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Sources of Manufacturing Productivity Growth in Africa

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Abstract

This paper investigates the sources of growth in manufacturing productivity in Cote D'Ivoire, Ethiopia and Tanzania in comparison with the case of Bangladesh. Based on the analysis of establishment census data since the mid-1990s, it finds that reallocation of market share between firms contributed substantially to productivity growth in each of the four countries, although to a varying extent. In Ethiopia, the impact of market share reallocations among survivors tended to be larger than those associated with increases in within-plant productivity. In addition, plant closure (or exit) boosted productivity more than new plant openings (or entry) did in the sense that the relative productivity of survivors (or continuing plants) was higher relative to that of closing plants (or exit cases) than it was relative to the productivity of newly opening plants (or new entrants). Reallocation of market share plays an important role in raising aggregate productivity in Côte d'Ivoire as well. But the pattern here is opposite to that in Ethiopia in that in Côte d'Ivoire entering (or newly opening) plants have larger impact on aggregate productivity growth than closing (or exiting) plants. Unlike the case with Cote D'Ivoire and of Ethiopia, the reallocation of market share among surviving plants is a smaller source of manufacturing productivity growth in Tanzania than the new plant openings and plant closure. The data suggest that the reallocation of market share among surviving plants and exiting plants has larger impact on productivity growth in Bangladesh than the productivity gap between new plants and survivors, as in the case of Ethiopia.

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I. Introduction

In this paper, we focus on three African countries at different rates of industrialization of their economies and assess the different sources of productivity growth in each country. Specifically, we estimate the size and sources of productivity growth for Ethiopia, Côte d'Ivoire, and Tanzania—and then compare these productivity gains to that in an external comparator—Bangladesh. To do this, we compiled establishment-level data from a wide range of sources including manufacturing censuses, business registrars, and economic censuses.

Using these data, we investigate whether differences in the performance of manufacturing establishments can be accounted for by differences in the efficiency with which resources are allocated to their most productive use. We carry out both the static Olley-Pakes (1996) decomposition and the dynamic Olley-Pakes decomposition (DOPD) proposed by Melitz and Polanec (2015). These decomposition methods break down aggregate productivity changes into two components: one component that captures shifts in the productivity distribution (via changes in the unweighted mean of establishment-level productivity); and another component that captures market share reallocations (via changes in the covariance between market shares and establishment-level productivity). This allows us to identify patterns of productivity growth across different types of firms (e.g., by firm size and industry) as well as the efficiency of the factor reallocation in allocating resources to a sector's most productive firms.

A growing literature has begun to examine the extent of factor misallocation in developing countries (Alfaro, Charlton, and Kanczuk, 2008; Alfaro and Chari, 2014; Barltesman, Haltiwanger, and Scarpetta, 2009, 2013; Hsieh and Klenow, 2009; Restuccia and Rogerson, 2008, 2017). This paper contributes to this literature in two primary ways. First, it is the first paper to our knowledge to apply the Olley-Pakes decomposition methods to African data. To carry out this decomposition, we have generated new longitudinal data for Ethiopia (2012-2014) and Tanzania (2008-2012) and gained access to new panel data from Côte d'Ivoire.[1] In the case of Ethiopia, our dataset adds to the existing panel which covers the period 1996 to 2009.[2] Plus, we have generated a short panel for Bangladesh that covers every other year between 1995 and 2001. Using these data, we examine the sources of manufacturing productivity growth including the relative importance of factor reallocation for African countries.

Several interesting findings emerge from this analysis. First, there are clear differences in the size and sources of productivity growth across both countries and plants within countries. In terms of country performance, Ethiopia outperformed both Côte d'Ivoire and Tanzania on nearly every metric that we estimated. For example, aggregate manufacturing productivity increased by 75 percent in Ethiopia between 2006 to 2016 while it increased by 6 percent in Côte d'Ivoire over a similar period (2004 to 2016). Aggregate manufacturing productivity fell in Tanzania over the period 2008 to 2012. Second, we find several similarities between Ethiopia's pattern of productivity growth in recent years and that of Bangladesh during its early years of industrialization. For example, Bangladesh's aggregate manufacturing productivity increased by 52 percent between 2001 and 2012 which is comparable to that achieved by Ethiopia between

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[1] We'd like to thank Nouhoum Traore for sharing the Ivorian panel data with us.

[2] In addition, we have establishment-level data for 2010, 2011, 2015, and 2016. We hope to match the establishments in those years to our existing dataset so that we have a panel covering the period 1996 to 2016. Similarly, we have one additional year of data for Tanzania (2013) and hope to extend the Tanzanian panel from 2008 to 2013.

2006 and 2016. Also, Ethiopia's garment and textile sector achieved comparable productivity growth rates to that achieved by Bangladesh's garment and textile industry.

Perhaps most interesting are the results that emerge when we estimate the sources of manufacturing productivity growth by firm size and industry. We find strong evidence, for example, that entrants are the main driver of manufacturing productivity growth among firms with less than 200 workers but not among larger firms. This finding raises the possibility that selection mechanisms—particularly the role of entry—may differ by firm size. In addition, we reveal that market share reallocations play an important role in driving productivity growth among garment and textile producers in both Ethiopia and Bangladesh.

Since garment and textile producers often face significant competition from abroad, we estimate the impact of trade exposure on plant-level total factor productivity (TFP). This is accomplished by employing semi-parametric estimation techniques to estimate plant-level total TFP and then use these TFP measures in a second stage regression (following Pavcnik, 2002) to estimate the effects of increased trade exposure on plant-level productivity. Importantly, our identification method separates the variation in productivity that arises due to changes in trade exposure from those emanating from other sources. Two important results stand out from this analysis. First, we find strong evidence that increased trade exposure significantly raises plant-level TFP in all three African countries. However, we find no evidence that increased trade exposure results in stronger selection mechanisms that weed out less efficient firms.

The rest of the paper is organized as follows. Section II highlights the important role that industrialization plays in the development process. In addition, this section discusses how productivity gaps between plants might persist in long run equilibrium. Section III describes the decomposition methods that we use—both the static Olley-Pakes productivity decomposition and the dynamic Olley-Pakes productivity decomposition. Section IV describes our data and their sources. Section V highlights our main results. Finally, Section VI concludes the paper.

II. Conceptual Background

An economy's aggregate productivity is the weighted sum of plant-level productivity where the weights are the market shares of individual plants. Economic growth occurs when individual plants become more productive but also when plants with above average productivity expand their market shares. This second component was well understood by the first generation of development economists who built multi-sector growth models based on this stylized fact (Lewis, 1956; Kuznets, 1961; Fei and Ranis, 1964). But, despite the passage of more than 50 years, empirical support of the underlying mechanisms that accelerate factor reallocation remains limited. Instead, much of the empirical growth literature during the past two decades has been based on one-sector models that seek to identify the "best" set of variables that are correlated with cross-country variations in income and growth. The weaknesses of such growth regressions are well known (see, for example, the critique by Durlauf, Johnson, and Temple, 2005).

More recently, increased attention has been given to identifying the mechanisms that facilitate and constrain the efficient allocation of resources across heterogenous production units (see Hopenhayn, 2014 and Restuccia and Rogerson, 2017 for good reviews of this literature). Recent estimates suggest that such misallocation can explain up to 60 percent of the aggregate TFP differences between rich and poor countries (Kalemli-Ozcan and Sorensen, 2012). The magnitude of this dispersion and its persistence over time raises the question of how low-productivity producers survive in the same industry as high-productivity producers, particularly in the long run. One view is that “the observed dispersion reflects the frictions and perhaps distortions that prevent resources from being immediately reallocated to the most productive firms” (Haltiwanger, 2015, p. 343). Examples include regulations that levy higher taxes on producers that are larger in terms of employment, sales or capital (Hopenhayn and Rogerson, 1993; Guner, Ventura, and Xu, 2008); financial frictions that distort the allocation of capital across producers making the same good (Buera et al, 2011); and trade policies that generate a wedge that prevents the equalization of marginal products across heterogenous producers (Eaton and Kortum, 2002; Melitz, 2003; Eaton, Kortum, and Kramarz, 2011).

Another view is that “there may be sources of curvature in the profit function, so the most productive firms do not take over the market” (Haltiwanger, 2015, p. 343). For example, heterogeneous firms may face downward sloping demand curves due to product differentiation or high transport costs that reduce the scale of market selection via firm entry and exit (Melitz, 2003; Syverson, 2004a, 2004b; Melitiz and Ottaviano, Jones et al, 2018). Such models have become increasingly popular over the last decade as new studies find evidence documenting the existence of substantial price dispersion across producers, even those operaing within the same narrowly defined industry.

In addition, productivity gaps might arise due to selection and learning dynamics among young firms. According to Jovanovic (1982), new firms do not fully know their own productivity but instead enter the market with some prior belief about their relative position in their sector’s productivity distribution. Each period, they update their beliefs as new information becomes available. Efficient firms grow and survive while inefficient firms exit the market. In this model, “firms differ in size not because of the fixity of capital, but because some learn they are more efficient than others" (Jovanovic, 1982, p. 649). As a result, learning dynamics and selection mechanisms that weed out inefficient firms play a key role in explaining industry dynamics. The Jovanovic model is consistent with several empirical findings including the observation that young firms have higher and more variable growth rates than older, more established firms.

Extensions of the Jovanovic model posit that learning dynamics are important not only to young firms but to older firms as well. Hopenhayn (1992), for example, argues that firms are subject to idiosyncratic shocks over their lifespan and must adapt to changing economic circumstances to survive. While a firm's past successes are correlated to its future successes, the ability to adapt to changing market conditions is what separates successful firms from unsuccessful firms. This combination of idiosyncratic firm shocks, learning dynamics, and firm selection results in resources being constantly reallocated across firms. Over time, new firms enter the market, surviving firms expand or contract, and inefficient firms exit the market. Such reallocation results in high turnover rates across both firms and jobs. For instance, in the United States during the 1990s, about one-third of the stock of jobs and over forty percent of manufacturing firms exited the market and then were replaced by new entrants during each five-year period (Hopenhayn, 1992). Such "churning" in the market results from productivity changes at the establishment level and lies at the heart of all firm dynamics.

III. Productivity Decomposition

In this paper, we use both the static and dynamic Olley-Pakes decomposition (Melitz and Polanec 2015) to examine the size and sources of productivity changes in four developing countries: Bangladesh, Côte d'Ivoire, Ethiopia, and Tanzania. These decompositions breakdown aggregate productivity Φ into two components: 1) the contribution due to a shift in the firm-level distribution of productivity, $\overline{\varphi}_t$; and 2) the contribution due to market share reallocations, cov_t. That is,

$$\Phi = \sum_i s_{it}\,\varphi_t = \overline{\varphi}_t + \sum_i (s_{it} - \bar{s}_t)(\varphi_{it} - \overline{\varphi}_t), \tag{1}$$

where the bar over a variable denotes the mean over all establishments in a given year. In this framework, the covariance represents the contribution to aggregate productivity that results from a reallocation of resources across establishments with different productivity levels. If the covariance is positive, it indicates that resources are moving from relatively less-productive establishments to relatively more-productive. Similarly, if the covariance is negative, it indicates that resources are moving from relatively more-productive establishments to relatively less-productive establishments.

Following Melitz and Polanec (2015), we can decompose such aggregate productivity changes, ΔΦ, over time in terms of the contribution of different groups of firms. For example, say we have three groups of firms: survivors (S), entrants (E), and exiting firms (X). The resulting decomposition is:

$$\Delta\Phi = (\Phi_{S2} - \Phi_{S1}) + S_{E2}(\Phi_{E2} - \Phi_{S2}) + S_{X1}(\Phi_{S1} - \Phi_{X1}) \tag{2}$$

$$= \Delta\overline{\varphi}_s + \Delta cov_s + S_{E2}(\Phi_{E2} - \Phi_{S2}) + s_{X1}(\Phi_{S1} - \Phi_{X1}) \tag{3}$$

The first line decomposes aggregate productivity changes into the contributions made by each group. The first component accounts for changes in aggregate productivity ΔΦ that arise due to changes in plant-level productivity among surviving firms as well as changes in the relative productivity between survivors and other firms (e.g., entrants and exits). For example, aggregate productivity rises when surviving firms become more productive but also when new firms with higher productivity *enter* the market and when inefficient firms with lower productivity *exit* the market.

The second line further breaks down each group's contribution. Specifically, the contribution of *survivors* can be decomposed into a component that captures the change in average productivity among survivors, $\Delta\bar{\varphi}_S$, and another component that captures the change in the covariance between the productivity of survivors and their market shares, cov_S. Similarly, the contribution of *entrants* can be decomposed into a component that captures the relative difference in the productivity of entrants and survivors, $S_{E2}(\overline{\varphi}_{E2-}\overline{\varphi}_{S2})$, and another component that captures the relative difference in the covariance between market shares and productivity across the two groups ($S_{E2}(cov_{E2-}cov_{S2})$. The contribution of *exiting firms* is analogous to that of entrants: one component that captures the relative difference in the productivity of exiting firms and survivors, $S_{X1}(\bar{\varphi}_{X1-}\bar{\varphi}_{E2})$, and another component that captures the relative difference in the covariance between market shares and productivity across the two groups, $S_{X1}(cov_{X1-}cov_{S1})$.

