internet connection)		2.378*** (0.126)			
Export intensity dummy (=1 if firm exports 25% or more of its total output)			2.100*** (0.136)		
Access to finance dummy (=1 if firm reports access to finance as more than a moderate obstacle				-0.647*** (0.149)	
Electricity (Number of power outages per month)					-0.004* (0.002)
Constant	16.24*** (0.151)	15.465*** (0.136)	15.762*** (0.142)	16.43*** (0.158)	16.276*** (0.226)
Number of observations	862	862	862	862	573
F	23.35	167.459	108.100	25.25	7.456
R-square	0.305	0.534	0.454	0.319	0.271

Note: *** p<0.01, ** p<0.05, * p<0.1

As we have already stated earlier, we want to determine the effect of two institutional variables namely, access to finance and electricity failure on firm-level total factor productivity (TFP). We have found the coefficients of 'access to finance' dummy to be negative and significant, which implies that 'access to finance' constraint affects the firm-level TFP adversely. In particular, we can conclude that firms, which experience major or severe obstacle in case of access to finance, are 57.4 percent less productive than that of the other firms in 2007. However, in 2013 the effect of 'access to finance' constraint on firm-level TFP became slightly larger. Again, from the estimated results of Table 6 and 7, we can see that the coefficients of electricity failure are negative and significant for both years. Hence, we can deduce that financial constraint and electricity failure have a negative effect on firm-level total factor productivity for both 2007 and 2013.

5.0 Conclusion and Policy Implication

With the quest of ascertaining the factors affecting total factor productivity of manufacturing firms in Bangladesh, this paper has extracted numerous useful insights that also have worthwhile policy implications. Before going further, we should not forget the possible existence of dual causality between firms' productivity and export orientation. Therefore, the estimated regression coefficients may have upward bias. However, we have discussed in the methodology section that the 'learning from export market participation' hypothesis is the more appropriate one for a country like Bangladesh. Taking into consideration the mentioned limitation, we can summarize the findings of the study as follows:

Larger firms are more productive as compared to smaller firms. This may be due to the economies of scale, which enables them to utilize resources more efficiently. Firms with higher output shares can be more productive. This is mainly because of the fact that, dominant firms hold the necessary resources, technical skill, and expertise. We have also found that management experience plays a pivotal role to increase the productivity of firms. In addition, the regression results suggest that the exporting firms in Bangladesh are more productive than non-exporting firms. The reason behind this is the learning process through technical support from external buyers or through the exposure to immense competition in the international markets.

We can also discern that firms with ICT can benefit from lower communication and transaction cost. This also helps them to maintain timely communication with its clients and suppliers, thus lead to higher productivity. As far as the institutional variables are concerned, we have found that financial constraint and electricity failures seem to have a negative effect on total factor productivity of manufacturing firms of Bangladesh.

From the aforementioned analysis, we can conclude that productivity of firms invariably depends on their own characteristics such as firm size, output share and managerial experience. It could also depend on other external factors such as access to ICT, access to finance, and poor infrastructure such as frequent power failures. The government needs to come forward by providing these firms easy and cheap internet connection. Furthermore, government should go for vast investment in power generation projects to ensure uninterrupted power supply for these firms. Last but not the least, for further expansions and enhancing productivity, the government should arrange to increase access to finance opportunities.

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