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Corporate Taxation, Import Competition and Productivity: Evidence from Ethiopian Manufacturing

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Abstract

Firms' behaviors and performances have crucial implications for any economy in terms of employment creation, foreign exchange generation, resource mobilization, growth acceleration and welfare improvement. Whether firms thrive depends on a multiplicity of factors that characterize the economic environment in which they operate. Varieties of domestic policies as well as shifts in the global economic landscape shape this economic environment. One important domestic policy is a country's corporate taxation, which can influence firms' decisions such as exporting, outsourcing, investing on capital and R&D activities. On the other hand, a series of economic partnership agreements have rendered fragmentation of the global value chain and intense import competition to be the essential characteristics of the current economic environment. Under these circumstances, resources and market are reallocated away from the less productive firms into more productive ones. Consequently, low-productivity firms are likely to exit whereas their high-productivity counterparts are likely to survive, experience growth, and integrate their activities to the global market via trade and investment.

Given the importance of any given country's policy settings and evolving global economic environment, this paper examines the causal effect of corporate taxation and import competition on firms' export and investment decisions as well as productivity growth at the firm and industry levels. The study uses a firm-level panel data on Ethiopian manufacturing firms over the period 1996-2010. The analysis first describes patterns of firm turnover, export participation, and investment; characterizes features of exporting and investing firms, and summarizes industry-level productivity dispersion. Afterwards, reduced-forms of the export, investment and productivity growth equations are separately estimated to obtain the causal effect of corporate taxation and import competition. Finally, key elements of the investment climate that constrain the business operations of Ethiopian firms are assessed, and this is presented in juxtaposition with firms of selected African countries.

From a simple description of the data, it is shown that there is a positive net entry (2.8%) and significant firm turnover rate (21-24%) annually. Furthermore, almost half of the firms (49%) undertake investment each year. By contrast, the export participation rate is quite low (5%). There is also a marked variation in the prevalence of export participation and capital investment across industries and over time. Relatedly, exporting and investing firms are more productive, larger and employ more inputs per unit of labor compared to firms that are active in only one or none of these activities. At the industry level, the data displays substantial heterogeneity in which high-productivity firms coexist alongside those with a rather low productivity.

In terms of aggregate productivity, the Ethiopian manufacturing has undergone through a rapid growth (21% annually). While there is no effect of taxation, import competition promotes productivity growth. It is also found that firm productivity growth increases when the productivity of the technical frontier firm rises. Moreover, the results imply industry convergence in which low-productivity firms experience faster growth compared to high-productivity firms.

For policy purposes, it is necessary to point out that most firms view the tax rate and tax administration issues to be relatively less restrictive to their business operations compared to shortage of materials, absence of market demand, and access to finance. However, this does not mean that there is no urgent need for tax reforms. The industrial policymaking process is also required to embrace the growing integration of the country to the global economy. Such integration can serve as an outlet for firms' outputs and an alternative source of production inputs. The resulting competition can also foster firm and aggregate productivity growth. To this end, it is desirable to encourage firms to integrate their activities to the global value chain. The relevant policy question is therefore how to provide firms with the necessary support in their effort to become global.

JEL classification: F14, H20, L60

Keywords: Corporate taxation, import competition, export, investment, productivity, Ethiopia

Introduction

Governments devise a variety of policy programs to shape the economic environment in which firms operate with the policy objective of improving individual and collective performances of firms. This is because firms' performances have crucial implications for the economy in the form of employment creation, foreign exchange generation, resource mobilization, growth acceleration and welfare improvement. As noted by Bournakis et al. (2013), one aspect of the policy environment that has been less exposed to a microeconomic research is the effect of a country's tax policy on firms' productivity. This is also true when one considers how it influences firms' economic decisions with respect to export market participation, outsourcing, foreign direct investment, capital investment, R&D expenditure, product innovation and the like.

A corporate taxation influences firm behavior and performance through two main channels. First, it puts a constraint on firms' available resource that can be used for the purposes of investment, export market participation, technology and skill upgrading, and process and product innovations. This additional constraint is critical given that some survey responses from low-income countries reveal shortage of working capital as a major obstacle to firm operation and growth.[1] Second, a tax burden may have dynamic implications by taking in firm resources that could have been invested in innovative activities, development of intangible assets, and purchase of capital goods. Hence, it can lower productivity growth and slow down productivity convergence by diminishing capital and R&D investments as well as making firms' export participation and intensity costly.

On the other hand, a topic that has recently gained lots of research interest is increasing openness of countries to international trade and investment and the ensuing growth, inequality and welfare consequences.[2] Substantial tariff reductions, bilateral and multilateral trade agreements, and decreasing transport costs have resulted in the fragmentation of the global value chain as well as higher import competition in countries. The effect of rising foreign competition (coming from imports and FDI flows) can lead to several outcomes. First, the competition can reallocate resources and market away from the less productive firms into more productive ones leading to higher firm exit rate and improving aggregate productivity. At the same time, such competition can force firms to improve their productivity such as through eliminating x-inefficiencies, technology adoption, innovation, capital and R&D investment, and worker training. In contrast, it can lower productivity because of loss of market share, which prevents firms from exploiting the advantages of scale and scope economies. A growing body of evidence from studies on manufacturing firms show that better-performing firms are likely to survive market competition, experience growth in size and more likely to integrate their activities to the global market via export and import participation. Put differently, better-performing firms survive foreign competition and even thrive in the face of intense competition in domestic and foreign markets.

In view of the importance of any given country's policy settings and evolving global economic environment, the main objective of this study is to examine the causal effect of corporate taxation and import competition on firms' behaviors and performances. More specifically, the focus is on firms' decision with respect to export market participation, capital investment as well as productivity growth at the firm and industry levels.

[1] Bloom et al. (2014) survey firms in selected low-income countries and provide evidence on the determinants of firm productivity and the constraining factors that imped productivity growth and size expansion. They report finance as one of the key constraints.

[2] Some of the notable contributions include Ashournia et al. (2013); Autor et al. (2014), and Autor et al. (2013).

This study focuses on firms in Ethiopia as a case study. Ethiopian manufacturing makes an interesting case. First, Ethiopian firms are located farther away from the technological frontier compared to their counterparts in developed and other developing countries. In addition, there is enormous firm productivity heterogeneity within as well as between narrowly defined industries. These features yield an opportunity to gain insights into the dynamics of firm and industry productivity growth. Second, it is found that there is considerable learning-by-exporting among Ethiopian manufacturing firms.[3] It can be argued that this learning effect contributes to productivity growth and possibly industry convergence. The problem then becomes if corporate taxation curtails export activity, it will have a negative effect on firm and aggregate productivity outcomes. It is also straightforward to put forward similar arguments regarding capital investment and import competition.[4] Third, the analysis requires the use of firm-level panel data with a reasonably long time dimension, and such data is available from Large and Medium Scale Manufacturing Industry Surveys conducted annually by the Central Statistical Agency of Ethiopia. It is essential to point out that the aforementioned characteristics of manufacturing firms are not unique to Ethiopia and are usually true for firms located in countries at a similar stage of economic development as that of Ethiopia. Although the findings in this study can easily be extrapolated to the behaviors and performances of firms in other least developed and developing countries, there is still a demand for documenting additional empirical evidence from these countries. [5]

Focusing on firms in Ethiopian manufacturing over the period 1996-2010, a simple description of the data displays a positive net entry rate (2.8%) and significant firm turnover (21-24%) annually. Furthermore, almost half of the firms (49%) invest on their fixed assets each year. By contrast, the share of firms with active export participation is quite low (5%). Besides, there is a marked variation in the prevalence of capital investment and export participation across industries and over time. Relatedly, firms investing and exporting are more productive, larger and employ more production inputs per unit of labor compared to their counterparts that are active in only one or none of these activities. In addition, substantial firm heterogeneity in terms of productivity is observed in the data, and highly productive firms coexist with their substantially low productive counterparts.

