

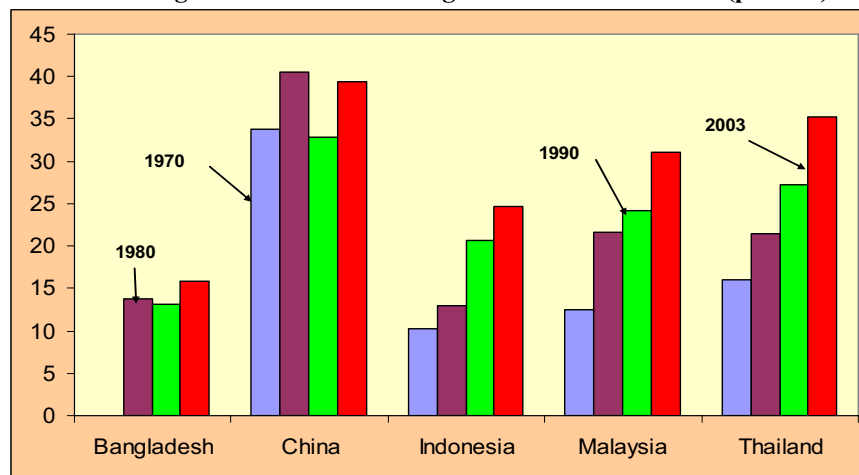
CHAPTER 1: FIRM-LEVEL PRODUCTIVITY IN BANGLADESH MANUFACTURING INDUSTRIES

I. Introduction and Main Findings

1.1 *The manufacturing sector has been a major driver of GDP growth in Bangladesh.* The sector recorded an impressive 7 percent average annual growth over the 1991-2005 period, increasing its share in GDP from 13 percent to 16 percent, compared with just 5 percent average growth in the 1980s. Manufacturing exports, garment exports especially, have been the major part of the story: these now account for over 90 percent of total exports, up from 67 percent in 1981 and 80 percent in 1991. Ready-made garment (RMG) exports, increased from an insignificant amount in early 1980s to US\$2.5 billion (6 percent of GDP) in FY96, and further to US\$7.9 billion (13 percent of GDP) in FY06. A number of other products, such as ceramics, pharmaceuticals, and food products have also experienced strong growth over the last decade, although from a much smaller base than garments.

1.2 *Continued dynamism in the manufacturing sector would be important for Bangladesh's transition to middle-income status.* Given the still modest share of manufacturing in GDP, there is considerable scope for the sector to lead the growth process for quite some time. A comparison with the East Asian economies that successfully made the transition from low- to middle- income status highlights the scope for this increase (**Figure 1.1**).

Figure 1.1: Manufacturing Sector's Share in GDP (percent)



1.3 *Significant challenges would need to be overcome for the manufacturing sector to fulfill its potential.* For one, the mainstay of manufacturing activities, the garments sector (which accounts for about 40 percent of manufacturing), is facing growing competition in global markets due to the dismantling of the quota restrictions that were in place, first under the Multi-Fiber Agreement (MFA) system and then under the Agreement on Textiles and Clothing (ATC) system.¹ Furthermore, special arrangements for the garment sector – in the form of bonded warehouse and EPZ facilities – may have helped the sector escape some of the business environment weaknesses that are endemic in Bangladesh, but, at the same time, this has also led to excessive concentration of manufacturing activities in garments, which is a source of vulnerability for the economy (see **Chapter 4**). To unleash the full potential of the

¹ Competition for garment exports is expected to intensify even more after 2008, when the remaining shackles on Chinese garment exports to the US are removed.

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manufacturing sector and to achieve greater diversification, it would be critical that the competitiveness of the Bangladeshi manufacturing sector be strengthened considerably.

Box 1.1: A Note on Firm-Level Data Used for Productivity Calculations

The analysis in this chapter uses data from a firm-level survey conducted for this report between November 2004 and September 2005. The survey was conducted by students of the Jahangirnagar University under the supervision of Prof. Abdul Bayes also of the same University. The survey covered a total of 682 firms in five industries: pharmaceuticals, food, ready-made garments, leather/footwear, and textiles. After the elimination of firms with data problems, the sample was cut to 575 firms, each firm having at most 5 years of production data – from 1999 till 2003. Annex 1 provides a detailed description of the data problems encountered.

The majority of firms in the sample belong to the garments industry reflecting the importance of the sub-sector in manufacturing in Bangladesh. Within garments, 86% of the surveyed firms belong to the woven sub-sector, 21% to the knitwear sub-sector, and 13% to the sweater sub-sector. Most firms have more than 50 workers, although the size distribution varies significantly across industries.

The sample comprises relatively young firms—more than half the firms were less than 10 years old while a third were 10 to 20 years old. About one-half of the firms were located in Dhaka while 17 percent were located in Chittagong (excluding the EPZs). However, the location of firms differs across industries: e.g., firms in the leather/footwear and pharmaceuticals industries are mostly concentrated in Dhaka. The table below summarizes the main characteristics of the surveyed firms based on the data for 2003.

The survey produced a wealth of information on production variables, firm characteristics, and aspects of the business environment – these are summarized in Annex Table 1.