The intuition is simple: the contribution of entrants (or exiting firms) to aggregate productivity is the change in aggregate productivity that would have been generated if we were to add entrants (or remove exiting firms) to some initial distribution of firms. Since we cannot observe entrants in period 1 nor exiting firms in period 2, we cannot apply the same counterfactual in both periods. Instead, the DOPD method uses "the set of surviving firms as a benchmark and [then] asks how adding the group of entrants (or exiters) affects the aggregate productivity change" (Melitz and Polanec, 2014). Using a different reference period for each group is critical because of the timing of entry and exit. In the DOPD method, entrants only contribute to productivity growth if their productivity is higher than survivors when entry occurs (period 2). Likewise, exiting firms only contribute to productivity growth if their productivity is higher than survivors when exit occurs (period 1). The fact that the DOPD specification uses different reference periods when estimating the impact of entry and exit is a clear advantage over other decomposition methods that use the same reference period (e.g., Griliches and Regev, 1995; Foster, Haltiwanger, and Krizan, 2001). These alternative methods are likely to result in measurement bias when measuring the contribution of one group or the other.

While the dynamic decomposition has clear advantages over the static decomposition, we use both methods to take advantage of the cross-sectional data that we have for the period since 2016. These data are included in our analysis to highlight current trends as well as the different sources of manufacturing growth over the past decade.

IV. Data

The analysis of business dynamics requires data that both tracks individual establishments over time and is representative of different firm types (e.g., survivors, entrants, and exiting plants). Typically, these criteria are met only by manufacturing censuses and business registers as survey-based data are unlikely to be representative of entrants and exiters as well as firms at different stages of their life-cycle (e.g, young and mature plants). Table 1 lists the data sources that we use to conduct our analysis. In total, we have data on more than 67,000 establishments from 45 country-year samples. Its breakdown is as follows: data covering 21 years for Ethiopia (1996-2016), 12 years for Côte d'Ivoire (2003-2014), six years for Tanzania (2008-2013), and six years for Bangladesh (1995, 1997, 1999, 2001, 2005, and 2012).

Our first step in the productivity decomposition is to classify each establishment as either an entrant, exiter, or a survivor. Following Bartelsman, Haltiwanger, and Scarpetta (2013), we adopt the following definitions:

> *Entrant (E)*: Entrants and their employees are defined by the *first year* they are observed in the registry. Entrants are those observed as (out, in) in the registry at time (t-1, t).
>
> *Exiter (X)*: Exiters and their employees are defined by the *last year* they are observed in the registry. Exiters are those observed as (in, out) in the registry at time (t-1, t).
>
> *Survivor (S)*: Survivors and their employees are those establishment that were in the registry for two consecutive years. Survivors are those observed as (in, in) at time (t-1, t).

Given these definitions, there is a clear link between the change in the stock of survivors and the number of entrants and exits in any two-year period. This relationship can be expressed as:

$$S_t - S_{t-1} = E_{t-1} - X_{t.} \tag{4}$$

Given that survivors and entrants both exist in time t, the total number of establishments in any year t is defined as the sum of survivors and entrants. That is,

$$T_t = S_t + E_{t.} \tag{5}$$

This implies that the change in the total number of establishments between year t and $t-1$ can be defined as the difference between the number of entrants and exits. We write this relationship as:

$$T_t - T_{t-1} = E_t - X_{t-1}. \tag{6}$$

In other words, the total change in the number of establishments, ΔT, between period t and $t-1$ is simply the difference between the cumulative sum of entrants and the cumulative sum of exits over the period. That is,

$$\Delta T = T_t - T_{t-1} = \sum E_t - \sum X_{t-1}$$

Using these definitions, we can classify each establishment into one of three categories: survivors (S), entrants (E), and exiting plants (X). Several patterns are worth noting. First, all four countries exhibit considerable firm turnover. About 20% of operating plants "enter" the market each year while another 18% of plants "exit." Given the fact that entry rates exceed exit rates, the number of plants in each country rises over time. While these increases are relatively modest in the African countries, Bangladesh ends the period with more than 10,000 new manufacturing plants.

Table 2 provides some descriptive statistics on the manufacturing sector in each country. The first pattern to notice is that African establishments are smaller than those in Bangladesh. In 2012, the median establishment in 2012 employed 33 workers in Côte d'Ivoire, 20 workers in Ethiopia, 20 workers in Tanzania, and 119 workers in Bangladesh.[3] Perhaps more important, the average scale of plants in Africa does not appear to be rising whereas it is clearly rising in Bangladesh. A quick look at the size distribution of African manufacturing establishments (Figures 1a-1d) reveals that the largest share of establishments employs less than 50 workers and increases in size over time. For example, the share of establishments employing less than 50 workers increases from 69 percent to 76 percent in Ethiopia (between 1996 and 2016); from 47 percent to 60 percent in Côte d'Ivoire (between 2003 and 2014); and from 62 percent to 68 percent in

[3] In each country, these numbers are based on establishments with 10+ workers.

Tanzania (between 2008 and 2013). In addition, all African countries experience a monotonic decline in the share of larger establishments over these time periods. The opposite trend occurs in Bangladesh where the share of establishments employing less than 50 workers *falls* from 79 percent to 62 percent and the share of larger establishments (e.g., those employing 50 to 199 workers) *rises* by 12 percent 25 percent over the period 2001 to 2012. The failure of the African manufacturing sector to generate scale should concern policy makers, particularly given recent evidence that larger establishments are highly correlated with both increased industrialization and higher income per capita (Buera and Kaboski, 2011; Buera et al, 2012; Bento and Restuccia, 2017).

These cross-country differences in scale may be partially driven by differences in the sectoral composition of the manufacturing sector in each country. As revealed in Figures 3a-3d, there are clear differences between manufacturing activities pursued by African and Asian establishments. In Bangladesh, 43 percent of all manufacturing establishments produce either textiles or garments (in 2012) whereas this share is just 13 percent in Ethiopia (in 2016), 5 percent in Tanzania (in 2013) and 2 percent in Côte d'Ivoire (2014). Since garments and textiles are often produced for global markets, this suggests that African establishments may not have a comparative advantage in these sectors. By contrast, the share of African establishments engaged in manufacturing activities that cater to domestic markets (e.g., food and beverages, furniture) remains high. In all three African countries, establishments that produce food and beverages comprise the largest share of manufacturing firms and the largest share of manufacturing employment (see Figures 5a-5d). Forty-three percent of manufacturing workers are employed by the food and beverage industry in Tanzania (in 2013) while 23 percent are employed in Ethiopia (in 2016) and 22 percent are employed in Côte d'Ivoire (in 2014). In Bangladesh, this percentage is only 6 percent.

Are these differences in sectoral composition and scale being driven by differences in plant-level productivity across establishments? We next turn to this issue by examining the sources of productivity growth among different categories of plants. Using both the static Olley-Pakes (1996) decomposition and the dynamic Olley-Pakes decomposition (DOPD) developed by Melitz and Polanec (2015). Our preferred method is the Melitz and Polanec (2015) decomposition but utilize the static decomposition method when panel data are not available. As discussed by Olley-Pakes (1996), this method is more directly linked to theoretical models of firm dynamics developed to analyze the sources of market share reallocations across heterogenous firms (see, for example, Hsieh and Klenow, 2009; Collard-Wexler, Asker and de Loecker, Bartlesman, Haltiwanger, and Scarpetta, 2011; and Restuccia and Rogerson, 2017).

V. Results

Tables 3 and 4 report the results of the Olley-Pakes decomposition methods. Several patterns are worth noting. First, aggregate productivity growth in Ethiopia (Table 3) outstripped that of both Côte d'Ivoire and Tanzania (Table 4). In Ethiopia, aggregate productivity increased by 76 percent between 2006 and 2016 whereas it increased by only 6 percent in Côte d'Ivoire over a similar period (2004 to 2014).[4] The weak performance of the Ivorian manufacturing sector is not surprising given the country's two civil wars and extreme political instability during this period. However, growth rates rebounded following the peace agreement that ended the Second Ivorian Civil War (2010-2011). As reported in Table 4, aggregate productivity increased by 30 percent in

[4] Table 5 reports that aggregate productivity growth increased by 47 percent between 1996 and 2009. Note our estimates contradict earlier findings by Newman et al (2016) drawn from the Groningen Africa Database who estimate manufacturing productivity changes based on aggregate (sectoral) data.

2012 and by 27 percent in 2013. Somewhat surprisingly, we find that aggregate manufacturing productivity in Tanzania fell each year between 2009 and 2012.

Second, we find evidence that market share reallocations contributed substantially to productivity growth in each country, although with vary magnitudes. In Ethiopia, the impact of market share reallocations among survivors (represented by Δcov) tended to be larger than those associated with increases in within-plant productivity (represented by the Δ in unweighted productivity). In addition, we find evidence that exiting plants boost productivity more than entering plants. The relative productivity of survivors is higher than that of exiting plants, suggesting that selection mechanisms are weeding out the least productive plants. In a related paper, Jones et al (2018) find that exiting plants in Ethiopia have lower physical total factor productivity (TFPQ) than surviving plants, but only when after controlling for producers' transport costs.

In Côte d'Ivoire, market share reallocations also play an important role in raising aggregate productivity. But, the pattern is opposite to what we find for Ethiopia. In Côte d'Ivoire, entering plants—not exiting plants—tend to have a larger impact on aggregate productivity growth. The relative productivity of entering plants is higher than that of surviving plants in 8 out of the 10 years between 2004 and 2014. By contrast, exiting plants reduce productivity in 7 out of 10 years during this period. Once again, a different pattern emerges in Tanzania. In Tanzania, we find that market share reallocations among surviving plants appear to have a smaller impact on aggregate productivity growth than both entry or exit. So how do these patterns compare to those in Bangladesh? Table 5 presents the decomposition of aggregate productivity growth for Bangladesh. While our data are limited, the evidence suggests that market share reallocations among surviving firms and exiting firms have the largest impact on productivity growth in Bangladesh. This pattern is similar to what we find for Ethiopia.

Next, we examine how the sources of productivity growth differ by firm size and industry. Given the large number of years covered, we present the results in roughly five-year intervals for each country. The results are reported in Tables 6 and 7. Several interesting findings emerge. First, the smallest plants (those with less than 50 workers) experienced the largest productivity growth in three out of the four countries (Ethiopia, Tanzania, and Bangladesh). This is important as plants in this size category comprise the majority of formal sector plants with at least 10 workers in each country. Côte d'Ivoire is the exception with slightly larger plants (those with 50 to 199 workers) experiencing the fastest productivity growth. Another key finding is that entrants are the main source productivity growth among plants with less than 200 workers and exiting plants have depress productivity in plants w200 to 499 workers. This raises the possibility that selection mechanisms may have different effects on plants that vary in size.

Finally, we conduct the productivity decomposition for plants in different industries. Initially, we focus on three industries: 1) garments and textiles; 2) food and beverages; and 3) furniture. While garments and textiles tend to be export-intensive industries, firms in the food and furniture industries tend to sell their products locally. Among garment and textile producers, Ethiopian plants achieved the highest productivity growth of the four countries. Aggregate productivity in Ethiopia rose by 24 percent between 1996 and 2001 and by 30 percent between 1996 and 2006. In Bangladesh, aggregate productivity increased by 33 percent between 1995 and 2001. Interestingly, this productivity growth was largely driven mainly by more efficient survivors gaining market shares and by less efficient plants exiting the market. A similar pattern emerges among garment and textile plants in Ethiopia. During the first period, market share reallocations were the primary source of productivity growth whereas, during the second period, the entry of more efficient plants was the driving force. Neither Côte d'Ivoire nor Tanzania experienced positive productivity growth in their garments and textile industries over the periods for which we have data.

Mixed results are found for firms in the food and beverage industry as well as for firms in the furniture industry. Overall aggregate productivity in the food and beverage industry grew by 11 percent in Ethiopia between 1996 and 2006 and by 33 percent in Bangladesh between 1995 and 2001. This productivity growth was driven by market share reallocations among survivors in Ethiopia and by selection mechanisms in Bangladesh. By contrast, aggregate productivity fell for plants producing food and beverages in both Côte d'Ivoire and Tanzania. For Côte d'Ivoire, this fall in productivity was due to surviving firms becoming less productive, a likely result of the political unrest in the country. In Tanzania, however, productivity fell as an increasing share of output was shifted to less productive plants in the industry.

Lastly, we examine the sources of productivity in the furniture industry in each country. Both Ethiopia and Côte d'Ivoire experienced a rise in aggregate productivity among furniture producers. Aggregate productivity rose by 36 percent between 1996 and 2006 in Ethiopia and by 19 percent in Côte d'Ivoire between 2004 and 2014. The main source of productivity growth in Ethiopia was due to surviving plants becoming more productive and gaining market share. By contrast, the main source of productivity growth in Côte d'Ivoire was due to more productive survivors gaining market share and less efficient plants exiting the market.