At the aggregate level, Ethiopian manufacturing has experienced a rapid aggregate productivity growth (21% annually) mainly due to improvements in firms' technical efficiencies. Reallocation of factor inputs (including firm entry and exit) has also contributed to the growth of aggregate productivity. As regards taxation and import competition, the findings show that there is no significant effect of either factors on firms' exporting and investment decisions. It is also found that productivity growth increases with improvement in the efficiency of the firm at the technological frontier. While there is no effect of taxation, import competition promotes productivity growth. Moreover, the results also show that there is industry productivity convergence in which low-productivity firms experience faster growth compared to their high-productivity counterparts. On the other hand, the proportion of firms that view aspects of the tax policy (tax rate and administration) as key constraints in their business operations is relatively small compared to other problems such as shortage of raw materials, absence of market demand, and access to finance.

[3] See Bigsten et al. (2004); Bigsten and Gebreeyesus (2009), and Van Biesebroeck (2005a).

[4] See Abreha (2017) for details on the role of import trade and evidence on learning-by-importing in Ethiopian economy.

[5] There are a few studies on other African countries. Bigsten et al. (2004) report similar characteristics of manufacturing firms in Cameron, Ghana, Kenya and Zimbabwe. Furthermore, Van Biesebroeck (2005a) and Van Biesebroeck (2005b) document properties of exporters and features of size and productivity growth in Burundi, Cameroon, Cóte d'Iovoire, Ethiopia, Ghana, Kenya, Tanzania, Zambia and Zimbabwe, respectively. Also see Tybout (2000) for a survey of the literature on the state of manufacturing firms in developing countries.

The findings of the paper will be of some relevance for both academia and policy makers. This is the first study that explicitly accounts for the interaction between corporate taxation, import competition, individual firm productivity growth and industry productivity convergence using a firm-level dataset from African manufacturing. Consideration of the dynamics of firm-level heterogeneity within and across industries also adds to our understanding of the convergence process in the productivity levels across countries. The findings will shed light on the effectiveness (or distortionary effect) of taxation and government-sponsored subsidy programs in low-income countries.[6] Relatedly, analysis of the effects of import competition on the performance of Ethiopian firms in the domestic as well as foreign markets can trigger further research on the topic, especially within the context of emerging and low-income countries.

For policy purposes, it is necessary to point out that most firms view the tax rate and tax administration issues to be relatively less restrictive to their business operations compared to shortage of materials, absence of market demand, and access to finance. However, this does not mean that there is no urgent need for tax reforms. The industrial policymaking process is also required to embrace the growing integration of the country to the global economy. Such integration can serve as an outlet for firms' outputs and an alternative source of production inputs. The resulting competition in local and foreign markets can also foster firm and aggregate productivity. To this end, it is desirable to encourage firms to integrate their activities to the global value chain. The relevant policy question is therefore how to provide firms with the necessary support in their effort to become global.

It is expected that the results reported in this paper potentially provide insights in the formulation, implementation and evaluation of government-sponsored industrial development policies, which are now the focal point of the policymaking process. Such insights can be useful given that thriving manufacturing industries are valuable as a source of employment generation, foreign direct investment destination, and integration to the global value chain. Any form of industrial policy intervention should take into account the aforementioned firm and industry characteristics as well as elements of the business environment that constrain firm survival and growth.

Furthermore, despite the sole focus on Ethiopian manufacturing, it is necessary to mention that the findings and the policy insights drawn from this study can shed some light on the policy issues pertaining to the manufacturing sectors of other Sub-Saharan African countries. In this respect, countries in the IGAD region are particularly interesting.[7] This follows from the fact that these countries have several common characteristics in terms of stage of economic development, sectoral composition, geographic similarities, and socio-economic and historical ties. These common features is further substantiated by similar characteristics of manufacturing firms usually observed in the data from these countries.[8]

The remainder of the paper is organized as follows. Section 2 presents the main sources of data, sample construction, and variable definition used in the analysis. It also summarizes a few salient features of the data. Section 3 describes the techniques employed in the estimation of the production function parameters as well

[6] The subsidy variable is rather poorly reported in the dataset used in this study. As a result, it was not possible to assess the impact of subsidy programs.

[7] The trade bloc Intergovernmental Authority on Development (IGAD) is formed by Djibouti, Eritrea, Ethiopia, Kenya, Somaliland, South Sudan, Sudan, and Uganda.

[8] This is especially true for Ethiopia and Kenya. To the best of my knowledge, I am not aware of any systematic body of empirical evidence available for the other IGAD member countries.

as decomposition of aggregate productivity into within and between effects. It also specifies the regression equations used to estimate the effect of taxation and import competition on export participation, capital investment, productivity growth, and industry productivity convergence. Section 4 reports and explains the estimation results, and section 5 concludes with a discussion of the policy implications of the findings.

1. Data description

1.1. Data source

The datasets for the project are obtained from the Central Statistical Agency of Ethiopia. The agency conducts annual surveys of large and medium firms engaged in manufacturing activities. In the data, economic activities are categorized as manufacturing based on ISIC-Rev.3 classification. Industries are here defined at the two-digit level, and it encompasses those in 15-37.[9] The survey covers all firms with at least 10 employees and which use power-driven machinery during the period 1996-2010. The datasets contain records of firms' output production, local and export sales, material and energy usage, employee composition, fixed asset structure, and tax expenses.

In this paper, gross output is defined as revenue generated from local and export sales after adjusting for stock of goods at the beginning and end of the year. The capital variable is constructed by exploiting the information on initial size of fixed assets, investment, and portion of the asset sold and depreciated using a perpetual inventory method. Using information on employees, a distinction is made between skilled workers (unpaid working proprietors; active partners and family workers, and administrative and technical employees) and unskilled workers (apprentice and production workers). The labor input variable excludes seasonal and temporary workers as data on these workers is infrequently reported.

Another dataset used in the analysis is the volume of export and import trade at the industry level. Data on the export and import trade are extracted from World Integrated Trade Solution (WITS) database.[10] The data is used to approximate the extent of import competition in Ethiopian manufacturing. More specifically, import competition is defined at the industry level and calculated as the ratio of industry-level import to final domestic demand, which is the sum of the industry's level of output and imports less its exports.[11] The GDP deflator, which is extracted from the World Development Indicators database, is used to deflate variables reported in nominal values.[12]

[9] The industries classified under the manufacturing category are: Food and beverages (15); tobacco products (16); textiles (17); wearing apparel (18); leather products (19); wood products (20); paper products (21); printing and publishing (22); coke and petroleum products (23); chemicals(24); rubber and plastic (25); non-metallic products (26); basic metals (27); fabricated metals (28); machinery and equipment (29); accounting and computing machinery (30); electrical machinery (31); communication equipment (32); medical instruments (33); motor vehicles (34); other transport equipment (35); furniture (36), and recycling (37). For a detailed description of the industry classification, see explanatory notes available from the UN Statistics Division.

[10] In the database, the available data for Ethiopia is from the year 1997 and onwards. As a result, there is loss of some data observations in the analysis of import competition.

[11] There may be a differential impact of import competition depending on the country origin of imports. This possibility is not addressed in this paper but it is a worthy topic for future research.

[12] The ideal price index would be the producer price index at the industry level. However, data on the index spanning the entire sample period is not available. Furthermore, no significant change in the results is expected if one uses the consumer price index given that the correlation coefficient between the two indexes is well above 0.95.

The final dataset has a panel structure in which the unit of analysis is firms with at least three years of consecutive appearance over the sample period. Firms with zero or unreported sales and any of the factor inputs are also excluded. Furthermore, to have sufficient within-industry variation, industries with very few firms are regrouped as other manufacturing. This group comprises firms in tobacco, paper, basic metals, machinery and equipment, office equipment, electrical machinery, and motor vehicles industries. The final sample used for analysis comprises 2,050 firms and 11,384 firm-year observations.

Additionally, a brief reference to the Enterprise Surveys by the World Bank is made to augment the quantitative analyses with survey responses on the conditions of the investment climate under which firms operate. It is also to provide a regional perspective by demonstrating how the Ethiopian case compares with a few selected African countries. The enterprise surveys cover firms of different size (micro, small, medium and large) that engage in manufacturing, retail and other services. They gather information on the perceptions of managers regarding the business environment and major constraints to their operation. These include access to resources (such as finance, foreign exchange and land), corruption, tax rate and administration, crime, political instability, anticompetitive practices, regulations and permits, infrastructure services, and macroeconomic aspects (such as inflation and exchange rate volatility).