Industry	Number of Firms	Size Distribution (% of Firms)				
		Small (<10 workers)	Medium (10-50 workers)	Relatively Large (50-150 workers)	Very Large (150-500 workers)	Extremely Large (> 500 workers)
Pharmaceuticals	51		5.9%	15.7%	45.1%	33.3%
Food	88	1.1%	12.5%	44.3%	33.0%	9.1%
Garments	276		0.4%	0.7%	48.6%	50.4%
Leather/Footwear	24	4.2%	20.8%	33.3%	29.2%	12.5%
Textiles	136		2.2%	16.9%	44.1%	36.8%
Total	575	0.4%	4.0%	13.9%	44.0%	37.7%

Industry	Age Distribution (% of Firms)				
	< 5 Years Old	5-10 Years Old	10-20 Years Old	20-40 Years Old	> 40 Years Old
Pharmaceuticals	15.7%	11.8%	29.4%	29.4%	13.7%
Food	26.4%	10.3%	35.6%	25.3%	2.3%
Garments	27.5%	27.5%	35.9%	8.3%	0.7%
Leather/Footwear		8.3%	25.0%	54.2%	12.5%
Textiles	29.4%	27.2%	27.2%	11.0%	5.2%
Total	25.6%	22.7%	32.8%	15.3%	3.7%

Industry	Location (% of Firms)					
	Dhaka	Dhaka Export Processing Zone	Chittagong	Chittagong Export Processing Zone	Khulna	Other
Pharmaceuticals	72.6%		5.9%			21.6%
Food	28.4%		39.8%		4.6%	27.3%
Garments	62.3%	4.7%	15.9%	9.8%		7.3%
Leather/Footwear	87.5%	4.2%	4.2%			4.2%
Textiles	29.4%	1.5%	9.6%	3.7%		55.9%
Total	51.3%	2.8%	16.7%	5.6%	0.7%	23.0%

1.4 *This chapter seeks to deepen the understanding of the factors that impact the productivity and, therefore, the competitiveness of the manufacturing sector in Bangladesh.* The chapter tracks the total factor productivity (TFP) performance of five major manufacturing industries over the 1999-2003 period

based on a firm-level survey that was done exclusively for this report (see **Box 1.1**). The industries covered were ready-made garments, textiles, pharmaceuticals, food, and leather/footwear – together these account for about 70 percent of the manufacturing sector and therefore give a good account of the sector.

1.5 *Analysis shows that the average annual (median) TFP growth over 1999-2003 was positive in four out of five manufacturing industries under consideration – garments being the lone exception.*²

Within the garment sector though, the average growth in the sweaters sub-sector was positive and relatively quite high. Employment generation was positive across the five industries, with annual growth rates of jobs varying between 0.7 percent in the food sector and 3 percent in the pharmaceuticals sector. Additionally, there was a sharp decline in the capital stock in all industries, likely reflecting build-up of excess capacity during the 1990s followed by a period of consolidation.

1.6 *Analysis also shows that allocation of resources within the pharmaceuticals, leather/footwear, and textiles industries during the sample period was inefficient:* in these industries, on average, firms that were less productive received a higher share of their industry's output. However, this phenomenon is relatively insignificant in determining the overall productivity performance at the industry level: firm-level productivity is the dominant force for that.

1.7 *Econometric analysis is used to determine factors that impact firm-level TFP performance, taking into account differences in firm characteristics* – such as location, industry, age, and size. The results suggest that in order to strengthen TFP performance of manufacturing firms, the following areas would need particular attention:

- (i) The rapidly emerging *energy supply constraints will need to be addressed*. Results show that power supply problems are costing firms dearly in terms of TFP losses. A 1 percent increase in number of power outages in a year reduces the TFP of the average firm by 10 percent.
- (ii) *Concerted efforts are necessary to improve Bangladesh's attractiveness to FDI*, the level of which has been quite low (less than 0.5 percent of GDP for the most part). FDI has recently picked up in extractive industries (coal and gas), telecommunications, and energy production – increasing FDI's share in GDP to about 1 percent – but not in manufacturing, where the potential for productivity gains is significant. Results show that firms with any level of foreign ownership are 10 percent more productive on average than firms that are wholly domestically owned.
- (iii) *Phasing out the high anti-export bias is important*. For this, it would be essential to further lower and streamline tariffs, improve trade facilitation, and tackle behind-the-border barriers to competitiveness. Results show that firms that export majority of their output are about 10 percent more productive on average. This advantage to exporters may be due to technology transfers from foreign buyers and having to adopt the stringent technical and quality standards of developed markets, and from coping with tighter time and competitive pressures. As further shown by the results, the benefit of being an exporter also improves over time as valuable experience is gained in export markets. Export orientation of firms not only increases TFP levels, but also TFP growth rates.
- (iv) *Human capital deficiencies will need to be tackled*. Results show that firm productivity improves with various measures of human capital. Higher-education levels and experience of managers in particular benefit productivity of firms, highlighting the importance of improving access to quality tertiary education, while consolidating earlier gains on primary and secondary education.
- (v) *Policies would need to develop the knowledge economy* to strengthen the basis for more innovative activities and adaptation of more advanced technologies, which results show as having a positive impact on productivity of Bangladeshi manufacturing firms. Quality certifications, too,

² The median TFP growth rate in an industry and in any given year is the growth rate such that half the firms in that industry and year have lower TFP growth rates and the other half have higher TFP growth rates.

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are found to improve firm productivity, and the application of these needs to be strengthened. Such certifications guarantee the use of internationally recognized technical standards (e.g., ISO quality certifications) and are an important means of acquiring state-of-the-art technological know-how.

- (vi) *The poor law and order, often cited as major concerns by private investors in Bangladesh, will need to be improved.* Results show that these hurt firm productivity: firm TFP is found to be negatively associated with protection payment by a firm relative to its sales, a proxy measure of law and order problems.
- (vii) Interestingly, results find *firm size and productivity to be negatively correlated* – the youngest and oldest among the surveyed firms were the least productive. This suggests that Bangladeshi firms in general are unable to benefit from economies of scale. Although hard to prove at this point, it may be partly reflecting the severe corporate management deficiencies in the country.