It is often argued that increased trade exposure in a market strengthens the selection mechanisms that weed out less efficient firms. Is there any evidence that increased trade exposure has this effect on African manufacturing firms? We test this hypothesis using a two-stage estimation technique similar to that developed by Pavnik (2002). In the first stage, we estimate plant-level TFP using the Levinsohn-Petrin (2003) technique for estimating production functions. This estimation technique controls for the possible correlation between a plant's chosen input levels and its unobserved plant-level productivity shocks by using intermediate inputs as a proxy for the unobserved productivity shock. Once we have estimated plant-specific TFP, we use these TFP measures in a second stage regression (following Pavcnik) to estimate the effects of increased trade exposure on plant-level productivity. Importantly, our identification method separates the variation in productivity that arises due to changes in trade exposure from those emanating from other sources. We do this by exploiting both the variation in productivity over time and across plants with different exposures to trade. We estimate the following equation:

$$TFP_{it} = \alpha_0 + \alpha_1 (Year)_{it} + \alpha_2 (Trade)_{it} + \alpha_3 (Trade * Year)_{it} + \alpha_4 (Trade * Exit)_{it} + \alpha_5 Z_{it} + v_{it} \quad (7)$$

where TFP_{it} is the unweighted productivity estimate for plant i in year t, $Year$ is a vector of year indicators, $Trade$ is a dummy variable that indicates whether plant i has positive foreign sales, and Z_{it} is a vector of plant characteristics including industry fixed effects and whether the plant exits the market in any given year. In this specification, the direct effects of trade are represented by the coefficient α_3 and the indirect effects of trade (via exit) are represented by the coefficient α_4. Tables 8, 9 and 10 report the results of the second-stage regression. Two important results stand out from this analysis. First, we find strong evidence that increased trade exposure significantly raises plant-level TFP. For each country, the coefficient on exporter is both positive and significant at the 1% level. However, we find no evidence that increased trade exposure results in stronger selection mechanisms that weed out less efficient firms.

VI. Conclusion

This paper examines the size and sources of productivity growth for three African countries—Ethiopia, Côte d'Ivoire, and Tanzania—and then compares these productivity gains to those of an external comparator: Bangladesh. We utilize static and dynamic Olley-Pakes decomposition and to obtain several interesting findings emerge from this analysis.

First, there are clear differences in the size and sources of productivity growth across both countries and plants within countries. In terms of country performance, Ethiopia outperformed both Côte d'Ivoire and Tanzania on nearly every metric that we estimated. Second, we find strong evidence that entrants are the main driver of productivity growth among small and medium-sized firms (those with less than 200 workers) but not among the countries' largest firms (those with 200+ employees). This finding raises the possibility that selection mechanisms—particularly the role of entry—may differ by firm size. In addition, the results reveal that market share reallocations play an important role in driving productivity growth among garment and textile producers in both Ethiopia and Bangladesh. Furthermore, the findings provide strong evidence that increased trade exposure significantly raises plant-level TFP but do not show that increased trade exposure in a market results in stronger selection mechanisms that weed out less efficient firms.

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TABLE 1:
Data Sources Used for Productivity Decomposition

Country	Name of Survey/Census	Source	Period	Sectors	Panel	Threshold
Côte d'Ivoire	Registrar of Companies for the Modern Enterprise Sectors	Business Registrar	2003-2014	All sectors	yes	None
Ethiopia	Survey of Large & Medium Scale Enterprises	Manufacturing Census	1996-2009 2012-2014	Manufacturing only	yes	Employment ≥ 10
	Survey of Large & Medium Scale Enterprises	Manufacturing Census	2010-2016	Manufacturing only	no	Employment ≥ 10
Tanzania	Annual Survey of Industrial Production (ASIP)	Manufacturing Census	2008-2012	Industrial sectors only	yes	Employment ≥ 10
	Census of Industrial Production (CIP)	Industrial Census	2013	All sectors	no	None
Bangladesh	Census of Manufacturing Industries (CMI)	Manufacturing Census	1995, 1997, 1999, 2001	Manufacturing only	yes	Employment ≥ 10
	Census of Manufacturing Industries (CMI)	Manufacturing Census	2005, 2012	Manufacturing only	no	Employment ≥ 10

TABLE 2: Descriptive Statistics

	Ethiopia: 1996-2016			Côte d'Ivoire: 2003-2014			Tanzania: 2008-2013			Bangladesh: 1995-2012		
Year	# of firms	# of workers	Median firm size	# of firms	# of workers	Median firm size	# of firms	# of workers	Median firm size	# of firms	# of workers	Median firm size
1995										28,769	2,016,638	70
1996	623	82,079	21									
1997	697	83,138	20							28,297	2,175,025	82
1998	725	81,764	20									
1999	725	89,508	21							26,969	2,230,087	103
2000	739	79,839	21									
2001	722	73,568	22							27, 276	2,801,441	86
2002	883	80,126	19									
2003	939	83,655	20	332	69,306	56						
2004	997	86,916	22	342	65,729	51						
2005*	763	86,161	35	339	60,596	54				27,461	2,347,769	90
2006	1,153	102,655	24	328	62,872	54						
2007	1,339	111,763	20	335	62,110	54						
2008	1,734	112,997	17	366	74,878	50	649	107,388	29			
2009	1,948	126,837	16	398	63,130	42	659	93,573	30			
2010	1,958	157,817	21	413	75,043	41	1,079	105,752	18			
2011	1,934	123,997	16	468	74,345	34	1,087	109,957	18			
2012	2,129	178,708	20	526	81,230	33	1,091	117,562	20	41,716	4,982,446	119
2013	2,388	202,347	21	569	74,820	33	998	107,732	22			
2014	2,405	196,637	20	591	91,373	32						
2015	2,718	200,390	15									
2016	2,719	227,971	17									

Table 3: Ethiopia
Decomposition of Aggregate Productivity Growth

Ethiopia Dynamic OP T=1	T=2	Aggregate Productivity	Surviving Firms: Δ Unweighted Productivity	Surviving Firms: Δ Covariance	Entering Firms	Exiting Firms
1996	1997	0.06	0.02	0.04	-0.02	0.02
1996	1998	0.01	-0.12	0.13	-0.03	0.03
1996	1999	0.09	-0.15	0.22	-0.03	0.04
1996	2000	0.19	-0.05	0.22	0.02	0.00
1996	2001	0.20	-0.20	0.21	0.11	0.09
1996	2002	0.02	-0.08	0.07	-0.01	0.04
1996	2003	0.20	-0.04	0.21	-0.01	0.05
1996	2004	0.28	0.06	0.19	-0.03	0.06
1996	2005	0.26	0.07	0.07	0.08	0.05
1996	2006	0.37	0.03	0.13	0.16	0.04
1996	2007	0.55	0.15	0.24	0.09	0.07
1996	2008	0.58	0.25	.023	-0.04	0.15
1996	2009	0.47	0.07	0.47	-0.17	0.09
…						
2012	2013	0.08	0.02	0.01	0.02	0.02
2013	2014	0.22	0.17	0.02	-0.08	0.11

Ethiopia Static OP T=1 T=2		Aggregate Productivity	Δ Unweighted Productivity	Δ Covariance
2006	2007	0.18	-0.05	0.23
2006	2008	0.22	-0.07	0.29
2006	2009	0.10	-0.19	0.29
2006	2010	0.08	0.33	-0.25
2006	2011	0.80	0.84	-0.04
2006	2012	0.17	0.32	-0.15
2006	2013	0.29	0.46	-0.17
2006	2014	0.39	0.56	-0.16
2006	2015	0.61	0.34	0.27
2006	2016	0.76	-0.07	0.76

Table 4: Côte d'Ivoire & Tanzania
Decomposition of Aggregate Productivity Growth

Côte d'Ivoire Dynamic OP		Aggregate Productivity	Surviving Firms		Entering Firms	Exiting Firms
			Δ Unweighted Productivity	Δ covariance		
T=1	T=2					
2004	2005	-0.02	-0.10	0.03	0.07	-0.01
2004	2006	-0.07	-0.10	0.00	-0.01	0.05
2004	2007	0.00	-0.01	-0.03	0.11	-0.07
2004	2008	-0.01	-0.05	0.01	0.08	-0.05
2004	2009	0.03	-0.11	-0.03	0.19	-0.02
2004	2010	0.20	-0.09	0.04	0.26	-0.01
2004	2011	-0.03	-0.27	0.12	0.10	0.02
2004	2012	0.27	-0.26	0.30	0.20	0.03
2004	2013	0.47	-0.20	0.28	0.39	0.00
2004	2014	0.06	-0.27	0.40	-0.01	-0.05

Tanzania Dynamic OP		Aggregate Productivity	Surviving Firms		Entering Firms	Exiting Firms
T=1	T=2		Δ Unweighted Productivity	Δ covariance		
2008	2009	0.22	0.22	-0.05	0.02	0.06
2008	2012	-0.14	-0.14	0.14	0.10	0.03
2008	2013	-0.08	-0.08	-0.02	0.25	0.01
2008	2014	-0.16	-0.16	0.05	0.17	-0.03

Table 5: Bangladesh
Decomposition of Aggregate Productivity Growth

Bangladesh Dynamic OP			Surviving Firms			
T=1	T=2	Aggregate Productivity	Δ Unweighted Productivity	Δ covariance	Entering Firms	Exiting Firms
1995	1997	0.13	-0.04	0.30	-0.35	0.21
1995	1999	0.01	-0.12	0.28	-0.21	0.06
1995	2001	0.33	-0.44	0.81	-0.19	0.16

Bangladesh Static OP				
T=1	T=2	Aggregate Productivity	Unweighted Productivity	Covariance
2001	2005	0.46	0.22	0.24
2001	2012	0.52	0.57	-0.05

Table 6:
Decomposition of Aggregate Productivity Growth by Firm Size

		Plants with 10-49 Workers					Plants with 50-199 Workers				
Country	Year	Aggregate Productivity	Δ Unweighted Productivity	Δ Cov	Entering Firms	Exiting Firms	Aggregate Productivity	Δ Unweighted Productivity	Δ Cov	Entering Firms	Exiting Firms
Ethiopia	1996-2001	1.16	-0.20	0.29	1.18	-0.12	0.11	-0.34	0.02	0.34	0.09
	1996-2006	0.48	0.35	-0.03	0.21	-0.05	0.44	-0.04	0.07	0.29	0.12
Côte d'Ivoire	2004-2009	-0.16	-0.13	0.08	0.41	-0.52	0.22	0.14	-0.27	0.48	-0.13
	2004-2014	-0.65	-0.20	0.10	0.15	-0.70	0.21	-0.17	0.18	0.43	-0.23
Tanzania	2008-2012	0.47	0.23	0.27	0.27	-0.31	-1.43	-0.59	-1.37	0.15	0.37
Bangladesh	1995-2001	0.13	-0.29	-0.21	0.32	0.31	0.02	-0.37	-0.09	0.27	0.20

		Plants with 200-499 Workers					Plants with 500+ Workers				
Country	Year	Aggregate Productivity	Δ Unweighted Productivity	Δ Cov	Entering Firms	Exiting Firms	Aggregate Productivity	Δ Unweighted Productivity	Δ Cov	Entering Firms	Exiting Firms
Ethiopia	1996-2001	-0.22	-0.14	-0.08	-0.13	0.013	0.30	-0.07	0.25	0.07	0.06
	1996-2006	0.02	0.13	-0.14	0.23	-0.20	0.55	-0.02	0.43	0.13	-0.01
Côte d'Ivoire	2004-2009	-0.06	-0.06	-0.35	0.28	0.07	-0.18	-0.10	-0.17	-0.03	0.12
	2004-2014	-0.48	.024	-0.08	-0.20	0.03	-1.47	-0.29	-0.14	-0.13	-0.91
Tanzania	2008-2012	-0.54	0.05	-0.73	-0.13	0.28	-0.34	0.19	-0.25	0.05	-0.33
Bangladesh	1995-2001	0.12	-0.04	-0.15	0.29	0.01	-0.06	0.06	0.27	-0.36	-0.03

Table 7:
Decomposition of Aggregate Productivity Growth by Industry

		Garments & Textiles					Food & Beverages				
Country	Year	Aggregate Productivity	Δ Unweighted Productivity	Δ Cov	Entering Firms	Exiting Firms	Aggregate Productivity	Δ Unweighted Productivity	ΔCov	Entering Firms	Exiting Firms
Ethiopia	1996-2001	0.25	-0.27	0.35	0.19	-0.03	0.01	-0.32	0.04	0.16	0.12
	1996-2006	0.54	0.05	-0.07	0.56	-0.02	0.11	-0.17	0.26	-0.04	0.07
Côte d'Ivoire	2004-2009	-0.40	-0.52	0.04	0.09	-0.01	-0.24	-0.13	-0.32	0.05	0.16
	2004-2014	-1.03	-1.26	0.00	-0.82	1.05	-1.25	-0.36	0.10	-0.42	0.56
Tanzania	2008-2012	-0.50	-0.14	-0.36	0.02	-0.03	-0.70	0.16	-0.93	0.05	0.03
Bangladesh	1995-2001	0.33	-0.44	0.81	-0.19	0.16	0.47	0.01	-0.28	0.64	0.10