1.2. Basic facts

Table 1 reports the number of firms along with the entry and exit rates over the years. Over 15-year window, we observe that the number of firms is increasing. This is also evident from the positive average net entry rates (entry less exit rates) over the course of the sample period. We see that the turnover rate of firms in Ethiopian manufacturing is reasonably high, which is around 21-24% annually.[13] Relatedly, Table 2 shows that most of the individual industries have experienced a positive net entry rates with the exception of textiles, wood products, and furniture.

Table 1: Summary of firm entry and exit rates

Year	# Firms	# New entry	% New entry	# Exit	% Exit	# Net entry	% Net entry
1996	-	-	-	-	-	-	-
1997	540	140	25.93	45	8.33	95	17.59
1998	581	143	24.61	102	17.56	41	7.06
1999	587	121	20.61	115	19.59	6	1.02
2000	606	159	26.24	140	23.10	19	3.14
2001	576	121	21.01	151	26.22	-30	-5.21
2002	683	212	31.04	105	15.37	107	15.67
2003	802	212	26.43	93	11.60	119	14.84
2004	817	160	19.58	145	17.75	15	1.84
2005	646	105	16.25	276	42.72	-171	-26.47
2006	933	382	40.94	95	10.18	287	30.76
2007	1,037	323	31.15	219	21.12	104	10.03
2008	1,228	299	24.35	108	8.79	191	15.55
2009	1,091	152	13.93	289	26.49	-137	-12.56
2010	812	128	15.76	407	50.12	-279	-34.36
1997-2010	-	-	24.13	-	21.35	-	2.78

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia.

[13] Similarly, Gebreeyesus (2008) reports a turnover rate of 22% using the same data source in the period 1996-2003.

Table 2: Industry-level mean entry and exit rates over the period 1997-2010

Industry name	% New entry	% Exit	% Net entry
15 Food and beverage	23.87	19.80	4.07
17 Textiles	15.60	17.93	-2.33
18 Wearing apparel	23.99	21.38	2.61
19 Leather products	17.60	16.53	1.07
20 Wood products	23.31	24.87	-1.56
22 Printing and publishing	18.05	15.02	3.03
24 Chemicals	19.30	16.14	3.16
25 Rubber and plastic	22.91	12.91	10.00
26 Non-metallic products	32.42	32.28	0.14
28 Fabricated metals	29.18	28.21	0.96
36 Furniture	28.18	36.41	-8.22
Other manufacturing	18.37	16.65	1.73
Total manufacturing	24.13	21.35	2.78

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia.

Table 3 tabulates the distribution of firms across industries as well as whether or not they participate in export markets and undertake investment. As can be seen from the table, almost half of the firms (49%) undertake investment each year. By contrast, the share of firms that actively participate in exporting is rather low, which is a little over 5%. There is somehow limited variation in the propensity to invest across industries and over time. A noticeable exception may be between Wood Products (38%) and Fabricated Metals (79%) in 1996.

Besides, the Rubber and Plastic industry has seen a large increase in the proportion of investing firms over time whereas a significant decline was observed in the Wearing Apparel as well as Fabricated Metals. However, there was a widespread cross-industry variation in terms of exporting. For instance, firms in the textiles, wearing apparel and leather products have relatively higher export participation rate as compared to firms in the other industries where the majority of the firms entirely restrict their activities to the domestic market. At the same time, the textile, wearing apparel, chemical have seen a considerable increase in the export participation while some experience a modest increase and others a decline.

In addition, Table 4 illustrates that there is a statistically significant, systematic difference between firms exporting, investing and those that are not undertaking either of these activities. The table reports percentage differences between export-only, invest-only, and export and invest firms in reference to those that are neither exporting nor investing but producing only for the domestic market. We observe that firms shipping their products to foreign markets and investing on their fixed assets are more productive, larger and employ more production inputs per unit of labor compared to their counterparts that are active in only one or none of the activities. In other words, these firms are better performing in terms of a variety of measures, and investment and exporting are connected to a larger scale of firm operation and productivity.

Table 3 Firm participation in exporting and capital investment

Industry name	1996			2010			1996-2010	
	# Firms	% Investing	% Exporting	# Firms	% Investing	% Exporting	% Investing	% Exporting
15 Food and beverage	128	46.88	2.34	294	51.70	3.74	44.14	4.47
17 Textiles	24	58.33	20.83	22	45.45	50.00	49.67	25.41
18 Wearing apparel	15	60.00	6.67	27	37.04	29.63	46.67	13.37
19 Leather products	42	54.76	21.43	52	51.92	28.85	62.02	31.42
20 Wood products	13	38.46	7.69	15	33.33	6.67	30.42	0.96
22 Printing and publishing	32	50.00	0.00	57	56.14	0.00	52.60	0.00
24 Chemicals	28	60.71	0.00	49	65.31	10.20	63.60	1.55
25 Rubber and plastic	12	41.67	0.00	62	62.90	0.00	63.46	0.26
26 Non-metallic products	51	39.22	1.96	88	36.36	0.00	43.66	1.38
28 Fabricated metals	19	78.95	0.00	33	45.45	6.06	55.29	1.08
36 Furniture	54	44.44	1.85	76	50.00	1.32	44.01	0.65
Other manufacturing	27	59.26	0.00	37	59.46	2.70	65.10	1.72
Total manufacturing	445	50.34	4.72	812	50.99	6.77	49.29	5.32

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia.

Table 4 Export and investment activity premia

	Output per worker	Capital per worker	Material per worker	Energy per worker	Employment size	Share of skilled workers
Export-only	88.54***	162.47***	97.29***	66.46***	293.20***	1.91
	(0.204)	(0.221)	(0.241)	(0.194)	(0.202)	(0.085)
Invest-only	59.47***	69.18***	65.38***	30.60***	136.77***	7.05***
	(0.033)	(0.056)	(0.039)	(0.037)	(0.044)	(0.015)
Export and invest	160.84***	154.77***	160.19***	54.75***	848.24***	20.46***
	(0.131)	(0.173)	(0.16)	(0.153)	(0.154)	(0.06)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	11,384	11,384	11,384	11,384	11,384	11,384
Adj. R^2	0.73	0.49	0.66	0.65	0.32	0.09

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia. Standard errors are clustered at the firm level and reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

2. Empirical strategy

This section describes how productivity at the firm level is estimated, and aggregate productivity growth is constructed. Afterwards, the focus shifts to the effects of corporate taxation and import competition.

2.1. Firm productivity

Firm productivity is measured by total factor productivity (TFP). For this purpose, a Cobb-Douglas production function is defined: $Y_{i,t} = A_{i,t} K_{i,t}^{\beta_k} L_{i,t}^{u\ \beta_u} L_{i,t}^{s\ \beta_s}$, where $Y_{i,t}$ represents value-added output (gross output net of materials and energy used in production) of firm i in time period t, and $K_{i,t}$, $L_{i,t}^{u}$, and $L_{i,t}^{s}$ denote capital, unskilled, and skilled labor, respectively. After a logarithmic transformation and decomposition of the technology parameter $A_{i,t}$ into total factor productivity $\omega_{i,t}$ and unobserved error term $\varepsilon_{i,t}$, the production function becomes:

$$(1) \quad y_{i,t} = \beta_k k_{i,t} + \beta_u l_{i,t}^{u} + \beta_s l_{i,t}^{s} + \omega_{i,t} + \varepsilon_{i,t}$$

It is assumed that $\omega_{i,t}$ follows an exogenous Markov process $\omega_{i,t} = E(\omega_{i,t}|\omega_{i,t-1}) + \xi_{i,t}$, where $\xi_{i,t}$ is an error term, and it is orthogonal to $\omega_{i,t-1}$.[14]

Estimation of the above production function invokes certain econometric issues. First, there is a potential simultaneity or transmission bias because firms' input choices are correlated with their unobserved (to the econometrician) productivities. The second problem is omitted price bias, and it arises from having to deflate firm revenue (since physical output is rarely reported) to measure volume of production using industry-wide price index instead of firm-level prices. In other words, unless there is perfect competition in goods and factors markets, prices are firm specific, and hence the use of aggregate price index brings a price bias. Another estimation concern is selection bias due to endogeneity of firm attrition from the data. This is mainly because firm exit or entry are not purely random events. The last methodological challenge has to do with multi-product firms. That is, firms' portfolio of goods they produce may not necessarily be exogenous. Rather, they make productivity-based product choices, which can be driven by technological differences across products.