II. The Significance of Total Factor Productivity in Output Performance of the Manufacturing Sector

1.8 *What matters more for output performance – factor accumulation or TFP growth?* By-and-large, there is an emerging consensus in the literature that TFP growth plays a more significant role, especially for explaining cross-country differences in GDP growth.³ The topic is more than just academic: it holds significant implications for policymakers – should their focus be on accumulation of capital (in other words, saving and investment) or on technology infusion via R&D, FDI, and higher-quality labor force?

1.9 What is the evidence on this from the firm-level data used in this chapter? A straightforward measure to determine the relative significance of firm-level TFP growth in output growth would be TFP growth/sales growth. The median value of this measure for each industry is presented below:

	Pharmaceuticals	Food	Garments	Leather/ Footwear	Textiles	Total Manufacturing
TFP Growth/Sales Growth (%) of the median firm	7	34	24	5	7	20

Source: Firm-level data collected for this report and staff calculations

As per this measurement, 20 percent of manufacturing sector output growth is accounted for TFP growth. But this measure does not account for output and TFP differences *among* firms. A more accurate assessment of the role of TFP growth in output growth would be provided by answering the following: if output growth of firm is higher than the sample average, then how much of that higher growth is attributable to TFP growth? For this, we run a regression of sales growth of each firm on TFP growth of the firm. The coefficient on TFP growth from this regression is 0.85, suggesting that 85 percent of the variation in sales growth may be attributable to TFP growth. While this figure may be on the high side, it does illustrate that *TFP plays a major role in shaping output growth*. This is also consistent with the findings of the cross-country studies noted above.

III. TFP Trends in Manufacturing Industries

Increasing TFP trends over 1999-2003

1.10 *This section presents trends in firm-level productivity performance of five major manufacturing industries in Bangladesh: these are readymade garments, textiles, pharmaceuticals,*

³ For example, Klenow and Rodriguez-Clare (1997) and Easterly and Levine (2000).

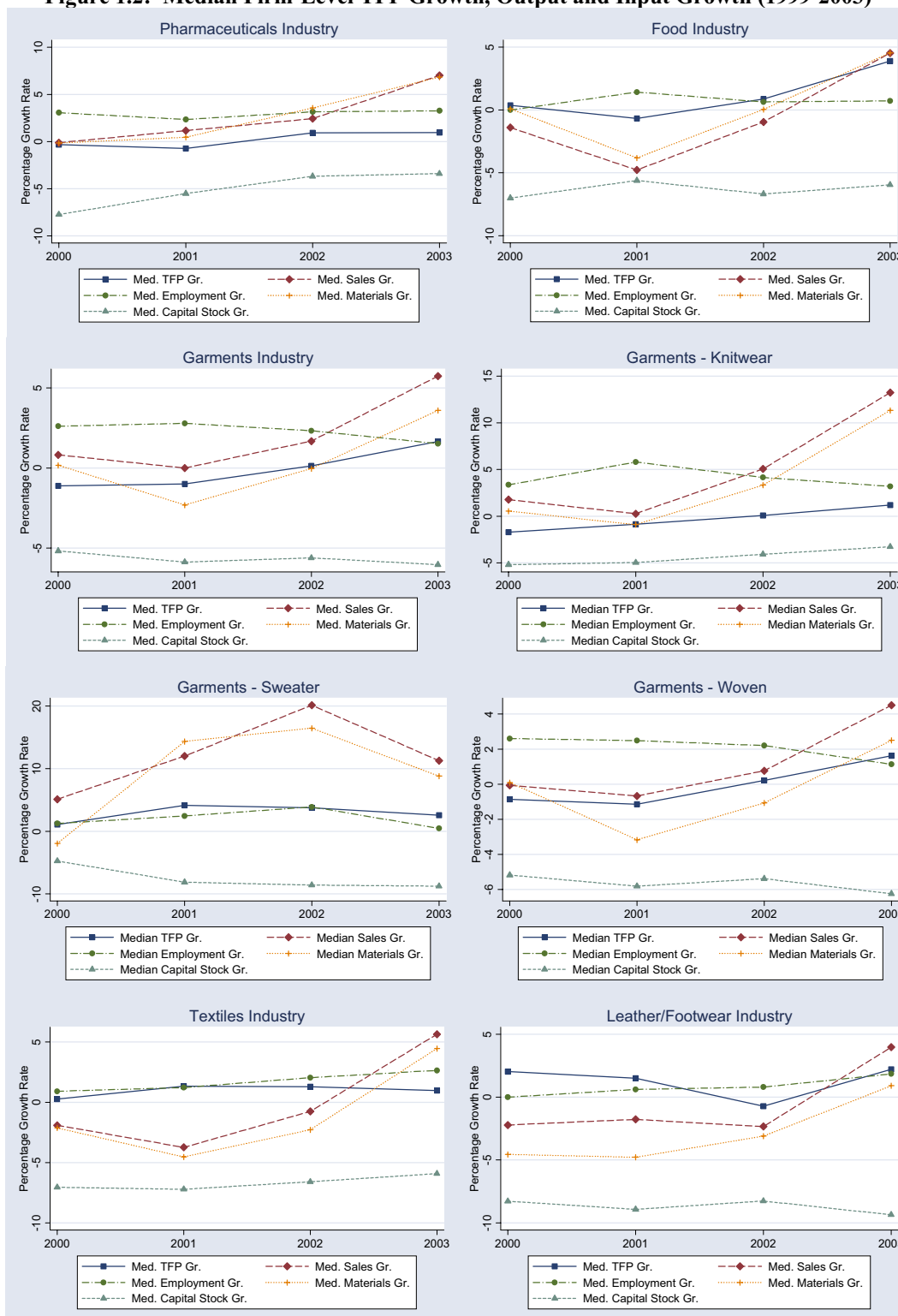
food, and leather/footwear. Productivity here is measured by the unobservable firm-level TFP that is estimated under specific assumptions about the production function (**Annex 1.2** explains the methodology used in obtaining the TFP measures). The firm-level survey for this exercise provides us with information on output (measured by sales) and inputs – which include labor, material, and capital – that is needed for estimating the production function. To adjust for the effect of inflation, we deflate sales by price levels. An important advantage of our analysis relative to the literature is that we deflate sales by firm-level prices rather than the industry-level prices that are often used.