		Furniture				
Country	Year	Aggregate Productivity	Δ Unweighted Productivity	ΔCov	Entering Firms	Exiting Firms
Ethiopia	1996-2001	-0.02	-0.47	0.72	-0.25	-0.02
	1996-2006	0.36	0.59	0.55	-0.59	-0.20
Côte d'Ivoire	2004-2009	-0.24	-0.05	0.07	-0.31	0.05
	2004-2014	0.19	-0.27	0.39	-0.25	0.32
Tanzania	2008-2012	-0.47	0.34	-0.36	0.00	-0.45
Bangladesh	1995-2001	-2.34	0.06	-2.25	0.58	-0.72

Table 8: Impact of Trade Exposure on Productivity: Ethiopia

	Plant-Level TFP	Plant-Level TFP
Exporter	0.631***	0.709***
	(0.134)	(0.140)
Exporter*2013	-0.231	-0.167
	(0.182)	(0.185)
Exporter*2014	-0.0328	-0.111
	(0.178)	(0.183)
Exiting firm	-0.215***	-0.197***
	(0.0438)	(0.0448)
Exporter*Exiting Firm		-0.376
		(0.203)
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Observations	6,004	6,004
R^2	0.113	0.114

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 9: Impact of Trade Exposure on Productivity: Cote d'Ivoire

	Plant-Level TFP	Plant-Level TFP
Exporter	0.514***	0.489***
	(0.0549)	(0.0603)
Exporter*2011	-0.0696	-0.0646
	(0.218)	(0.218)
Exporter*2012	0.107	0.0962
	(0.215)	(0.215)
Exporter*2013	0.109	0.0994
	(0.220)	(0.220)
Exporter*2014	0.0635	0.0864
	(0.228)	(0.229)
Exiting firm	-0.0246	-0.0409
	(0.0397)	(0.0431)
Exporter*Exiting Firm		0.105
		(0.109)
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Observations	6,515	6,515
R^2	0.161	0.161

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 10: Impact of Trade Exposure on Productivity: Tanzania

	Plant-Level TFP	Plant-Level TFP
Exporter	0.539*	0.526*
	(0.253)	(0.262)
Exporter*2009	-0.489	-0.497
	(0.394)	(0.397)
Exporter*2010	-0.197	-0.192
	(0.398)	(0.399)
Exporter*2011	0.252	0.251
	(0.381)	(0.381)
Exporter*2012	-0.299	-0.286
	(0.384)	(0.390)
Exiting firm	-0.0891	-0.101
	(0.136)	(0.150)
Exporter*Exiting Firm		0.0699
		(0.362)
Year Fixed Effects	Yes	Yes
Industry Fixed Effects	Yes	Yes
Observations	789	789
R^2	0.095	0.095

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 1a: Ethiopia:

Firm Count & Employment by Firm Size

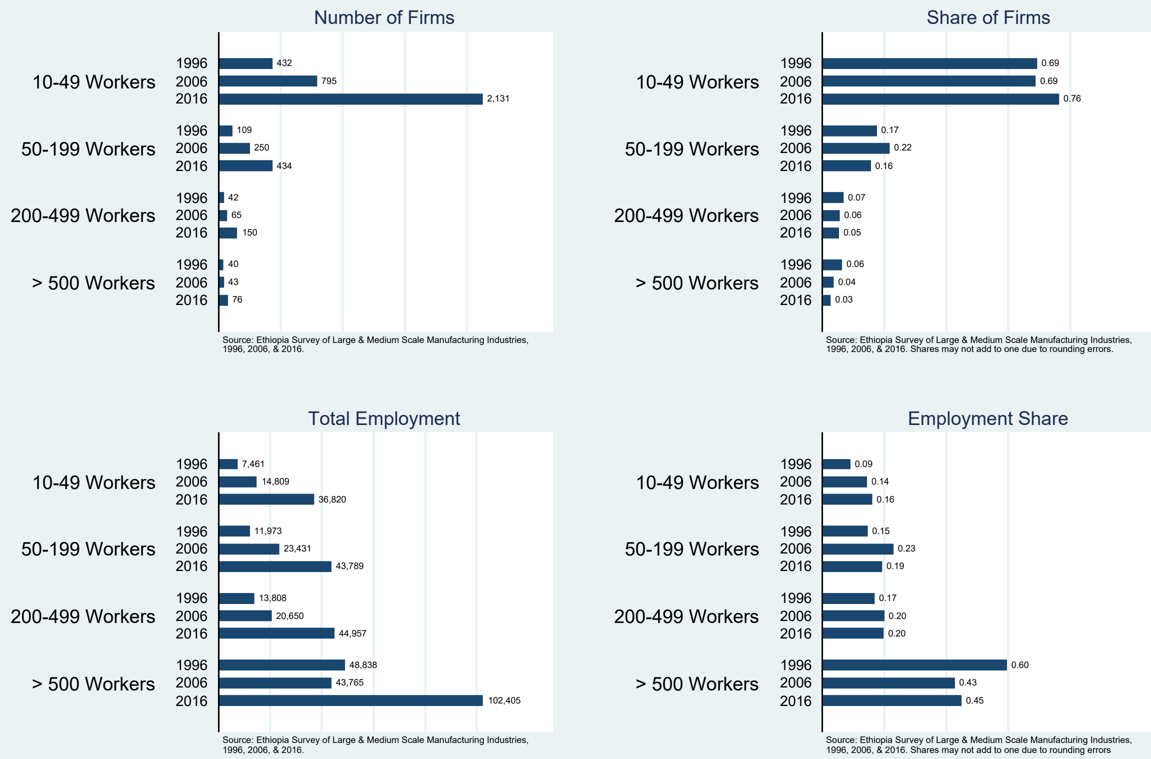
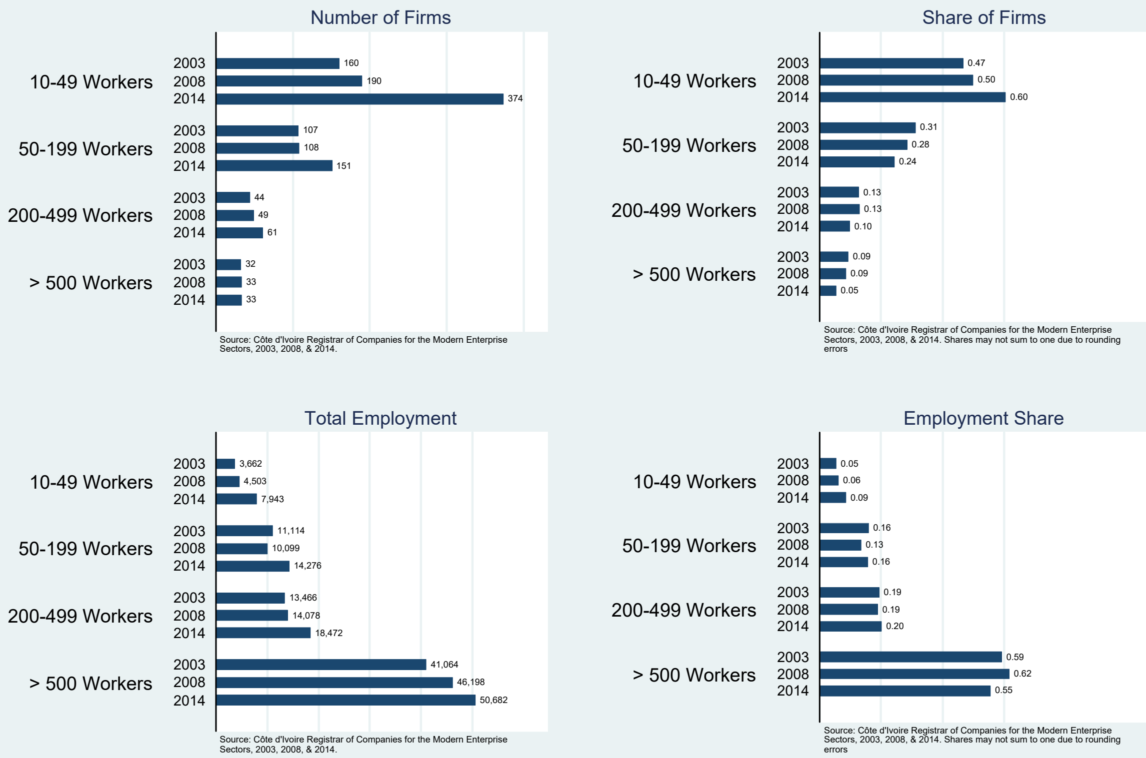


Figure 1b: Côte d'Ivoire

Firm Count & Employment by Firm Size



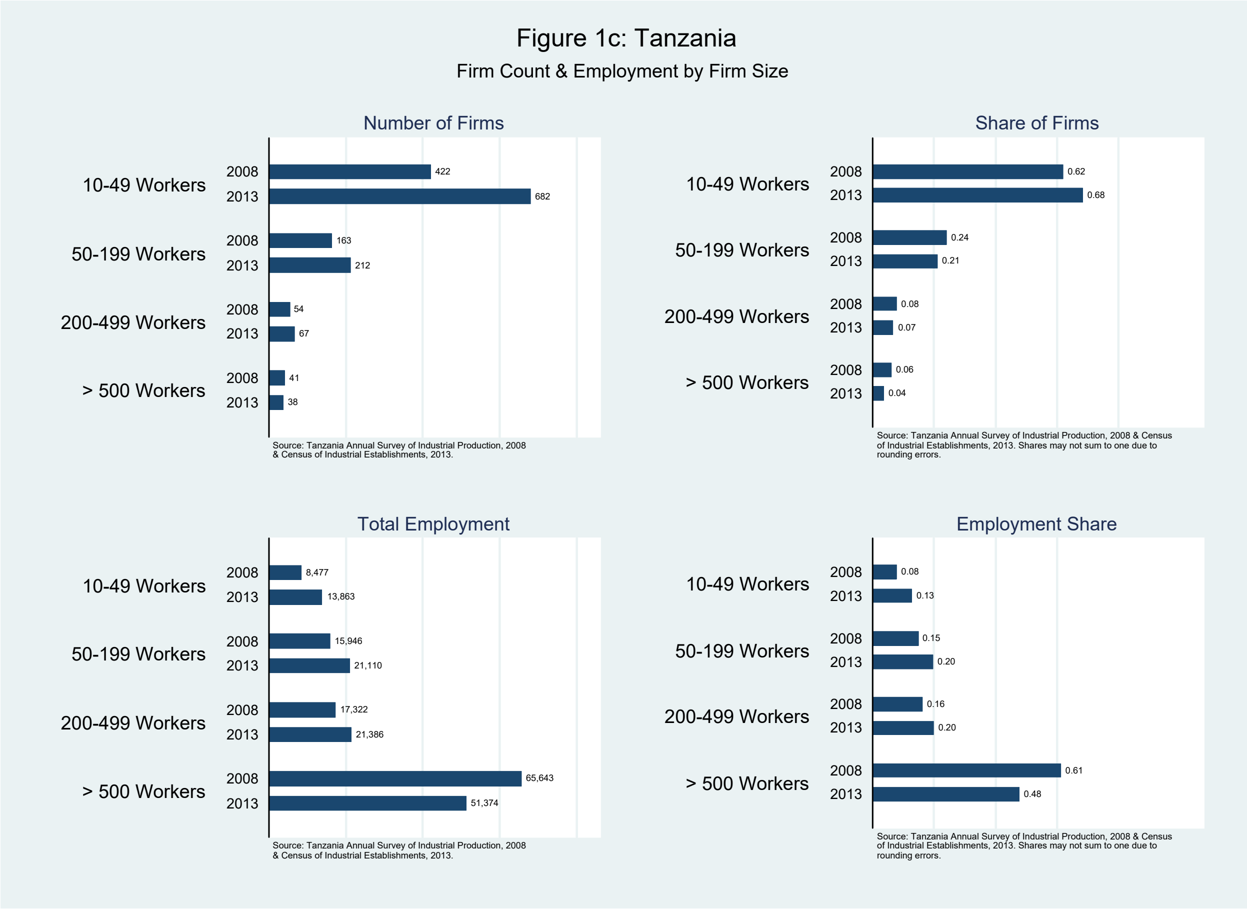
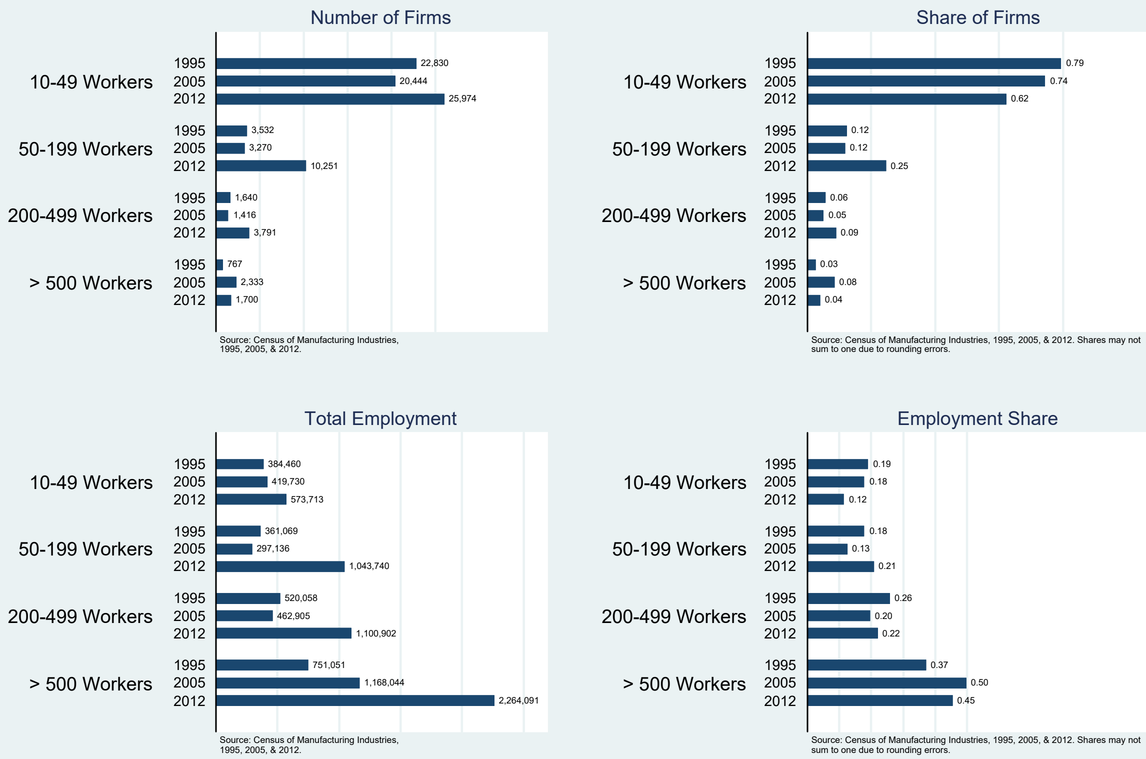