In order to deal with the aforementioned econometric issues, a number of estimation techniques have been developed over time.[15] To begin with, the most straightforward technique is a pooled OLS regression. The basic assumption is that the explanatory variables are uncorrelated with the error term in a given time period. However, in the presence of unobserved factors correlated with input choices such as ω_{it}, the estimated coefficients are inconsistent and their standard errors are invalid due to simultaneity, endogenous selection, omitted variable biases as well as serial correlation. A similar technique is a fixed effects transformation, which is OLS regression on demeaned or differenced variables. This technique yields consistent estimates given that the unobserved component correlated with the inputs variables is time-invariant. However, the assumption of time-invariant firm productivity is highly restrictive.

[14] It is possible to extend this specification into a controlled Markov process to estimate dynamic effects of exporting, importing, R&D investment and the like. Since the scope of the study does not consider these features of the productivity dynamics, an exogenous Markov productivity is adopted.

[15] See Van Beveren (2012) for a survey of the literature on the production functions estimation techniques.

On the other hand, Olley and Pakes (1996) develop a two-stage semi-parametric approach to address the simultaneity and selection biases that pooled OLS and within transformation fail to deal with convincingly. The simultaneity problem is addressed through a polynomial approximation of the unobserved component using investment as a proxy. This is assuming that the relationship between firms' investment and productivity shocks is monotonically increasing. This requires at least firms to have non-zero investment flows. By explicitly incorporating firm survival probability, the technique also addresses the issue of endogeneity of firm attrition in the data.[16]

A similar estimation method is developed by Levinsohn and Petrin (2003). The rationale behind this method is to overcome the theoretical and practical shortcomings of investment as a proxy. Theoretically, it may not necessarily be the case that investment and productivity have a monotonically increasing relationship. This emanates, for example, from the lumpy nature of investment. Practically, a non-trivial proportion of firms report zero investment in most surveys, and therefore the exclusion of these firms may result in efficiency loss in the parameter estimates. As an alternative, they suggest using intermediate inputs (materials and energy) as proxy variables. The argument is that intermediate inputs are highly responsive to productivity shocks as compared to investment expenditure, and thereby more likely to fulfill the monotonicity condition required for estimation. Moreover, a rather limited number of firms report zero usage of intermediate inputs (unlike investment spending), and hence there will be no loss of efficiency due to fewer observations.

However, Ackerberg et al. (2015) point out a critical identification problem in the Olley-Pakes and Levinsohn-Petrin algorithms. They show that there is multicollinearity in the first-stage, and there is no sufficient information to identify the coefficients on freely variable inputs like labor. As a way of dealing with this problem, Wooldridge (2009) suggests a one-step GMM approach that involves specifying different sets of instruments for different equations with the same dependent variable and show that both the Olley-Pakes and Levinsohn-Petrin algorithms can produce valid results.

This study compares the results from these alternative techniques. Specifically, this includes estimates from pooled ordinary least squares (OLS); fixed effects transformation (FE); first differencing (FD); Levinsohn-Petrin (LP) and Wooldridge-Levinsohn-Petrin (WLP) techniques. Because the data contains substantial entries with zero investment flows (which is half of the firms each year, see Table 3), and this invalidates the monotonicity condition required for identification, this study does not employ the Olley-Pakes and Wooldridge-Olley-Pakes approaches.

2.2. Aggregate productivity growth decomposition

Once the TFP is constructed, the next task is to compute and decompose aggregate productivity growth into technical efficiency (within-firms) and reallocation (between-firms) components. For this purpose, a technique from a recent contribution by Petrin and Levinsohn (2012) is used. The attractiveness of this method, unlike the previous ones, is that it accommodates non-neoclassical aspects of markets for goods and input factors such as market imperfections, price rigidities, and firm heterogeneities.

[16] The unbalanced nature of the panel data can also mitigate the problem of endogenous firm selection. In fact, Olley and Pakes (1996) and Levinsohn and Petrin (2003) experiment with and without the inclusion of the survival probability under the setting of unbalanced panel data and find no substantial efficiency gain.

Suppose firm i's production function is given by: $Q^i(X_i, M_i, \omega_i)$ where $X_i = (X_{i1}, X_{i2}, \ldots\ldots, X_{iK})$ represents a vector of primary inputs and $M_i = (M_{i1}, M_{i2}, \ldots\ldots, M_{iK})$ refers to vector of intermediates inputs with $M_{i,j}$ denoting firm $j's$ output used as a production input by firm i, and ω_i firm i's technical efficiency (TFP). After allowing for fixed and sunk costs of production F_i , the output function becomes: $Q_i = Q^i(X_i, M_i, \omega_i) - F_i$.

Petrin and Levinsohn (2012) show that aggregate productivity growth (APG) can be expressed as:

$$(2)\quad APG = \sum_i D_i d\omega_i + \sum_i D_i \sum_k (\varepsilon_{i,k} - s_{i,k}) dx_{i,k} + \sum_i D_i \sum_j (\varepsilon_{i,j} - s_{i,j}) dm_{i,j} - \sum_i D_i df_i$$

where $D_i = \frac{P_i Q_i}{\sum_{i=1}^{N} VA_i}$ is the Domar weight in which VA_i is value-added; $\varepsilon_{i,k}$ and $\varepsilon_{i,j}$ are elasticity of output with respect to primary input x_k and intermediate input m_j, respectively; $s_{i,n}$ revenue shares of input n , and $a = \ln(A)$ where $a = X, M, F$. The first term is technical efficiency (TE) and represents a change in APG when firms start producing more output with the same unit of inputs. The remaining terms capture reallocation efficiency (RE) and shows the change in APG because of reallocations of inputs across firms including firm entry and exit. Under this decomposition, reallocation takes places through the movement of resources from firms with lower value of marginal product-input cost gap to those with higher gap.

As firm level data is usually aggregated and reported in discrete time intervals, there is a need to write APG using a discrete time approximation, and it becomes:

$$(3)\quad APG = \sum_i \bar{D}_{i,t} \Delta\omega_{i,t} + \sum_i \bar{D}_{i,t} \sum_k (\varepsilon_{i,k} - \bar{s}_{i,k,t}) \Delta x_{i,k,t} + \sum_i \bar{D}_{i,t} \sum_j (\varepsilon_{i,j} - \bar{s}_{i,j,t}) \Delta m_{i,j,t} - \sum_i \bar{D}_{i,t} \Delta f_{i,t}$$

with the Domar weights and revenue shares of inputs given by: $\bar{D}_{i,t} = \frac{D_{i,t} + D_{i,t-1}}{2}$ and $\bar{s}_{i,k,t} = \frac{s_{i,t} + s_{i,t-1}}{2}$, respectively.

2.3. Corporate taxation, import competition and productivity

The next step is to specify a reduced-form probit model of export participation and capital investment. Given that unobserved errors which affect both equations are supposedly correlated, the estimation will be done by running a probit and bivariate probit of $\Pr(EXP_{i,t} = 1, INV_{i,t} = 1) = \Phi(X\beta)$ where X includes the main variable of interest—corporate taxation and import competition—and a set of firm and industry characteristics.

Afterwards, the final step is the estimation of the causal effect of corporate taxation and import competition on firm productivity growth and industry productivity convergence. The estimating equation is specified as:

$$(4)\quad \Delta\omega_{i,t} = \alpha_1 \Delta\omega_{f,t} + \alpha_2 CTR_{i,t-1} + \alpha_3 GAP_{i,t-1} + \lambda Z_{i,t-1} + \delta_t + S_j + u_{i,t}$$

$$(5)\quad \Delta\omega_{i,t} = \alpha_1 \Delta\omega_{f,t} + \alpha_2 IMC_{j,t-1} + \alpha_3 GAP_{i,t-1} + \lambda Z_{i,t-1} + \delta_t + S_j + u_{i,t}$$

where $\Delta\omega_{f,t}$ denotes the productivity growth of technology frontier firm; $\mathrm{CTR}_{i,t-1}$ ratio of tax payment to output (log scale); $GAP_{i,t-1} = \omega_{f,t-1} - \omega_{i,t-1}$ productivity distance between firm i and technology frontier firm f (which is defined as, for example, the most productive firm in the industry); Z a vector of observable firm characteristics; δ_t and S_j year and industry dummy variables, and $u_{i,t}$ error term. Estimated coefficients

of $CTR_{i,t-1}$, $IMC_{j,t-1}$ and $GAP_{i,t-1}$ show the effect of corporate taxation, import penetration and industry productivity convergence patterns, respectively. Because corporate taxation and import competition at the industry level can be assumed to be exogenous to any firm under consideration, these coefficient estimates have a reasonably acceptable causal effect interpretation.