1.11 **Figure 1.2** presents the median TFP trends for each of the five industries.⁴ The main results may be summarized as follows:

- In all industries except garments, the average annual (median) TFP growth over the 1999-2003 period was positive. Average growth in the garments sector as a whole was marginally negative over the period. With an average annual growth of 1.3 percent median TFP growth in the leather industry was the highest.
- There is considerable variation within the garments sector. While the average of the annual median TFP growth in both the woven and knitwear (excluding sweaters) sub-sectors was negative over the 1999-2003 period, in the sweaters sub-sector it was positive and relatively quite higher.
- Each sector and each garment sub-sector exhibited positive median TFP growth in 2002 and 2003, with the sole exception of a 0.7 percent decline in the leather industry in 2002.
- The pharmaceuticals and garments sectors and knitwear (excluding sweaters) and woven subsectors recovered with positive median growth in 2002 and 2003 after recording negative median growth in TFP in 2000 and 2001.
- The textiles sub-sector was the only sector or sub-sector with positive median growth in each of the four years under consideration.
- Each sector displayed positive trends in employment generation. Employment creation was particularly strong in the pharmaceuticals and garments industries, with number of employees growing annually at 2-3 percent per year.
- The sharp decline in the capital stock in each sector is striking. In each sector, the capital stock declined at an annual rate of at least 5 percent – the annual rate of decline was 9 percent in the case of the leather industry. This reflects relatively small investments by firms over the sample period, which is also consistent with the stagnation of the private investment rate (in the 15.5-15.8 percent range) over 1999-2001 at the national level. There has been a sharp pick-up in national private investment since 2002, which the firm-level data presented here do not reflect. It is possible that strong growth in national private investment at the rate of 13 percent per annum over 1992-1999 may have led to some excess capacity, which then resulted in the subsequent slowdown.

⁴ There are several ways to capture TFP dynamics at the industry level after estimating TFP at the firm level. One is the weighted-average TFP for firms in an industry—where the weights are assigned as per the firm size however measured. While giving the most accurate picture of the aggregate industry trends, by definition this measure is biased toward the performance of the larger firms. Alternatively measures include the unweighted-average TFP across all firms and TFP of the median firm. We prefer here the median TFP because it both gives equal weight to all firms – which seems more appealing from a policymaker’s perspective – and is also more robust to presence of extreme values, unlike the simple average measure. Nonetheless, the summary TFP performance calculated by the other two methods is reported in **Annex Table 1.3**.

Figure 1.2: Median Firm-Level TFP Growth, Output and Input Growth (1999-2003)