Figure 1c: Tanzania
Firm Count & Employment by Firm Size
Number of Firms
10-49 Workers
2008 422
2013 682
50-199 Workers
2008 163
2013 212
200-499 Workers
2008 54
2013 67
> 500 Workers
2008 41
2013 38
Source: Tanzania Annual Survey of Industrial Production, 2008 & Census of Industrial Establishments, 2013.
Share of Firms
10-49 Workers
2008 0.62
2013 0.68
50-199 Workers
2008 0.24
2013 0.21
200-499 Workers
2008 0.08
2013 0.07
> 500 Workers
2008 0.06
2013 0.04
Source: Tanzania Annual Survey of Industrial Production, 2008 & Census of Industrial Establishments, 2013. Shares may not sum to one due to rounding errors.
Total Employment
10-49 Workers
2008 8,477
2013 13,863
50-199 Workers
2008 15,946
2013 21,110
200-499 Workers
2008 17,322
2013 21,386
> 500 Workers
2008 65,643
2013 51,374
Source: Tanzania Annual Survey of Industrial Production, 2008 & Census of Industrial Establishments, 2013.
Employment Share
10-49 Workers
2008 0.08
2013 0.13
50-199 Workers
2008 0.15
2013 0.20
200-499 Workers
2008 0.16
2013 0.20
> 500 Workers
2008 0.61
2013 0.48
Source: Tanzania Annual Survey of Industrial Production, 2008 & Census of Industrial Establishments, 2013. Shares may not sum to one due to rounding errors.

Figure 1e: Bangladesh

Firm Count & Employment by Firm Size



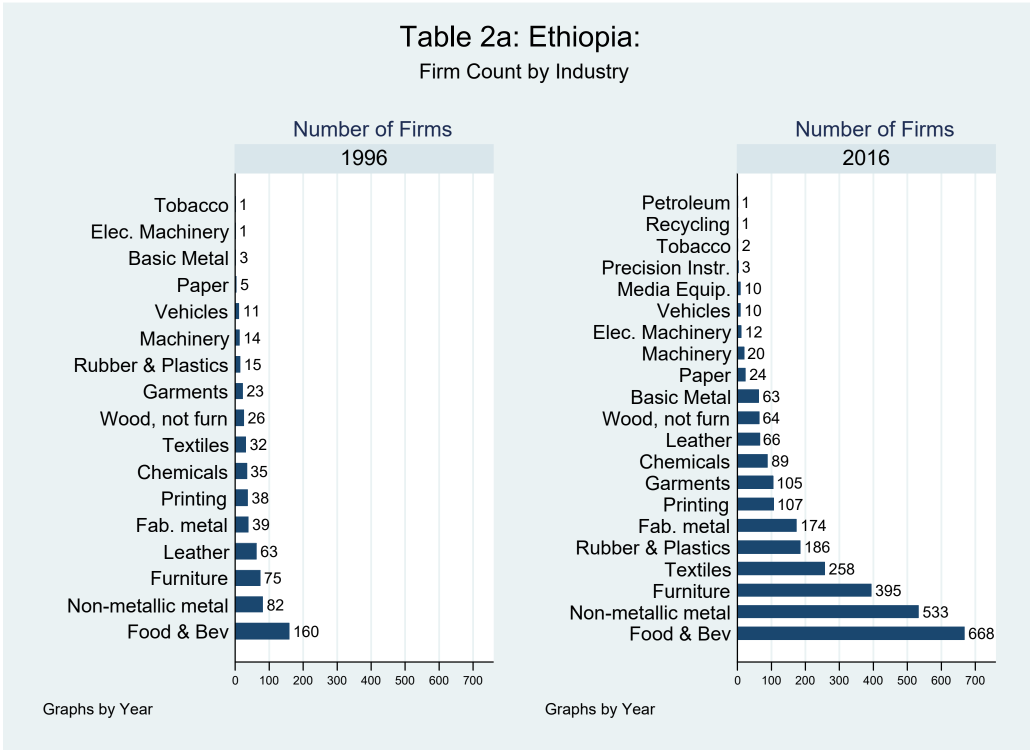


Table 2a: Ethiopia:
Firm Count by Industry
Number of Firms
1996
Tobacco 1
Elec. Machinery 1
Basic Metal 3
Paper 5
Vehicles 11
Machinery 14
Rubber & Plastics 15
Garments 23
Wood, not furn 26
Textiles 32
Chemicals 35
Printing 38
Fab. metal 39
Leather 63
Furniture 75
Non-metallic metal 82
Food & Bev 160
0 100 200 300 400 500 600 700
Graphs by Year
Number of Firms
2016
Petroleum 1
Recycling 1
Tobacco 2
Precision Instr. 3
Media Equip. 10
Vehicles 10
Elec. Machinery 12
Machinery 20
Paper 24
Basic Metal 63
Wood, not furn 64
Leather 66
Chemicals 89
Garments 105
Printing 107
Fab. metal 174
Rubber & Plastics 186
Textiles 258
Furniture 395
Non-metallic metal 533
Food & Bev 668
0 100 200 300 400 500 600 700
Graphs by Year

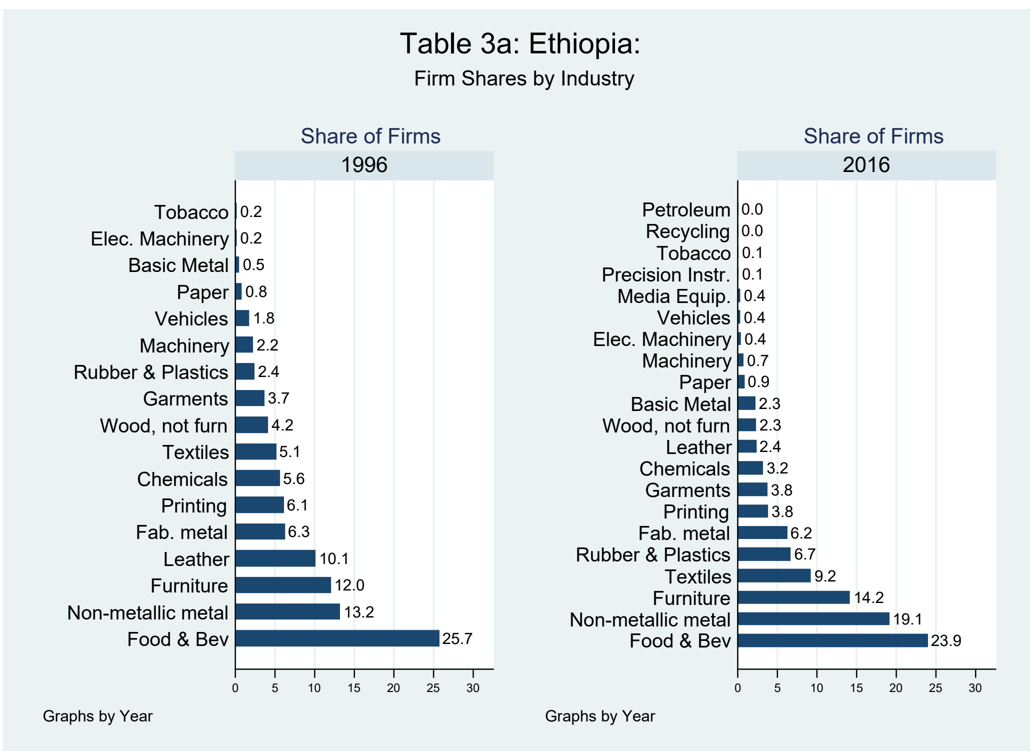


Table 3a: Ethiopia:
Firm Shares by Industry
Share of Firms
1996
Tobacco 0.2
Elec. Machinery 0.2
Basic Metal 0.5
Paper 0.8
Vehicles 1.8
Machinery 2.2
Rubber & Plastics 2.4
Garments 3.7
Wood, not furn 4.2
Textiles 5.1
Chemicals 5.6
Printing 6.1
Fab. metal 6.3
Leather 10.1
Furniture 12.0
Non-metallic metal 13.2
Food & Bev 25.7
0 5 10 15 20 25 30
Graphs by Year
Share of Firms
2016
Petroleum 0.0
Recycling 0.0
Tobacco 0.1
Precision Instr. 0.1
Media Equip. 0.4
Vehicles 0.4
Elec. Machinery 0.4
Machinery 0.7
Paper 0.9
Basic Metal 2.3
Wood, not furn 2.3
Leather 2.4
Chemicals 3.2
Garments 3.8
Printing 3.8
Fab. metal 6.2
Rubber & Plastics 6.7
Textiles 9.2
Furniture 14.2
Non-metallic metal 19.1
Food & Bev 23.9
0 5 10 15 20 25 30
Graphs by Year

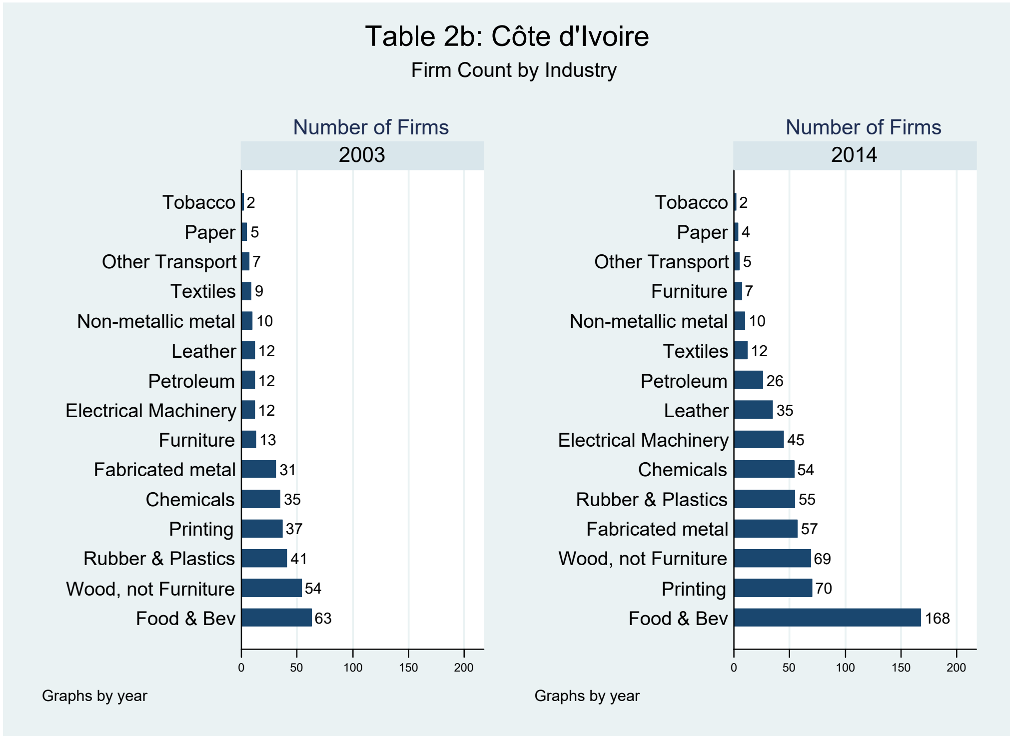


Table 2b: Côte d'Ivoire
Firm Count by Industry
Number of Firms
2003
Tobacco 2
Paper 5
Other Transport 7
Textiles 9
Non-metallic metal 10
Leather 12
Petroleum 12
Electrical Machinery 12
Furniture 13
Fabricated metal 31
Chemicals 35
Printing 37
Rubber & Plastics 41
Wood, not Furniture 54
Food & Bev 63
0 50 100 150 200
Graphs by year
Number of Firms
2014
Tobacco 2
Paper 4
Other Transport 5
Furniture 7
Non-metallic metal 10
Textiles 12
Petroleum 26
Leather 35
Electrical Machinery 45
Chemicals 54
Rubber & Plastics 55
Fabricated metal 57
Wood, not Furniture 69
Printing 70
Food & Bev 168
0 50 100 150 200
Graphs by year