3. Estimation results

In this section, the estimation results are shown and the main findings discussed.

3.1. Productivity dispersion

Table A.1 in the appendix reports the coefficients of the production function in equation (1). The estimation is done separately for each individual industry. We observe differences in the estimated output elasticities across industries. Additionally, most of these elasticities fall within the size intervals of estimates usually found in the productivity literature. Despite some differences across estimation techniques, there is high degree of similarity in the output elasticity estimates. As can be seen from Table A.2 in the appendix, the correlation coefficients between TFP estimates obtained from the various techniques are large, positive and significant. This is especially the case between the LP and WLP methods.

Table 5 summarizes the productivity dispersion within industries. Both the standard deviations of firm productivity and the ratios of the upper and lower quantiles are large. The interpretation of these numbers goes as follows. In Food and Beverage industry, for example, the 90th percentile firm produces almost 26 ($= \exp(3.25)$) times more measured units of output than the 10th percentile firm using the same level of production inputs. Similarly, the firm at the 75th percentile of the productivity distribution is 5 times as much productive as the one at the 25th percentile.[17] In general, these results clearly establish that there is considerable firm heterogeneity, and highly productive firms coexist with their counterparts with substantially low productivity.

This feature of high productivity dispersion is consistent with studies that focus on firms in developing countries.[18] For example, Hsieh and Klenow (2009) for China and India which is found to be greater than that of the U.S., and the productivity dispersion is even more pronounced when one estimates physical quantity based productivity instead of revenue based productivity. Similarly, Pagés (2010) documents that productivity dispersion within narrowly defined industries of selected countries in Latin America is greater compared to their counterparts in developed countries.

Based on firm-level data from East Asian countries, Hallward-Driemeier et al. (2002) demonstrate that underdeveloped and less integrated local markets allow low-productivity firms to coexist with high-productivity firms because of insufficient competition in the goods and factor markets (which is strongly correlated with the level of economic development of the country under consideration). This feature of markets in less developed countries translates into greater productivity dispersion within industries.

[17] Some of the reported differences seem to be rather high. There may be a need to find out whether this is due to extremely outlying observation. Nevertheless, this does not change the overall findings; within-industry productivity dispersion is quite large.

[18] See Bartelsman et al. (2013); Fox and Smeets (2011), and Syverson (2004) for evidence from developed countries.

Table 5 Industry-level productivity dispersion

Industry name	OLS			FE			FD			LP			WLP		
	$sd(\omega)$	$\omega_{75}-\omega_{25}$	$\omega_{90}-\omega_{10}$	$sd(\omega)$	$\omega_{75}-\omega_{25}$	$\omega_{90}-\omega_{10}$	$sd(\omega)$	$\omega_{75}-\omega_{25}$	$\omega_{90}-\omega_{10}$	$sd(\omega)$	$\omega_{75}-\omega_{25}$	$\omega_{90}-\omega_{10}$	$sd(\omega)$	$\omega_{75}-\omega_{25}$	$\omega_{90}-\omega_{10}$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
15 Food and beverage	1.36	1.68	3.25	1.74	2.38	4.32	1.74	2.38	4.32	2.29	3.19	5.89	1.69	2.31	4.22
17 Textiles	1.34	1.71	3.44	1.68	2.38	4.39	1.68	2.38	4.39	3.11	4.89	8.51	2.13	3.01	5.74
18 Wearing apparel	1.14	1.47	2.61	1.57	1.93	4.00	1.57	1.93	4.00	1.43	1.92	3.40	1.27	1.76	3.07
19 Leather products	1.09	1.43	2.69	1.12	1.47	2.81	1.12	1.47	2.81	1.66	2.21	4.46	1.24	1.57	3.21
20 Wood products	1.23	1.58	3.06	1.27	1.69	3.16	1.27	1.69	3.16	1.31	2.10	3.21	1.61	2.10	4.09
22 Printing and publishing	0.88	1.19	2.22	1.04	1.29	2.47	1.04	1.29	2.47	1.32	1.84	3.50	1.01	1.42	2.61
24 Chemicals	1.33	1.78	3.22	1.33	1.81	3.27	1.33	1.81	3.27	1.76	2.31	4.70	1.33	1.77	3.26
25 Rubber and plastic	1.10	1.42	2.73	1.13	1.44	2.78	1.13	1.44	2.78	1.36	1.86	3.29	1.14	1.51	2.72
26 Non-metallic products	1.15	1.51	2.85	1.22	1.61	3.00	1.22	1.61	3.00	1.53	1.97	3.71	1.33	1.74	3.26
28 Fabricated metals	1.19	1.65	2.86	1.36	2.07	3.39	1.36	2.07	3.39	1.62	2.57	4.25	1.27	1.86	3.15
36 Furniture	1.17	1.58	2.83	1.19	1.62	2.85	1.19	1.62	2.85	1.47	1.95	3.64	1.26	1.64	3.01
Other manufacturing	1.35	1.59	3.40	1.64	2.32	4.25	1.64	2.32	4.25	2.43	3.81	6.30	1.81	2.53	4.52
Total manufacturing	1.55	1.95	3.81	2.06	2.66	5.25	2.06	2.66	5.25	2.41	3.24	5.99	2.02	2.37	4.78

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia.

Table 6 Aggregate productivity growth decomposition

Year	APG	Technical Efficiency					Reallocation Efficiency				
		OLS	FE	FD	LP	WLP	OLS	FE	FD	LP	WLP

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia.

3.2. Productivity growth decomposition

Table 6 shows that Ethiopian manufacturing has experienced a rapid productivity growth; approximately 21% annually. Besides, the growth has consistently been positive over the last 10 years of the sample period. Most of the growth is attributed to improvements in firms' technical efficiencies. Reallocation of factor inputs including firm entry and exit has also contributed to the improvements of aggregate productivity. As normally expected, most of the reallocation effects are positive in a sense that movement of any resource from less productive firms to more productive ones raises overall productivity. A relatively smaller role of the reallocation component is suggestive of market frictions and sizable adjustment costs in product and factors markets. In spite of the size differences in the technical and reallocation terms across estimation techniques, the results are robust as shown in Table A.3 in the appendix where the correlation coefficient is positive, large and significant between estimators of each component of the aggregate productivity growth. In contrast, we notice a weak, mostly negative relationship between the technical and reallocation efficiency components.

3.3. Taxation, import competition and productivity

Table 7 displays probit model estimates of the export participation and investment functions. We see that productivity, size of capital holding, employment size and international trade orientations have a positive effect and are statistically relevant predictors of firms' decision to export and undertake fixed assets investment. This is consistent with a large body of empirical evidence on the nature of firm international trade in advanced and developing economies. Furthermore, both exporting and investing reveal state persistence, as shown from the significance of previous period exporting and investing variables, and this is indicative of substantial sunk and fixed costs involved in undertaking these activities. However, there is no significant effect of either corporate taxation or import competition on firm's export and investment decisions; this is also evident from the analysis of the marginal effects (not reported here).

As regards the productivity growth and taxation, Table 8 shows that firms benefit from the productivity growth of the technological frontier firm, as shown by a positive and significant coefficient estimate of $\Delta\omega_{f,t}$. This means a 1% growth in the productivity of the frontier firm translates to a 0.20-0.28% improvement in the productivity of others. There is also industry productivity convergence, and this is evident from an estimate on $GAP_{i,t-1}$. Those firms located farther from the technology frontier firm tends to experience a rapid productivity growth. A 1% productivity lag from the frontier firm is associated with 0.31-0.43% faster

productivity growth. Again, corporate tax has no economically relevant effect on firm productivity growth. Table 9 also establishes qualitatively similar results. The only exception here is that higher import competition improves firm productivity. For each percentage point increase in the import competition, productivity rises by 0.04-07%. This may be because greater competitive pressure from foreign goods force firms to increase their technical efficiency via technology upgrading, worker training, or getting rid of x-inefficiencies.