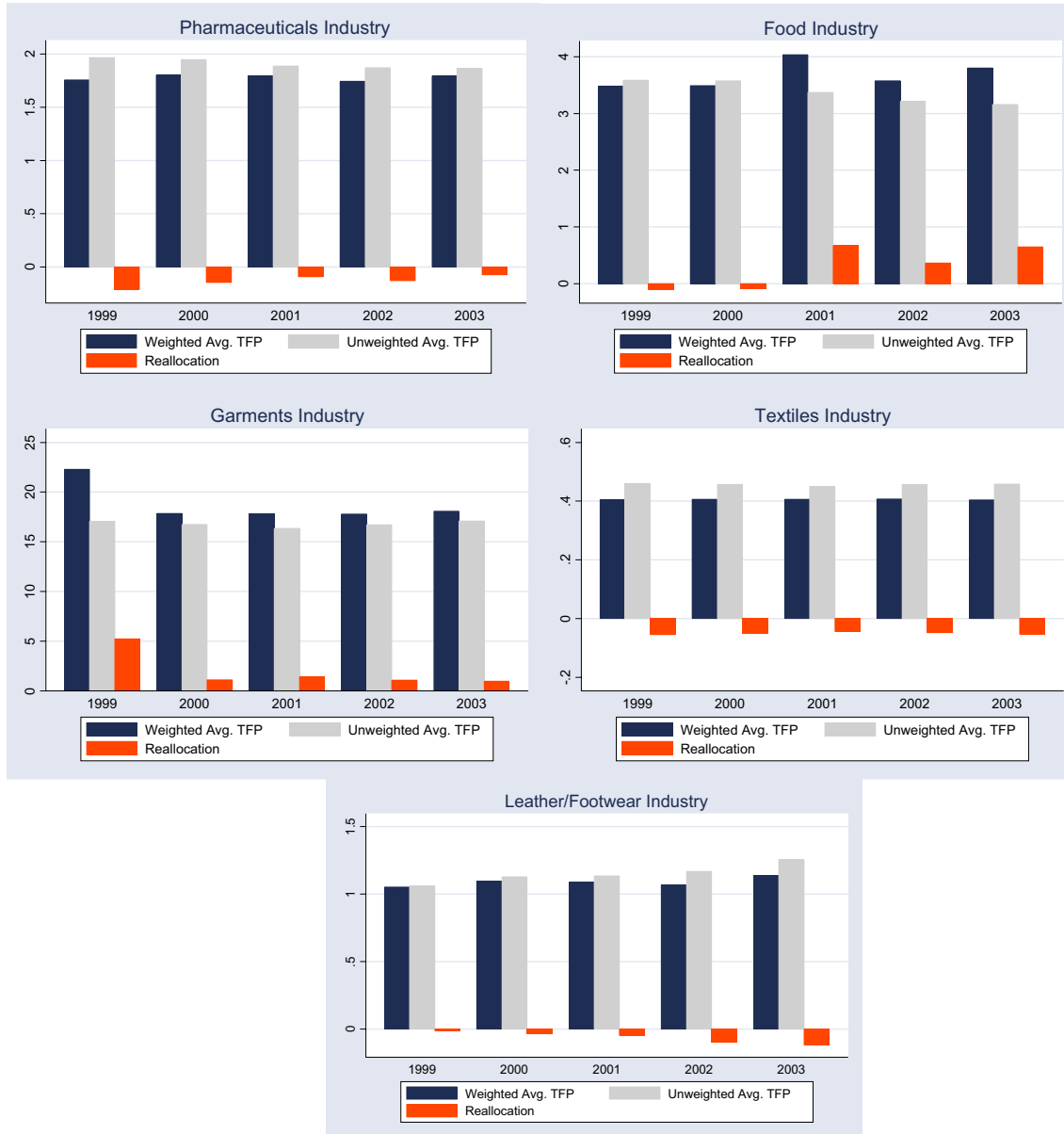


Source: Firm-level data collected for this report and staff calculations

IV. Insignificant Role of Allocative Efficiency of Resources Within an Industry

1.12 Productivity in any given industry in any given year may grow (decline) because its firms become more (less) productive and/or because output is reallocated towards the more (less) productive firms. In fact, industry level productivity (weighted-average TFP of all firms in the industry) can be broken into two components: (i) industry-level unweighted-average TFP and (ii) a term measuring the covariance between firms’ shares in total sales and firms’ TFP. The covariance term measures allocative efficiency: if it is positive, then the more productive firms in the industry have higher market shares and the allocation of resources is efficient.⁵

Figure 1.3: Decomposition of Industry-Level TFP



Source: Firm-level data collected for this report and staff calculations

⁵ This positive statement has no normative content. There may be reasons why a reallocation of output to less productive firms that are, e.g., more socially or environmentally responsible, could increase economic welfare. Here, we consider only the efficient allocation of resources (output) to their more productive use.

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1.13 As seen in **Figure 1.3**, the industry-level TFP patterns are explained mostly by the firm-level TFP performance, not by the allocative efficiency of output across firms in any of the industries.

1.14 Other key features of the analysis include:

- In the garments industry over the entire period, and in the food industry since 2001, the allocative efficiency has made a positive contribution to industry-level productivity.
- In the pharmaceuticals, textiles, and leather/footwear industries, allocative efficiency has made a negative contribution to industry level productivity. This inefficiency in these three industries may be related to the lack of competition – including import competition – or to ineffective bankruptcy rules and the lack of markets for used capital that prevent the exit of less productive firms.

V. Determinants of Firm-Level TFP

1.15 *This section identifies the factors that impact the level and growth of firm-level productivity in Bangladesh.* **Annex 1.2** provides more details on the econometric methodology used in identifying the determinants of TFP performance.⁶ Specifically, the chapter considers the impact on firm-level TFP of (i) human capital, (ii) global integration, (iii) technology, (iv) finance, and (v) other factors impacting business environment. In addition, this section also assesses the role of firm size and age. Various measures are constructed in each of these areas using firm-level data survey mentioned in **Box 1.1**. A brief description of each factor follows.

- 1) **Human capital** here is measured by the education level and years of experience of the firm's managers, and by education-based as well as occupation-based measures of workforce skills. As shown in **Annex Table 1.5**, there is quite a bit of variation in the human capital characteristics within our sample of firms. In pharmaceuticals, food, and textiles industries, more than 70 percent of the firms are run by managers with post-graduate education, compared with only 54 percent in garments and 42 percent in leather/footwear. At the same time, the lower educational achievement of managers in the leather/footwear industry is somewhat compensated for by their longer work experience. Among the workers, only a small percentage is college-educated – ranging from only 3 percent in the footwear/leather industry to 24 percent in the pharmaceuticals industry. This reflects the low levels of education attainment in Bangladesh: 2.6 years on average for the population as a whole in 2000 according to the Barro and Lee (2000) statistics and 4.2 years for the working-age population as per the 2003 Labor Force Survey (**Chapter 3**).⁷ In contrast, skilled workers represent more than 60 percent of the workforce in all industries except the pharmaceuticals industry where the share is only 44 percent.⁸
- 2) **Global integration** occurs because of foreign ownership or by trading across borders. **Annex Table 1.6** shows the corresponding summary statistics. Foreign-owned firms represent about 10 percent of the sample. The ownership composition does not vary much across industries,

⁶ Existing literature suggests a list of policy variables that could potentially impact firm-level productivity, including export orientation, level of foreign ownership, human capital and training, and the investment climate. Many of these policy-relevant factors have also been considered in the macro literature to explain differences in GDP growth across countries. In testing for these policy variables in a single unified framework, the analytical work here, in fact, is a step over the existing literature where different strands of policy variables are generally tested for separately.

⁷ Data on average educational achievement of the workforce in the manufacturing sector is not available.