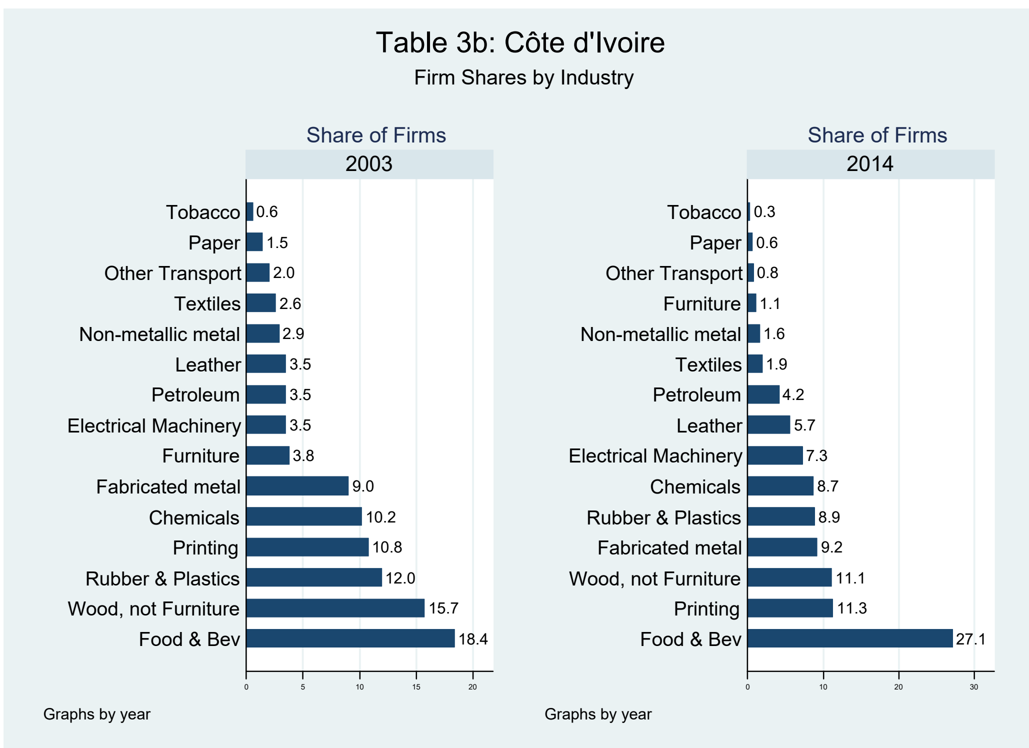


Table 3b: Côte d'Ivoire
Firm Shares by Industry
Share of Firms
2003
Tobacco 0.6
Paper 1.5
Other Transport 2.0
Textiles 2.6
Non-metallic metal 2.9
Leather 3.5
Petroleum 3.5
Electrical Machinery 3.5
Furniture 3.8
Fabricated metal 9.0
Chemicals 10.2
Printing 10.8
Rubber & Plastics 12.0
Wood, not Furniture 15.7
Food & Bev 18.4
0 5 10 15 20
Graphs by year
Share of Firms
2014
Tobacco 0.3
Paper 0.6
Other Transport 0.8
Furniture 1.1
Non-metallic metal 1.6
Textiles 1.9
Petroleum 4.2
Leather 5.7
Electrical Machinery 7.3
Chemicals 8.7
Rubber & Plastics 8.9
Fabricated metal 9.2
Wood, not Furniture 11.1
Printing 11.3
Food & Bev 27.1
0 10 20 30
Graphs by year

Table 2c: Tanzania

Firm Count by Industry

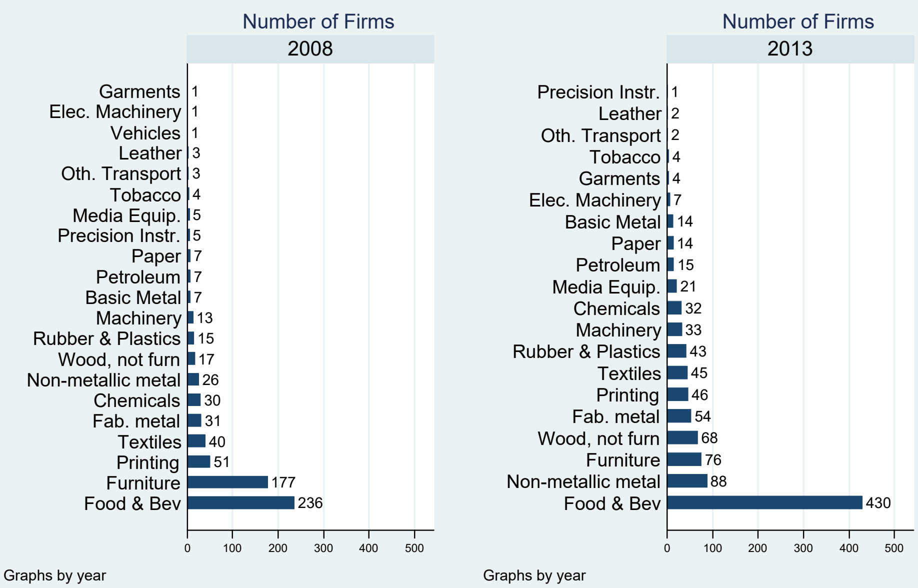
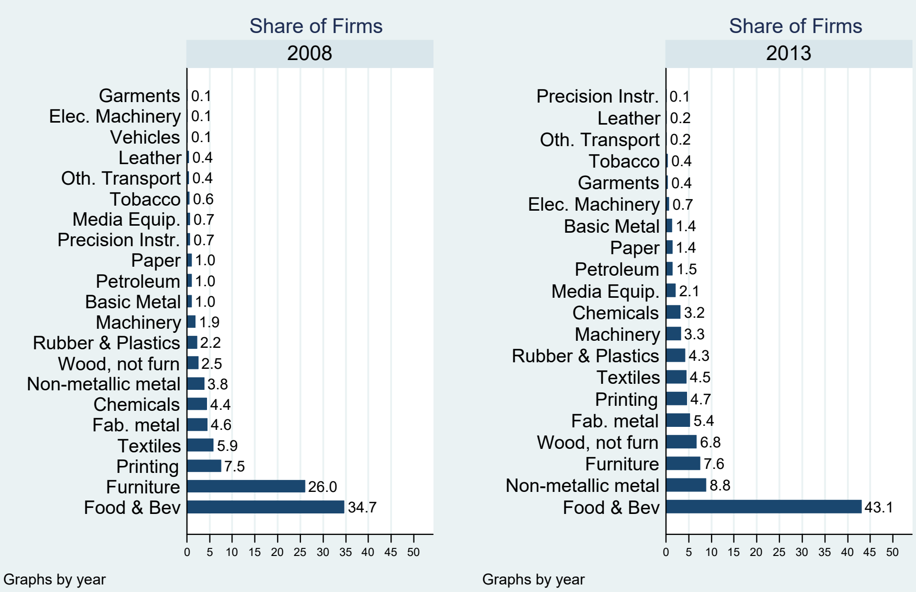


Table 3c: Tanzania

Firm Shares by Industry



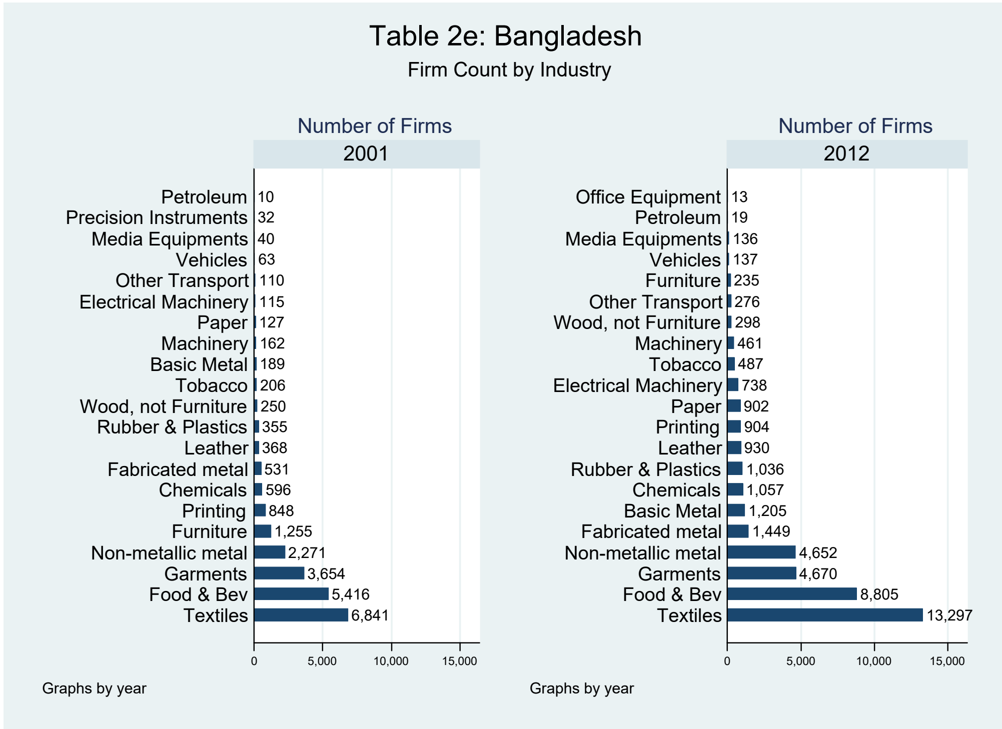


Table 2e: Bangladesh
Firm Count by Industry
Number of Firms
2001
Petroleum 10
Precision Instruments 32
Media Equipments 40
Vehicles 63
Other Transport 110
Electrical Machinery 115
Paper 127
Machinery 162
Basic Metal 189
Tobacco 206
Wood, not Furniture 250
Rubber & Plastics 355
Leather 368
Fabricated metal 531
Chemicals 596
Printing 848
Furniture 1,255
Non-metallic metal 2,271
Garments 3,654
Food & Bev 5,416
Textiles 6,841
0
5,000
10,000
15,000
Graphs by year
Number of Firms
2012
Office Equipment 13
Petroleum 19
Media Equipments 136
Vehicles 137
Furniture 235
Other Transport 276
Wood, not Furniture 298
Machinery 461
Tobacco 487
Electrical Machinery 738
Paper 902
Printing 904
Leather 930
Rubber & Plastics 1,036
Chemicals 1,057
Basic Metal 1,205
Fabricated metal 1,449
Non-metallic metal 4,652
Garments 4,670
Food & Bev 8,805
Textiles 13,297
0
5,000
10,000
15,000
Graphs by year

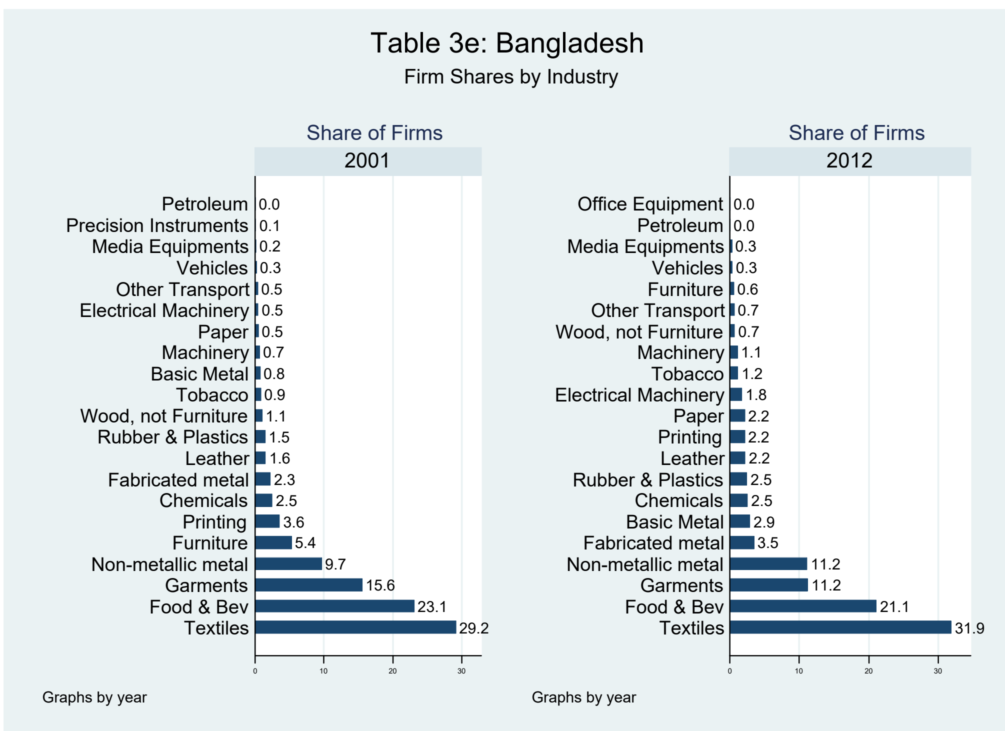


Table 3e: Bangladesh
Firm Shares by Industry
Share of Firms
2001
Petroleum 0.0
Precision Instruments 0.1
Media Equipments 0.2
Vehicles 0.3
Other Transport 0.5
Electrical Machinery 0.5
Paper 0.5
Machinery 0.7
Basic Metal 0.8
Tobacco 0.9
Wood, not Furniture 1.1
Rubber & Plastics 1.5
Leather 1.6
Fabricated metal 2.3
Chemicals 2.5
Printing 3.6
Furniture 5.4
Non-metallic metal 9.7
Garments 15.6
Food & Bev 23.1
Textiles 29.2
Graphs by year
Share of Firms
2012
Office Equipment 0.0
Petroleum 0.0
Media Equipments 0.3
Vehicles 0.3
Furniture 0.6
Other Transport 0.7
Wood, not Furniture 0.7
Machinery 1.1
Tobacco 1.2
Electrical Machinery 1.8
Paper 2.2
Printing 2.2
Leather 2.2
Rubber & Plastics 2.5
Chemicals 2.5
Basic Metal 2.9
Fabricated metal 3.5
Non-metallic metal 11.2
Garments 11.2
Food & Bev 21.1
Textiles 31.9
Graphs by year