Table 7 Probit model of export participation and investment

	Probit				Bivariate probit	
	$\Pr(INV_{i,t}=1)$ (1)	$\Pr(INV_{i,t}=1)$ (2)	$\Pr(EXP_{i,t}=1)$ (3)	$\Pr(EXP_{i,t}=1)$ (4)	$\Pr(INV_{i,t}=1)$ (5)	$\Pr(EXP_{i,t}=1)$ (6)
$CTR_{i,t-1}$	0.000	-	-0.000***	-	0.000	-0.000***
	(0.000)		(0.000)		(0.000)	(0.000)
$IMC_{i,t-1}$	-	0.011	-	0.006	0.011	0.003
		(0.034)		(0.060)	(0.034)	(0.061)
$\omega_{i,t-1}$	0.091***	0.099***	0.104***	0.141***	0.094***	0.158***
	(0.020)	(0.021)	(0.052)	(0.046)	(0.021)	(0.048)
$k_{i,t-1}$	0.049***	0.048***	0.137***	0.117***	0.048***	0.116***
	(0.012)	(0.012)	(0.040)	(0.038)	(0.012)	(0.038)
$l_{i,t-1}$	0.278***	0.280***	0.140***	0.145***	0.274***	0.164***
	(0.026)	(0.027)	(0.046)	(0.048)	(0.027)	(0.045)
$l^s(share)_{i,t-1}$	0.168***	0.169***	-0.043	-0.078	0.167***	-0.071
	(0.036)	(0.037)	(0.091)	(0.092)	(0.036)	(0.092)
$INV_{i,t-1}$	0.746***	0.738***	-0.152	-0.166	0.738***	-0.183*
	(0.045)	(0.046)	(0.103)	(0.105)	(0.046)	(0.106)
$EXP_{i,t-1}$	0.039	0.046	2.578***	2.581***	0.038	2.587***
	(0.118)	(0.118)	(0.147)	(0.152)	(0.120)	(0.151)
$IMP_{i,t-1}$	0.112***	0.099*	0.020	-0.036	0.0095*	-0.024
	(0.052)	(0.052)	(0.112)	(0.115)	(0.052)	(0.115)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.26	0.25	0.69	0.70	$\rho = 0.06$	
Obs.	5,637	5,324	5,013	4,710	5,324	5,324

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia. Standard errors are clustered at the firm level and reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Notes: The productivity used in these estimations is obtained using the Levinsohn-Petrin method. Results based on productivity estimates from other methods are available upon request.

Table 8 Effect of taxation on firm productivity growth

	OLS	FE	FD	LP	WLP
	(1)	(2)	(3)	(4)	(5)
$\Delta\,\omega_{f,t}$	0.281***	0.228***	0.235***	0.201***	0.212***
	(0.021)	(0.027)	(0.032)	(0.026)	(0.026)
$GAP_{i,t-1}$	0.435***	0.332***	0.338***	0.381***	0.396***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
$CTR_{i,t-1}$	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.24	0.19	0.20	0.22	0.23
Obs.	5,453	5,453	5,453	5,453	5,453

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia. Standard errors are clustered at the firm level and reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Notes: The productivity used in these estimations is obtained using the Levinsohn-Petrin method. Table A.4 reports the detailed estimation results. Results based on productivity estimates from other methods are available upon request.

Table 9 Effects of import competition on firm productivity growth

	OLS	FE	FD	LP	WLP
	(1)	(2)	(3)	(4)	(5)
$\Delta\,\omega_{f,t}$	0.256***	0.207***	0.218***	0.183***	0.204***
	(0.020)	(0.028)	(0.033)	(0.027)	(0.027)
$GAP_{i,t-1}$	0.431***	0.312***	0.329***	0.368***	0.388***
	(0.018)	(0.017)	(0.017)	(0.017)	(0.017)
$IMC_{i,t-1}$	0.069***	0.057***	0.061***	0.051***	0.038
	(0.025)	(0.025)	(0.024)	(0.024)	(0.024)
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.23	0.18	0.19	0.22	0.22
Obs.	5,159	5,159	5,159	5,159	5,159

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia. Standard errors are clustered at the firm level and reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Notes: The productivity used in these estimations is obtained using the Levinsohn-Petrin method. Table A.5 reports the detailed estimation results. Results based on productivity estimates from other methods are available upon request.

3.4. Other factors affecting firm performance

The aforementioned findings show that corporate tax burden does not negatively affect exporting, investing and productivity growth at the firm and industry levels. On the other hand, import competition accelerates productivity growth. These results provide a rationale to look for other determinants undermining firm performance. Fortunately, the questionnaires used in the industry surveys ask firms to identify major obstacles for their business operation and capacity utilization. They are requested to rank the following problems: shortage of supply of raw materials and spare parts; absence of market demand for their product; lack of

working capital; shortage of foreign exchange; electricity and water supply disruption; frequent machine breakage; lack of working premise; problems with employees, and government rules and regulations.

Based on responses to these survey questions, Table A.6 in the appendix summarizes the fraction of firms indicating absence of market demand as the first major obstacle for their operation and full productive capacity utilization. The response rate suggests that this problem has become less critical over time. However, there is still a non-negligible number of firms pointing lack of market as a key constraint. In a similar manner, Table A.7 in the appendix uncovers that a significant proportions of the firms (approximately 30%) rank shortage of material inputs as the most important barrier for not being operational throughout the year as well as operating below full capacity.

Moreover, a brief reference to the Enterprise Surveys by the World Bank is made to augment the quantitative analyses with survey responses on the conditions of the investment climate influencing firms' economic performance. The enterprise surveys cover firms of different size (micro, small, medium and large) and that engage in manufacturing, retail and other services. They gather information on the perceptions of managers regarding the business environment and major constraints to their operation. These include access to resources (such as finance, foreign exchange and land), corruption, tax rate and administration, crime, political instability, anticompetitive practices, regulations and permits, infrastructure services, and macroeconomic issues (such as inflation and exchange rate volatility).

To give some regional perspective on how the Ethiopian case compares to other low-income countries, a group of countries from the IGAD region are considered. Using data extracted from the enterprise surveys, Table A.8 in the appendix documents the proportion of firms that consider taxation as crucial economics constraint. The first column shows the total tax rate as percentage of commercial profits. According to World Bank (2017), the total tax rate is defined as "the amount of taxes and mandatory contributions payable by businesses after accounting for allowable deductions and exemptions as a share of commercial profits. Taxes withheld (such as personal income tax) or collected and remitted to tax authorities (such as value added taxes, sales taxes or goods and service taxes) are excluded." We see that the Ethiopian tax rate (30.30%) is the lowest compared to the other countries: Djibouti (37.85%); Eritrea (84.50%); Kenya (49.47%); Sudan (38.37%), and Uganda (36.15%). In similar fashion, the proportion of Ethiopian firms that consider the tax rate as a major obstacle to their business operations is the lowest. A qualitatively identical pattern is also observed when it comes to tax administration issues.[19] It is necessary to underscore that these results are not in contradiction to the urgent need to implementing a series of tax reforms in order to build a sound tax system in Ethiopia. This is especially true for the other countries in the region where substantially large fraction of firms identify aspects of the tax policy as one of the main factors impeding their business operation

[19] A summary (not reported here) regarding access to finance exhibits that almost a third of Ethiopian firms consider access to finance as major constraining factor for their business operations. In comparison, this is greater than the proportion of firms in Djibouti, Eritrea, Kenya and Sudan whereas it is lower relative to those in South Sudan and Uganda.

4. Conclusion and policy implications

The findings in this paper uncover a positive net entry; significant firm turnover rate; reasonably high frequency of capital investment, and substantially low export participation. In addition, there is substantial firm productivity heterogeneity within industries as well discernable differences in the propensity to export and invest across industries and over time. Further, changes in firms' technical efficiencies primarily and reallocation of factor inputs along with firm turnover have contributed to fast productivity growth in the Ethiopian manufacturing sector.

The estimation results also imply no significant effect of taxation on firms' exporting and investment decisions as well as their productivity growth. Perhaps, the government has been providing generous investment and export tax schemes in most of the sample years such that taxation is no longer a factor in exporting and investing decisions. Moreover, the tax incentive packages may be relevant for market entry decisions among potential entrants, and they have no significant effect once firms start production operation. Note that a complete understanding of the issue calls for further work on the topic.