⁸ A worker is classified as skilled here if he or she falls into any of the following categories – professional, technical, administrative, managerial and skilled production workers.

except for the leather/footwear industry where a significantly smaller proportion (4 percent) is foreign-owned. Export orientation on the other hand varies significantly across industries. While almost all firms in the garments industry and 92 percent of the firms in the leather/footwear industry are exporters, only 26 percent of firms in the pharmaceuticals industry are. In the garments and leather/footwear industries, most of the firms are majority exporters, i.e., they export over half their output. In contrast, in the pharmaceuticals industry there are no majority exporters. Finally, firms in the garments and footwear/leather industries have, on average, a much longer experience in export markets than firms in other industries.⁹

- 3) **Technology** here is measured by (i) the percentage of machinery that is computerized; (ii) the vintage of the capital stock (percentage of machinery less than 5 years old); (iii) whether or not the firm has any staff working on R&D activities; and (iv) whether or not the firm has been awarded one or more quality certifications (e.g., ISO).¹⁰ **Annex Table 1.7** shows summary statistics for the technology-related measures. In the garments and footwear/leather industries, only a fraction – less than a tenth – of machinery is computerized. In contrast, in the pharmaceuticals industry it is much higher at 42 percent. While in the garments and textiles industries almost half the machinery is less than 5 years old, only 16 percent of the machinery is in the leather/footwear industry. In the pharmaceuticals industry about 70 percent of the firms have staff engaged in some form of R&D activity, while the ratio is less than 20 percent in all other industries. Finally, the percentage of firms with one or more quality certifications varies substantially across industries: it is highest in the pharmaceuticals industry (40 percent) and lowest in the leather/footwear industry (8 percent).
- 4) Several measures are used to assess the role of **financial intermediation (Annex Table 1.8)**. Over 60 percent of the firms report having an outstanding bank loan in each of the industries except garments where the ratio is only 30 percent. More than 60 percent of firms report having an overdraft credit line. Furthermore, between 16 percent (garments) and 49 percent (leather/footwear) of the firms use financing from banks and other financial intermediaries to cover any part of their working capital, and the range is between 6 percent (leather/footwear) and 38 percent (textiles) for financing investment.¹¹
- 5) **The business environment** corresponds to the institutional, policy, and regulatory environment in which firms operate. While previous studies have mostly relied on managerial opinions and perceptions about the business environment, our measures have the advantage of including mostly objective measurements. Bureaucratic efficiency is measured by the number of days needed to clear customs for imports and exports and the percentage of weekly time spent by managers dealing with regulation capture. The number of power outages suffered and whether or not a firm has a generator capture the reliability of the public infrastructure. Whether or not a firm pays bribes to “get things done” and the share of sales paid as bribes are used as measures of corruption. Finally, security payments or protection payments as a share of firm sales capture potential crime.¹²

⁹ We use detailed information to construct the export experience variable. The firm survey asks the year since when a firm has exported, whether and in which year the firm has interrupted exports and if the firm interrupted exports, in which year exports restarted.

¹⁰ Another measure of technology is the percentage of imported machinery. However, we do not use it in the regressions since it exhibits little variation across firms: 90% of firms import 100% of their machinery.

¹¹ Financial intermediaries here include leasing companies, special development banks, and any other public financing agency.

¹² In the survey questionnaire, (i) “get things done” was explained as bribes needed for firms to resolve issues related to customs, taxes, regulations, and services, (ii) security expenses cover security guards, alarm and security systems, and (iii) protection payments are those to organized crime to prevent violence.

Annex Table 1.9 shows summary statistics for the business environment measures. Between a fifth to a quarter of managers' time is spent in dealing with regulation and bureaucracy. Power outages appear to be a major problem for all industries, especially so in the food and leather/footwear industries where firms on average suffer 560 and 885 power outages, respectively, per year. In face of the frequent power outages, it is not surprising that more than 80 percent of firms in all industries own a generator. There is evidence of high levels of corruption in the interactions of Bangladeshi firms with government officials and the bureaucracy. More than 85 percent of the firms indicated that firms in their industry needed to pay bribes to government officials to get things done. Such bribes amount to 1.3 percent of sales on average in the garments industry, double of that in the other industries. Finally, firms spend minimal resources on security expenses and protection payments.

1.16 *In addition, we also test for the impact of the size and the age of firms on their productivity.* Studies for the US have found that firms generally enter an industry with a small size and low productivity. Firms that survive grow and converge quickly to the average size and productivity in the industry. Developed country studies have also analyzed the relationship between firm age and firm productivity. These hypotheses are yet to be tested broadly for developing countries though. Ours is the first such analysis for Bangladesh.

What determines TFP levels in Bangladesh?

1.17 *This section reports the findings of econometric analysis of the determinants of firm-level TFP for the period 1999-2003, as reported in Annex Tables 1.10 and 1.11.* Annex 1.3 discusses some important econometric problems encountered in the estimations and how and to what extent these were tackled in the analysis.

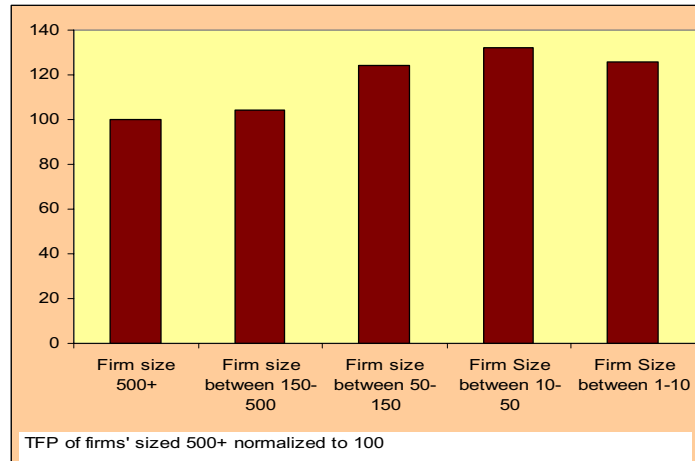
- *Firm size and productivity are inversely related.* We adopt the size classification used in the Bangladesh Census of Manufacturing Industries (CMI), according which: *small firms* have less than 10 workers, *medium firms* have between 10 and 50 workers, and *large firms* have more than 50 workers. We further divide the *large firm* category into 3 sub-categories: *relatively large firms* have between 50 and 150 workers, *very large firms* have between 150 and 500 workers, and *extremely large firms* have more than 500 workers. As seen in **Figure 1.4**, relative to the *extremely large-sized* firms, firms of smaller sizes are more productive.¹³ *Medium-sized* firms are the most productive firms – on average 32 percent more productive than extremely large-sized firms.¹⁴ Thus, contrary to findings for developed economies, in Bangladesh the larger firms are *not* the most productive. Although it is not possible to verify at this point, this may be because of the severe corporate management deficiencies and the resulting dearth of qualified middle managers in Bangladesh which become increasingly binding as the firm size increases, preventing exploitation of available economies of scale.¹⁵

¹³ This is contrary to the predictions of theoretical models of industrial dynamics with firm heterogeneity that predict that more productive firms are larger (e.g., Jovanovic (1982)). This is confirmed by empirical studies for developed economies.