Table 4a: Ethiopia:

Employment by Industry

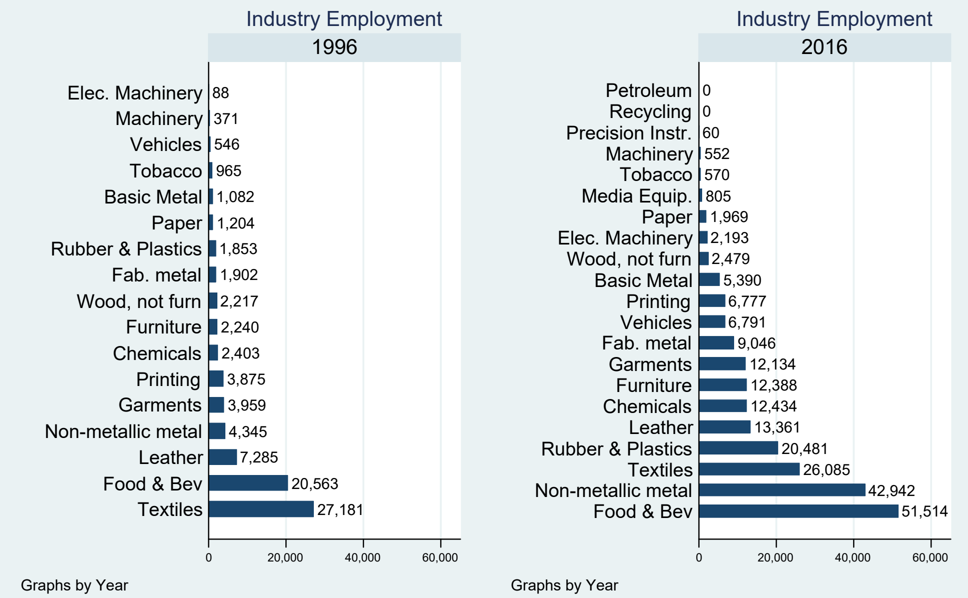
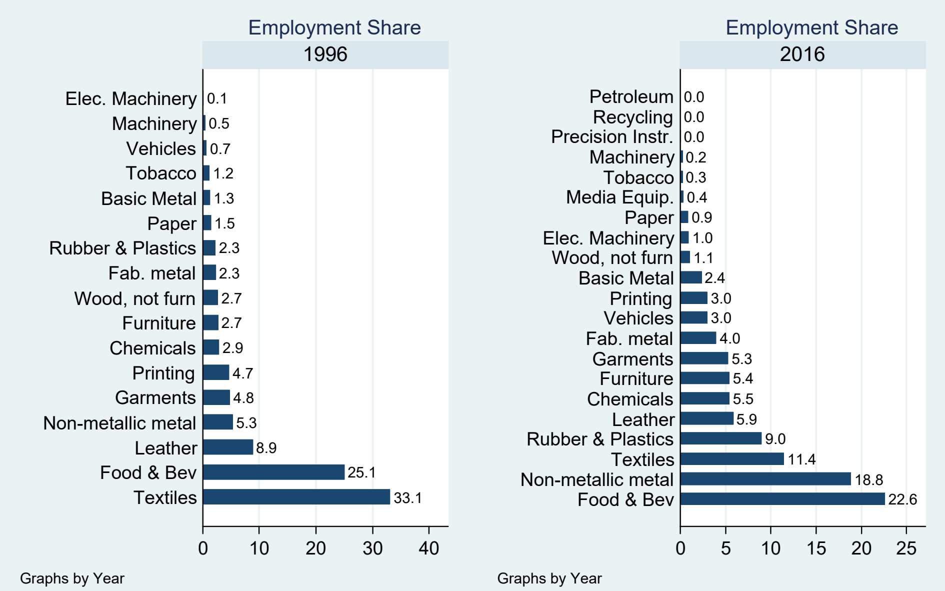


Table 5a: Ethiopia:

Employment Shares by Industry



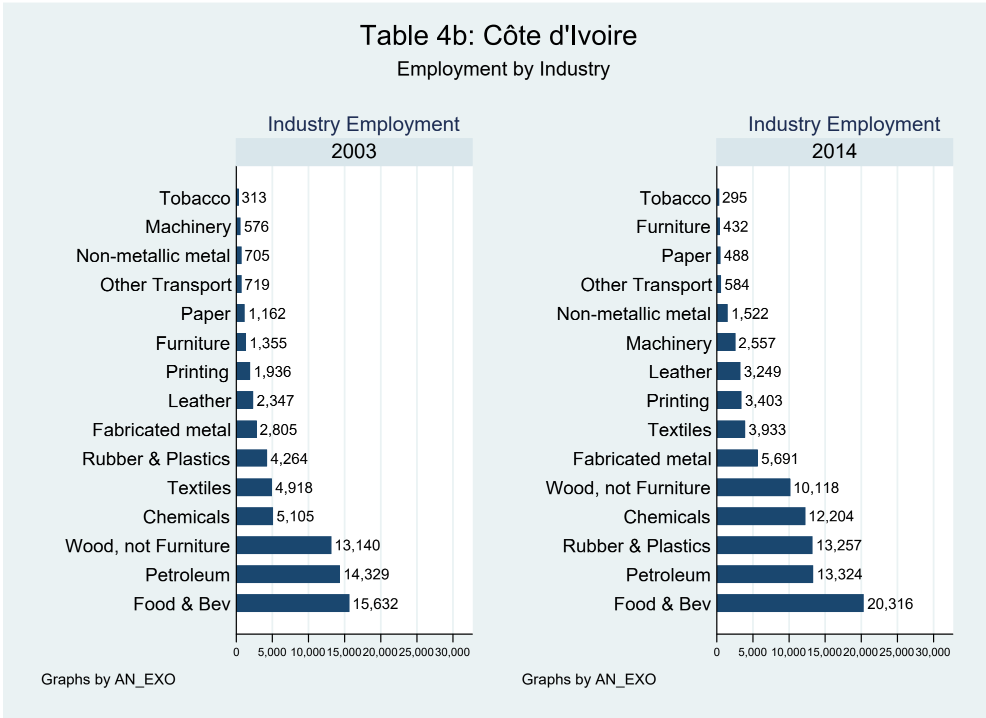


Table 4b: Côte d'Ivoire
Employment by Industry
Industry Employment
2003
Tobacco 313
Machinery 576
Non-metallic metal 705
Other Transport 719
Paper 1,162
Furniture 1,355
Printing 1,936
Leather 2,347
Fabricated metal 2,805
Rubber & Plastics 4,264
Textiles 4,918
Chemicals 5,105
Wood, not Furniture 13,140
Petroleum 14,329
Food & Bev 15,632
0 5,000 10,000 15,000 20,000 25,000 30,000
Graphs by AN_EXO
Industry Employment
2014
Tobacco 295
Furniture 432
Paper 488
Other Transport 584
Non-metallic metal 1,522
Machinery 2,557
Leather 3,249
Printing 3,403
Textiles 3,933
Fabricated metal 5,691
Wood, not Furniture 10,118
Chemicals 12,204
Rubber & Plastics 13,257
Petroleum 13,324
Food & Bev 20,316
0 5,000 10,000 15,000 20,000 25,000 30,000
Graphs by AN_EXO

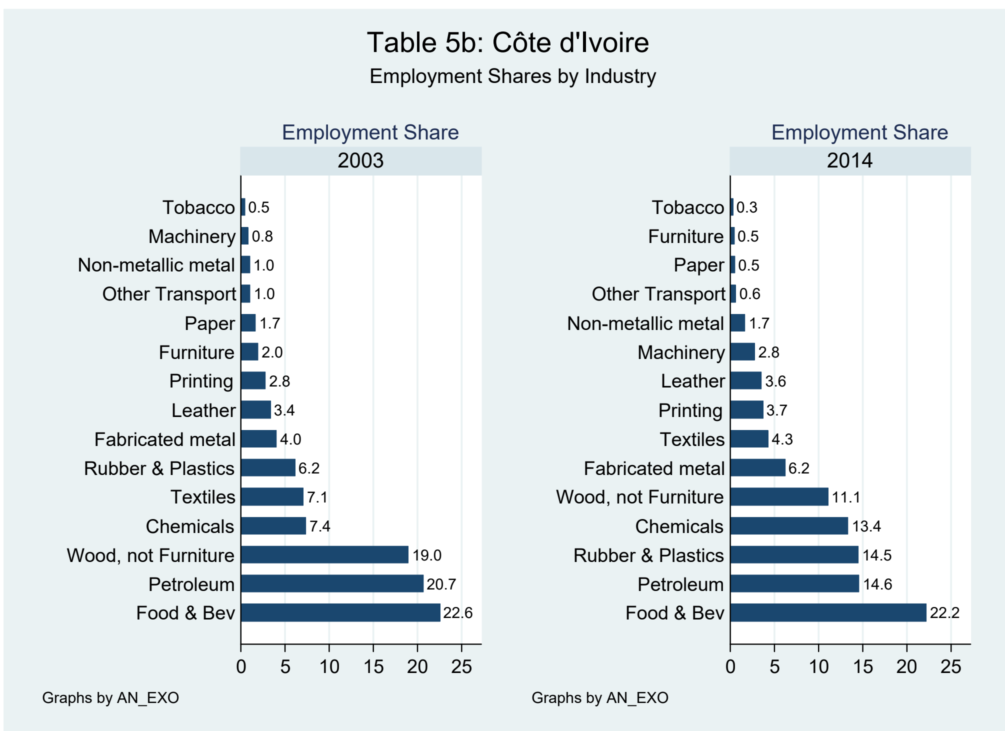


Table 5b: Côte d'Ivoire
Employment Shares by Industry
Employment Share
2003
Tobacco 0.5
Machinery 0.8
Non-metallic metal 1.0
Other Transport 1.0
Paper 1.7
Furniture 2.0
Printing 2.8
Leather 3.4
Fabricated metal 4.0
Rubber & Plastics 6.2
Textiles 7.1
Chemicals 7.4
Wood, not Furniture 19.0
Petroleum 20.7
Food & Bev 22.6
0 5 10 15 20 25
Graphs by AN_EXO
Employment Share
2014
Tobacco 0.3
Furniture 0.5
Paper 0.5
Other Transport 0.6
Non-metallic metal 1.7
Machinery 2.8
Leather 3.6
Printing 3.7
Textiles 4.3
Fabricated metal 6.2
Wood, not Furniture 11.1
Chemicals 13.4
Rubber & Plastics 14.5
Petroleum 14.6
Food & Bev 22.2
0 5 10 15 20 25
Graphs by AN_EXO