As regards import competition, it spurs productivity growth, and this can be attributed to the fact that firms need to improve their overall efficiency and quality of their product to be able to compete with foreign goods and producers. At industry and sector level, this can also mean reallocation of market shares and resources towards better performing firms. Here, it is necessary to distinguish between imports of production inputs (intermediates and capital goods) and final consumption goods. Note that import penetration can result in the displacement of local firms' products at the same time serve as an essential source of production inputs. As shown by Abreha (2017), a large number of firms identify shortage of raw materials as the first major obstacle in their production operation, and using imported inputs in fact improves the technical efficiency of Ethiopian manufacturing firms. However, the potential gains are dwarfed by firms' limited absorptive capacity. Relatedly, Bigsten et al. (2016) find that input tariff liberalization brings about productivity growth in Ethiopian manufacturing. Therefore, this calls for more research on the topic that explicitly distinguishes between the effect of imported final goods and intermediates and the extent to which the productivity growth is attributed to learning-by-importing and foreign goods competition.

Regarding the policy implications of the findings, we stress the relevance of other constraining factors that must be targeted in the policy design and implementation besides taxes and imports. In this respect, a summary of survey question responses reveal shortage of material inputs as a leading obstacle to firm production operation and capacity utilization. To a lesser degree, absence of market demand is also indicated as a key constraint, which can be a cumulative outcome of low local purchasing power, limited export participation (as an alternative market option), and competition from foreign products. These constraints needs to be addressed in any policy intervention.

On the other hand, the presence of high firm turnover rate in Ethiopian manufacturing sector can mean two things. First, high entry and exit may be a sign of well-functioning market where better-performing firms survive and grow while the poor performing counterparts exit. Additionally, the decomposition of aggregate productivity growth into technical efficiency and reallocation effects reveal that the market is relatively capable of allocating resources from less productive ones to more productive firms. Policy interventions to further increase the flexibility of the market to allocate inputs and finance will be a very rewarding undertaking.[20]

[20] Given the findings in this paper, it is incorrect to rule out entirely the possibility that such a high turnover imply structural problems that firms have difficulty overcoming in order to remain competitive and grow.

Although there is no noticeable role of taxation in determining firm behavior and performance on firms currently under operation, an interesting avenue of future research would be whether taxation is an important factor affecting foreign ownership of local firms and flow of foreign investment into the country. This is relevant question because there is a tradeoff in terms of providing tax incentives: the flow of investment attracted versus the tax revenue that could have been invested on infrastructure and other development initiatives. Another relevant aspect that requires additional research is how the investment and export incentives shape up the quality of investment (in terms of value added, employment creation and technology transfer). In addition, more effort should be directed towards tax administration issues such as settlements and refunds. Not least, meaningful results can be achieved from awareness creation activities targeted towards business owners and other stakeholders on the structure, procedure, rights and obligations of the Ethiopian tax, investment and foreign trade policies.

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Annex 1: Table 1 Value-added production function: output elasticities

Industry name	OLS			FE			FD			LP			WLP		
	l^u	l^s	k	l^u	l^s	k	l^u	l^s	k	l^u	l^s	k	l^u	l^s	k
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
15 Food and beverage	0.655	0.488	0.272	0.373	0.208	0.122	0.175	0.162	0.036	0.380	0.228	0.072	0.460	0.268	0.086
	(0.053)	(0.045)	(0.026)	(0.043)	(0.043)	(0.017)	(0.052)	(0.040)	(0.014)	(0.051)	(0.006)	(0.002)	(0.092)	(0.074)	(0.020)
17 Textiles	0.269	0.362	0.255	0.447	-0.042	0.064	-0.225	0.015	0.065	-0.025	0.178	0.106	-0.348	0.430	0.055
	(0.170)	(0.211)	(0.050)	(0.150)	(0.106)	(0.038)	(0.225)	(0.115)	(0.048)	(0.093)	(0.077)	(0.016)	(0.241)	(0.361)	(0.037)
18 Wearing apparel	0.261	0.477	0.231	1.004	0.349	0.281	0.295	0.210	0.118	0.158	0.405	0.222	-0.183	0.467	0.318
	(0.133)	(0.136)	(0.050)	(0.171)	(0.169)	(0.077)	(0.137)	(0.149)	(0.082)	(0.166)	(0.022)	(0.044)	(0.260)	(0.246)	(0.088)
19 Leather products	0.556	0.354	0.289	0.401	0.423	0.215	0.214	0.145	0.034	0.437	0.238	0.066	0.554	0.153	0.111
	(0.112)	(0.099)	(0.068)	(0.095)	(0.099)	(0.045)	(0.068)	(0.114)	(0.038)	(0.197)	(0.220)	(0.010)	(0.158)	(0.135)	(0.044)
20 Wood products	0.716	0.401	0.151	0.426	0.762	0.072	0.623	0.872	0.042	0.497	0.109	0.119	0.657	-0.312	0.130
	(0.214)	(0.161)	(0.042)	(0.212)	(0.213)	(0.068)	(0.227)	(0.229)	(0.039)	(0.158)	(0.212)	(0.067)	(0.424)	(0.407)	(0.072)
22 Printing and publishing	0.781	0.298	0.243	1.057	0.604	0.178	0.391	0.252	0.090	0.529	0.197	0.152	0.689	0.040	0.155
	(0.078)	(0.068)	(0.042)	(0.075)	(0.077)	(0.026)	(0.099)	(0.076)	(0.025)	(0.005)	(0.085)	(0.003)	(0.157)	(0.109)	(0.045)
24 Chemicals	0.531	0.382	0.299	0.619	0.310	0.263	0.133	0.191	0.031	0.454	0.251	0.343	0.614	0.288	0.332
	(0.124)	(0.144)	(0.085)	(0.097)	(0.107)	(0.068)	(0.105)	(0.130)	(0.078)	(0.036)	(0.041)	(0.085)	(0.223)	(0.211)	(0.069)
25 Rubber and plastic	0.500	0.353	0.275	0.718	0.398	0.204	0.562	0.216	-0.013	0.414	0.336	0.251	0.300	0.413	0.204
	(0.135)	(0.121)	(0.083)	(0.121)	(0.115)	(0.058)	(0.111)	(0.092)	(0.055)	(0.065)	(0.233)	(0.323)	(0.272)	(0.219)	(0.115)
26 Non-metallic products	0.497	0.674	0.160	0.402	0.552	0.097	0.202	0.425	0.057	0.358	0.379	0.063	0.664	0.245	0.067
	(0.060)	(0.065)	(0.040)	(0.058)	(0.081)	(0.027)	(0.058)	(0.082)	(0.035)	(0.078)	(0.058)	(0.025)	(0.158)	(0.140)	(0.044)
28 Fabricated metals	0.829	0.247	0.392	0.644	0.143	0.225	0.486	0.345	0.121	0.709	0.117	0.346	0.702	0.148	0.288
	(0.110)	(0.125)	(0.065)	(0.138)	(0.123)	(0.054)	(0.163)	(0.104)	(0.032)	(0.012)	(0.079)	(0.094)	(0.232)	(0.206)	(0.074)
36 Furniture	0.701	0.413	0.220	0.517	0.481	0.147	0.298	0.218	0.071	0.484	0.207	0.112	0.547	0.196	0.121
	(0.077)	(0.076)	(0.032)	(0.074)	(0.071)	(0.030)	(0.066)	(0.062)	(0.029)	(0.037)	(0.053)	(0.024)	(0.133)	(0.148)	(0.036)
Other manufacturing	0.430	0.576	0.482	0.461	0.413	0.116	0.261	0.021	-0.018	0.206	0.453	0.132	-0.146	0.638	0.160
	(0.178)	(0.149)	(0.085)	(0.150)	(0.140)	(0.053)	(0.155)	(0.157)	(0.062)	(0.009)	(0.035)	(0.049)	(0.275)	(0.228)	(0.079)

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia. Standard errors are clustered at the firm level and reported in parentheses.