¹⁴ These findings are robust across different specifications. These findings also hold true if we use capital stock as the measure of firm size: i.e., firms with larger capital stocks have lower TFP.

¹⁵ Our sample is skewed towards larger firms as it includes only a few small firms (those with less than 10 workers). The small firms included are likely to be particularly efficient since they have survived and are part of the same business associations as the “bigger players” in their industry. Thus, the focus of our findings on size and TFP

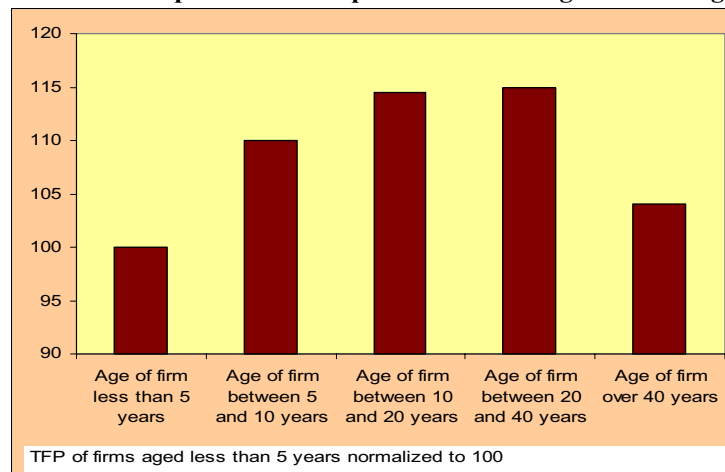
Figure 1.4: Firm Size and Average Productivity Are Negatively Correlated



Source: Firm-level data collected for this report and staff calculations

- **An inverted U-shaped pattern is seen in the relationship between firm age and productivity.** The most productive firms are those that are either 10-20 years old or 20-40 years old, followed by firms that are 5-10 years old, then by firms that are more than 40 years old, and finally by firms that are less than 5 years old (Figure 1.5). This inverted U-shaped life-cycle pattern suggests that firms start at low TFP while they are young, and then improve their productivity, through learning-by-doing, engaging in innovation, and participation in international markets.

Figure 1.5: Inverted-U Shaped Relationship Between Firm Age and Average Productivity



Source: Firm-level data collected for this report and staff calculations

- **Power supply problems lower significantly the firm TFP.** Specifically, if a firm belongs to an industry and location that has 1 percent more power outages than another industry-location, then its TFP is lower by almost 10 percent. The economic cost of the power sector problems that have resulted in large nation-wide deficiencies in power supply are therefore extremely high.
- **Human capital has a positive impact on firm productivity.** Firms with more skilled workers (where skilled workers group includes professional, technical, administrative, managerial and skilled production workers) and firms with a higher fraction of college-educated workers are

should be on the comparison across size categories for medium-sized and particularly for large-sized firms (i.e., those with more than 50 workers).

found to be more productive, significantly so in the case of skilled workers. Firms with more experienced managers and with managers with post-graduate education have higher TFP – 3 percent higher TFP in the case of firms whose managers hold a post graduate degree. These results point out to the importance of human capital development – a dimension lagging behind in Bangladesh despite sustained improvements over the last couple of decades – for the performance of manufacturing firms. In particular, it highlights the significance of access to quality tertiary education to prepare more qualified management cadres.

- ***Global integration has a positive impact on firm productivity.***
 - Foreign ownership has a positive impact on firm TFP. Firms with any fraction of foreign ownership are about 10 percent more productive than firms without foreign ownership.¹⁶ The usual benefits of foreign ownership – arising from both the tangible assets (e.g., better technology) and the intangible assets (e.g., better access to distribution and marketing channels and networks) – are likely to be at play here.
 - Exporting has a positive impact on firm TFP. Firms that export the majority of their output are about 11 percent more productive on average compared with firms that don't. The TFP advantage of exporters may be due to technology transfers received from foreign buyers as well as the possibility that exporters improve their own technological capabilities in order to exploit profitable opportunities in export markets.¹⁷ Productivity in exporting firms also benefits from having to adopt stringent technical and quality standards of developed markets, coping with tighter time pressures, and having to face more stringent competition in general. Further, exporters face several challenges that likely result in learning-by-exporting and consequent improvements in firm TFP. To capture the learning-by-exporting effect we test for the effect of the number of years that a firm has exported. Results confirm the positive of learning-by-exporting effect on TFP.
- ***Research and development has a positive impact on firm productivity.*** Firms with staff engaged in R&D activities have higher TFP. However, we do not simply interpret R&D literally as activities that bring breakthrough patentable innovations. Given the very low overall R&D levels in the country,¹⁸ it is more meaningful to ask how successful are the R&D staff in adaptation of technology and production processes to local conditions. In confirmation of this, we find that although firms with a larger percentage of new machinery (a measure of new technology) have lower TFP, that effect is counteracted when the firm has staff engaged in R&D activities. Even stronger results are obtained when the technology measure is the percentage of computerized machinery. Computerized machinery is associated with significantly higher TFP (about 16 percent higher) if the firm is engaging in R&D activity; the effect of computerized machinery on TFP is negative in itself. *These findings suggest that more advanced technologies tend to improve TFP performance but only in the presence of significant absorptive capacity.*

Similarly, quality certifications are positively and significantly associated with firm TFP. Such certifications guarantee the use of internationally recognized technical standards (e.g., ISO quality certifications) and are an important means for firms to acquire state-of-the-art technological know-how and raise their capability to compete on global markets.