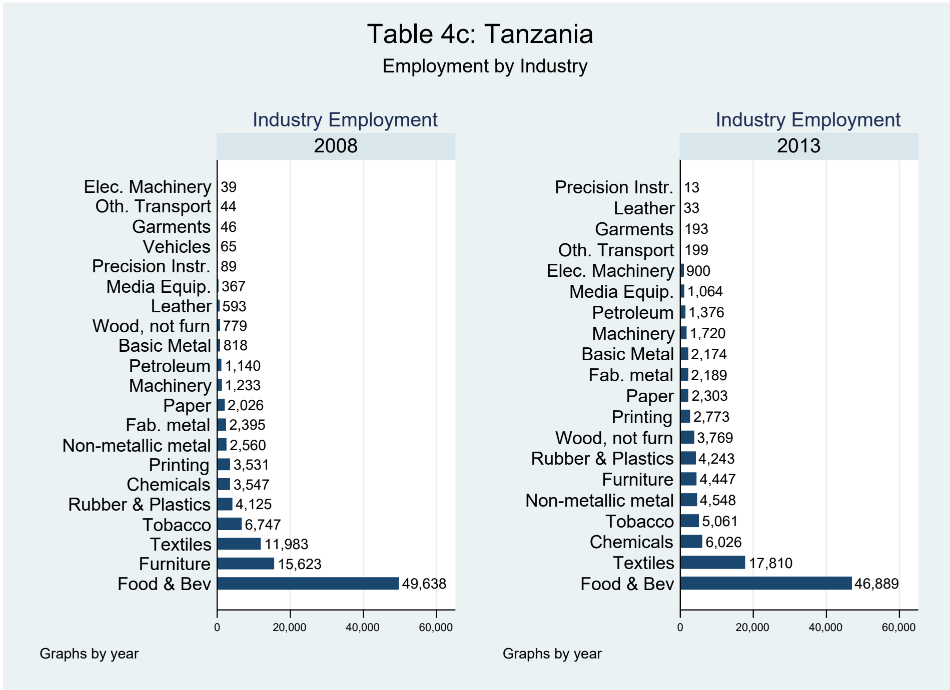


Table 4c: Tanzania
Employment by Industry
Industry Employment
2008
Elec. Machinery 39
Oth. Transport 44
Garments 46
Vehicles 65
Precision Instr. 89
Media Equip. 367
Leather 593
Wood, not furn 779
Basic Metal 818
Petroleum 1,140
Machinery 1,233
Paper 2,026
Fab. metal 2,395
Non-metallic metal 2,560
Printing 3,531
Chemicals 3,547
Rubber & Plastics 4,125
Tobacco 6,747
Textiles 11,983
Furniture 15,623
Food & Bev 49,638
0
20,000
40,000
60,000
Graphs by year
Industry Employment
2013
Precision Instr. 13
Leather 33
Garments 193
Oth. Transport 199
Elec. Machinery 900
Media Equip. 1,064
Petroleum 1,376
Machinery 1,720
Basic Metal 2,174
Fab. metal 2,189
Paper 2,303
Printing 2,773
Wood, not furn 3,769
Rubber & Plastics 4,243
Furniture 4,447
Non-metallic metal 4,548
Tobacco 5,061
Chemicals 6,026
Textiles 17,810
Food & Bev 46,889
0
20,000
40,000
60,000
Graphs by year

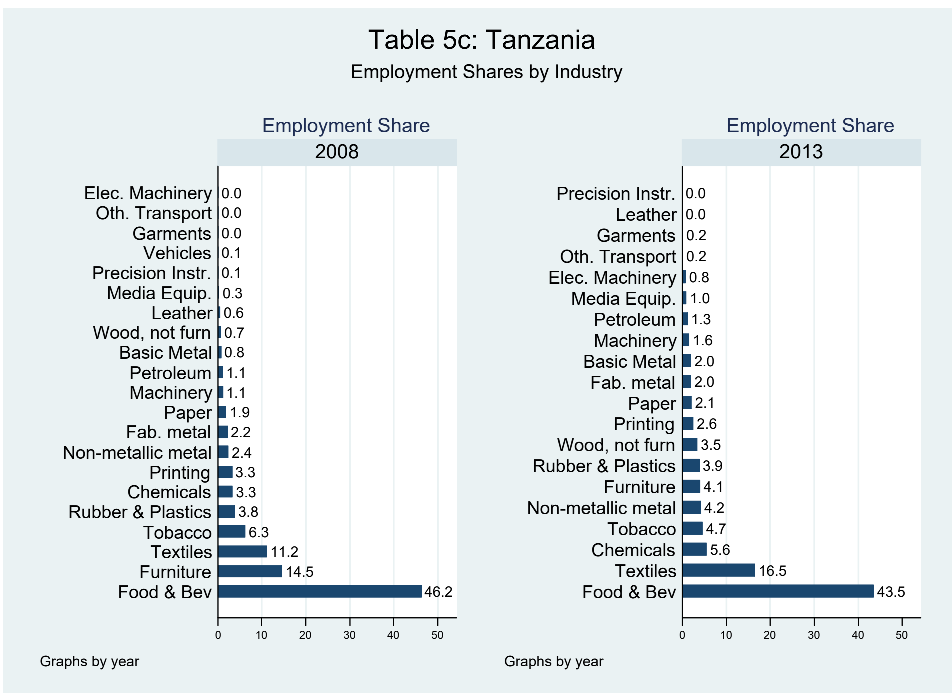


Table 5c: Tanzania
Employment Shares by Industry
Employment Share
2008
Elec. Machinery 0.0
Oth. Transport 0.0
Garments 0.0
Vehicles 0.1
Precision Instr. 0.1
Media Equip. 0.3
Leather 0.6
Wood, not furn 0.7
Basic Metal 0.8
Petroleum 1.1
Machinery 1.1
Paper 1.9
Fab. metal 2.2
Non-metallic metal 2.4
Printing 3.3
Chemicals 3.3
Rubber & Plastics 3.8
Tobacco 6.3
Textiles 11.2
Furniture 14.5
Food & Bev 46.2
0
10
20
30
40
50
Graphs by year
Employment Share
2013
Precision Instr. 0.0
Leather 0.0
Garments 0.2
Oth. Transport 0.2
Elec. Machinery 0.8
Media Equip. 1.0
Petroleum 1.3
Machinery 1.6
Basic Metal 2.0
Fab. metal 2.0
Paper 2.1
Printing 2.6
Wood, not furn 3.5
Rubber & Plastics 3.9
Furniture 4.1
Non-metallic metal 4.2
Tobacco 4.7
Chemicals 5.6
Textiles 16.5
Food & Bev 43.5
0
10
20
30
40
50
Graphs by year

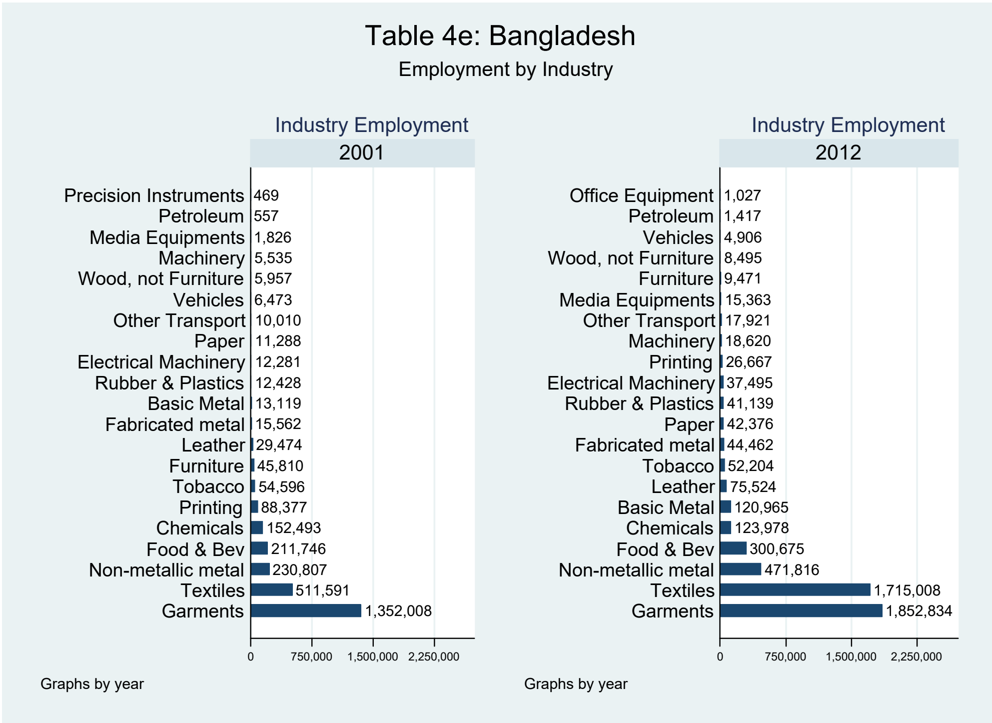


Table 4e: Bangladesh
Employment by Industry
Industry Employment
2001
Precision Instruments 469
Petroleum 557
Media Equipments 1,826
Machinery 5,535
Wood, not Furniture 5,957
Vehicles 6,473
Other Transport 10,010
Paper 11,288
Electrical Machinery 12,281
Rubber & Plastics 12,428
Basic Metal 13,119
Fabricated metal 15,562
Leather 29,474
Furniture 45,810
Tobacco 54,596
Printing 88,377
Chemicals 152,493
Food & Bev 211,746
Non-metallic metal 230,807
Textiles 511,591
Garments 1,352,008
0
750,000
1,500,000
2,250,000
Graphs by year
Industry Employment
2012
Office Equipment 1,027
Petroleum 1,417
Vehicles 4,906
Wood, not Furniture 8,495
Furniture 9,471
Media Equipments 15,363
Other Transport 17,921
Machinery 18,620
Printing 26,667
Electrical Machinery 37,495
Rubber & Plastics 41,139
Paper 42,376
Fabricated metal 44,462
Tobacco 52,204
Leather 75,524
Basic Metal 120,965
Chemicals 123,978
Food & Bev 300,675
Non-metallic metal 471,816
Textiles 1,715,008
Garments 1,852,834
0
750,000
1,500,000
2,250,000
Graphs by year

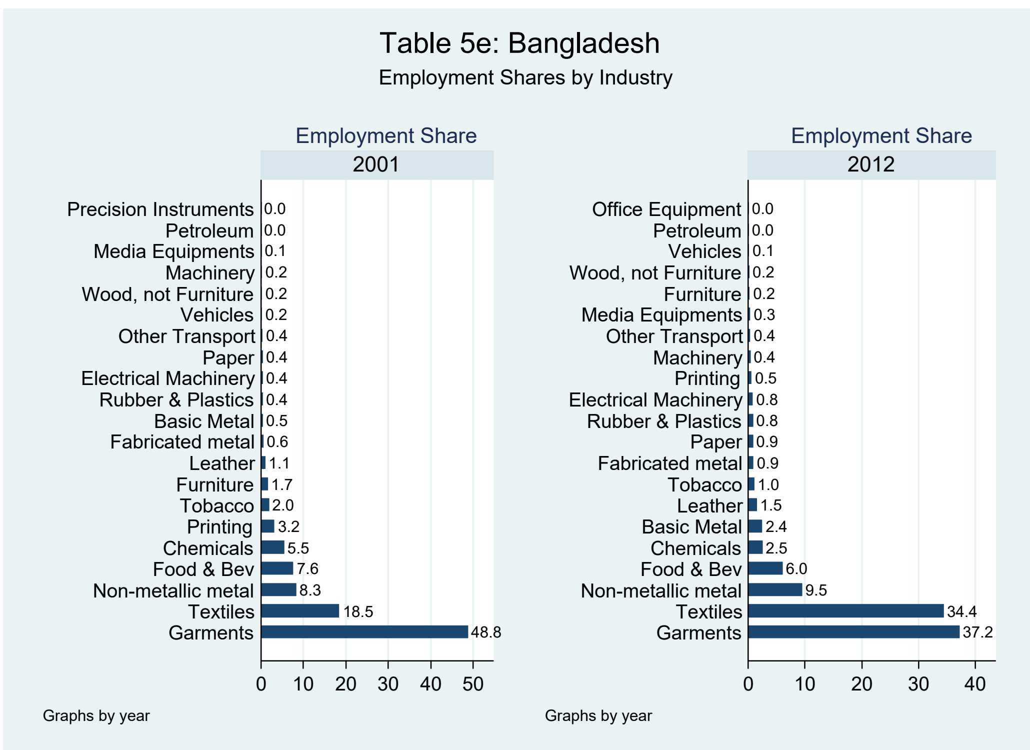


Table 5e: Bangladesh
Employment Shares by Industry
Employment Share
2001
Precision Instruments 0.0
Petroleum 0.0
Media Equipments 0.1
Machinery 0.2
Wood, not Furniture 0.2
Vehicles 0.2
Other Transport 0.4
Paper 0.4
Electrical Machinery 0.4
Rubber & Plastics 0.4
Basic Metal 0.5
Fabricated metal 0.6
Leather 1.1
Furniture 1.7
Tobacco 2.0
Printing 3.2
Chemicals 5.5
Food & Bev 7.6
Non-metallic metal 8.3
Textiles 18.5
Garments 48.8
0 10 20 30 40 50
Graphs by year
Employment Share
2012
Office Equipment 0.0
Petroleum 0.0
Vehicles 0.1
Wood, not Furniture 0.2
Furniture 0.2
Media Equipments 0.3
Other Transport 0.4
Machinery 0.4
Printing 0.5
Electrical Machinery 0.8
Rubber & Plastics 0.8
Paper 0.9
Fabricated metal 0.9
Tobacco 1.0
Leather 1.5
Basic Metal 2.4
Chemicals 2.5
Food & Bev 6.0
Non-metallic metal 9.5
Textiles 34.4
Garments 37.2
0 10 20 30 40
Graphs by year