Annex 1: Table 2 Correlation matrix of productivity estimates from different techniques

	OLS	FE	FD	LP	WLP
OLS	1				
FE	0.397	1			
FD	0.386	0.722	1		
LP	0.536	0.812	0.756	1	
WLP	0.534	0.807	0.764	0.956	1

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia. Notes: All correlation coefficients are significant at 1% level of significance.

Annex 1: Table 3 Correlation matrix of APG, TE and RE components from different productivity estimators

	APG	TE:OLS	TE:FE	TE:FD	TE:LP	TE:WLP	RE:OLS	RE:FE	RE:FD	RE:LP	RE:WLP
APG	1										
TE:OLS	0.778	1									
TE:FE	0.865	0.971	1								
TE:FD	0.890	0.926	0.987	1							
TE:LP	0.862	0.973	0.999	0.986	1						
TE:WLP	0.831	0.986	0.993	0.966	0.995	1					
RE:OLS	0.290	-0.375	-0.206	-0.104	-0.213	-0.277	1				
RE:FE	0.429	-0.205	-0.082	***-0.011***	-0.087	-0.137	0.946	1			
RE:FD	0.511	-0.050	0.030	0.062	0.026	***-0.005***	0.830	0.960	1		
RE:LP	0.429	-0.207	-0.081	***-0.010***	-0.089	-0.101	0.948	0.997	0.967	1	
RE:WLP	0.390	-0.259	-0.117	-0.030	-0.126	-0.188	0.912	0.984	0.909	0.990	1

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia. Notes: Italicized entries are not significant at 10% level of significance.

Annex 1: Table 4 Effect of taxation on firm productivity growth

	OLS	**FE**	**FD**	**LP**	**WLP**
	(1)	(2)	(3)	(4)	(5)
$\Delta\,\omega_{f,t}$	0.281***	0.228***	0.235***	0.201***	0.212***
	(0.021)	(0.027)	(0.032)	(0.026)	(0.026)
$GAP_{i,t-1}$	0.435***	0.332***	0.338***	0.381***	0.396***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
$CTR_{i,t-1}$	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$k_{i,t-1}$	0.022***	0.043***	0.052***	0.048***	0.044***
	(0.009)	(0.007)	(0.007)	(0.007)	(0.007)
$l_{i,t-1}$	-0.014	0.058***	0.209***	0.155***	0.160***
	(0.017)	(0.017)	(0.018)	(0.016)	(0.017)
$l^{s}(share)_{\,i,t-1}$	0.017	0.039	0.065***	0.045*	0.027
	(0.026)	(0.025)	(0.023)	(0.024)	(0.025)
$EXP_{i,t-1}$	0.046	0.034	0.112*	0.086*	0.079
	(0.057)	(0.056)	(0.050)	(0.052)	(0.052)
$IMP_{i,t-1}$	0.051	0.042	0.041	0.061*	0.068**
	(0.034)	(0.032)	(0.032)	(0.032)	(0.033)
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.24	0.19	0.20	0.22	0.23
Obs.	5,453	5,453	5,453	5,453	5,453

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia. Standard errors are clustered at the firm level and reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01. Notes: The productivity used in these estimations is obtained using the Levinsohn-Petrin method. Results based on productivity estimates from other methods are available upon request.

Annex 1: Table.5 Effects of import competition on firm productivity growth

	OLS	**FE**	**FD**	**LP**	**WLP**
	(1)	(2)	(3)	(4)	(5)
$\Delta\,\omega_{f,t}$	0.256***	0.207***	0.218***	0.183***	0.204***
	(0.020)	(0.028)	(0.033)	(0.027)	(0.027)
$GAP_{i,t-1}$	0.431***	0.312***	0.329***	0.368***	0.388***
	(0.018)	(0.017)	(0.017)	(0.017)	(0.017)
$IMC_{i,t-1}$	0.069***	0.057***	0.061***	0.051***	0.038
	(0.025)	(0.025)	(0.024)	(0.024)	(0.024)
$k_{i,t-1}$	0.021***	0.041***	0.050***	0.046***	0.042***
	(0.009)	(0.007)	(0.007)	(0.007)	(0.007)
$l_{i,t-1}$	-0.004	0.071***	0.213***	0.165***	0.169***
	(0.017)	(0.018)	(0.018)	(0.017)	(0.017)
$l^{s}(share)_{\,i,t-1}$	0.014	0.039	0.062***	0.043*	0.024
	(0.026)	(0.025)	(0.024)	(0.024)	(0.025)
$EXP_{i,t-1}$	0.061	0.067	0.152***	0.117**	0.112*
	(0.058)	(0.061)	(0.055)	(0.056)	(0.055)
$IMP_{i,t-1}$	0.058*	0.054*	0.053	0.073**	0.080**
	(0.035)	(0.033)	(0.033)	(0.033)	(0.034)
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adj. R^2	0.23	0.18	0.19	0.22	0.22
Obs.	5,159	5,159	5,159	5,159	5,159

Source: Author's analysis based on data from the Central Statistical Agency of Ethiopia. Standard errors are clustered at the firm level and reported in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Annex 1: Table 6 Absence of market demand as a first major problem for firm operation

Year	No full-year operation (1)	Under capacity operation (2)	Major operational difficulty (3)
1996	31.25	42.70	34.63
1997	29.02	46.96	34.69
1998	39.26	50.50	40.03
1999	27.27	36.58*	33.95
2000	28.18	36.87*	39.48
2001	41.99	48.02*	45.33
2002	31.76	43.36	30.09
2003	30.94	43.45	31.08
2004	28.09	44.36	33.62
2005	23.10	37.19*	33.60
2006	21.79	36.45	25.90
2007	12.90	27.47	20.91
2008	9.09	18.34	12.89
2009	7.90	17.24	15.34
2010	9.95	14.47	13.91
2011	8.46	17.75	14.63
1996-2011	28.81	35.11	28.75

Source: Compiled from annual Statistical Bulletins on large and medium scale manufacturing and electricity industries surveys, Central Statistical Agency of Ethiopia. * The reported figures are own computation from the original dataset.

Annex 1: Table 7 Shortage of raw materials as a first major problem for firm operation

Year	No full-year operation (1)	Under capacity operation (2)	Major operational difficulty (3)
1996	25.96	28.87	18.93
1997	25.49	23.34	17.55
1998	24.38	22.96	19.03
1999	28.79	27.82	25.92
2000	28.52	22.77	19.35
2001	23.38	19.63	16.37
2002	33.33	22.90	23.01
2003	23.13	22.35	21.93
2004	31.10	29.06	26.92
2005	30.33*	33.18*	31.41*
2006	37.31	33.70	34.17
2007	32.37	41.09	34.17
2008	37.93	40.77	33.53
2009	30.97	33.99	34.12
2010	34.68	41.54	42.87
2011	28.10	40.15	33.77
1996-2011	29.74	30.07	27.07

Source: Compiled from annual Statistical Bulletins on large and medium scale manufacturing and electricity industries surveys, Central Statistical Agency of Ethiopia. * The reported figures are own computation from the original dataset.

Annex 1: Table.8 Percentage of firms considering taxation as an obstacle to business operations

Country name	Total tax rate	Tax rate			Tax administration		
		Minor	Moderate	Major	Minor	Moderate	Major
Djibouti	37.85	46.99	27.44	23.68	56.77	22.93	19.17
Eritrea	84.50	81.01	14.53	2.79	82.68	14.53	1.12
Ethiopia	30.30	55.14	22.48	21.17	58.78	21.16	18.97
Kenya	49.47	35.06	25.15	39.41	45.78	26.81	26.90
South Sudan	-	23.04	30.62	45.39	34.55	37.53	27.24
Sudan	38.37	4.68	19.18	75.83	5.14	23.41	71.30
Uganda	36.15	26.78	27.80	45.10	54.18	24.09	21.60

Source: Compiled from Enterprise Surveys (http://www.enterprisesurveys.org), The World Bank. Notes: The original ranking of the severity of taxation as an obstacle has be regrouped as follows: Minor= no or minor obstacle; moderate=moderate obstacle, and major=major or very severe obstacle. Number of firms (fiscal year): Djibouti—266 (2012); Eritrea—179 (2008); Ethiopia—484 (2004/05) and 644 (2011); Kenya—657 (2006) and 781 (2012); South Sudan—738 (2013); Sudan—662 (2013), and Uganda—563 (2005) and 762 (2012).

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