¹⁶ This finding is obtained in regressions that control for industry, location, and year dummy variables, therefore it is not driven by macroeconomic fluctuations (i.e., the fact that business cycles in the FDI-sending countries make some years more prone to foreign investment), nor by a composition effect (i.e., the fact that certain industries are more prone to receive FDI), and it is also not driven by a location effect (i.e., the fact that FDI firms are more likely to locate in certain regions such as EPZs).

¹⁷ Westphal (2002) documents the latter possibility for firms in Taiwan.

¹⁸ R&D expenditures represent only 0.03% of GDP in Bangladesh, compared to 0.7% in China and India, and 0.2% in the Philippines.

- **Potential for crime dampens TFP performance.** Firms making larger protection payments are significantly less productive than other firms. We assume that larger protection payments to be “spared” from organized crime are a proxy for an environment with more potential crime. In unreported regressions, we also find a negative effect of the ratio of security expenses to sales when that variable is the proxy for potential crime.
- **No clear relationship between financial intermediation and firm TFP.** Firms with an overdraft facility or credit line have higher TFP, but this relationship is not statistically significant. In contrast, firms with access to a bank loan have significantly lower TFP. Qualitatively similar findings are obtained in the regressions that test only for the impact of using the overdraft facility or with access to a bank loan along with some basic control variables.¹⁹ In unreported regressions, we do find a positive correlation between the percentage of working capital financed by banks and related institutions and firm TFP. These intriguing findings likely have to do with the inefficiencies of the banking sector in Bangladesh and deserve a more detailed analysis. However, they should by no means be taken as evidence that access to external finance is not relevant for firm performance.
- **Some counterintuitive results emerge in looking at the linkage between TFP and corruption/red tape.** For example, the percentage of management time spent on dealing with regulations is found to be positively correlated with TFP. This could easily be because better performing firms are more visible to public officials which makes them more subject to inspections or visits from officials. Moreover, firms with higher TFP may also be more involved in activities – such as firm expansion, exports, etc. – that require permits and/or meetings with officials. Similarly, we find that firm TFP is higher in industries and locations where firms pay a larger percentage of their sales in bribes to get things done. Again, even though counterintuitive, it is quite plausible that this is because firms with higher TFP can afford to pay larger bribes to cut through bureaucratic hassles. Finally, the number of days needed to clear customs for imports does not seem to impact firm TFP.

What determines TFP growth in Bangladesh?

1.18 Results of the econometric estimations of the factors that affect the change in TFP between 1999-2003 are presented in **Annex Table 1.12**. Summary results follow:

- **There is strong evidence of conditional TFP convergence.** Results show consistently and significantly that firms with lower initial TFP level tended to grow faster. Over time, this process would lead to convergence in firms’ TFP to the average TFP in the firms’ industry and location.
- **The size of the firm is inversely related to TFP growth.** Medium-sized and large-sized firms are found to have significantly higher TFP growth than extremely large-sized firms. A possible interpretation is that smaller firms may be more flexible in adapting to shocks. Or, it could be that corporate management deficiencies become more binding as the firm gets larger, inhibiting its growth. Since the TFP level too was found to be inversely related to firm size, it seems that the gap between smaller and larger firms in terms of their productivity is widening over time.

¹⁹ There is widespread evidence of a correlation between firm size and access to finance. In fact, size is often used as a proxy for financing constraints (see, e.g., Beck, Demirgüç-Kunt, and Maksimovic (2005)). The finding that firms with access to a bank loan have lower TFP is unchanged, however, when we estimate our regressions excluding size but including the other basic controls. Thus, the negative effect of the loan dummy variable is not driven by the potential correlation between firm size and access to finance.

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- ***We find an inverse relationship between firm age and TFP growth.*** Older firms have lower TFP growth than firms that are less than five years old. Although not significant, the findings on age are similar to those obtained for firms in African countries.²⁰
- ***Global integration is associated with faster TFP growth.*** Firms that export majority of their output seem to enjoy faster TFP growth. In fact, being a majority exporter increases TFP growth by 0.7 percentage points per year on average. Learning-by-exporting seems to be at play here as firms with more experience in exporting are also those with higher TFP growth. Foreign owned firms also seem to have higher TFP growth, although this particular result is statistically not significant.
- ***Firms with more skilled workers have significantly faster TFP growth.*** Also, firms with higher levels of external training have higher TFP growth.
- ***Degree of red tape hurts TFP growth.*** Firms whose managers spend a larger percentage of their time dealing with regulation have lower TFP growth rates. A 10 percentage point increase in percent of managers' time spent on regulation can lower TFP growth by 2.5 percentage points.

VI. Conclusions

1.19 The findings of this chapter highlight several important areas of policy relevance in which improvements are likely to bring large benefits for firm-level productivity in Bangladesh. The importance of accelerating infrastructure development stands out starkly. In addition, policies to promote human capital formation at various levels, incentivize R&D activities by firms, and encourage use of quality certifications hold significant potential in terms of improving productivity in manufacturing activities. Deepening of global integration by both promoting export orientation among manufacturing firms and enabling foreign ownership of manufacturing activities in Bangladesh is another high pay-off reform area.

1.20 Finally, the analytical work in this chapter points to the benefits of systematically collecting information for the manufacturing sector. The Government would be well advised to institutionalizing again a comprehensive and regular census of manufacturing firms in Bangladesh.

²⁰ Van Biesebroeck (2005)