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Productivity premia and firm heterogeneity in Eastern Africa

Binyam A. Demena, Jamal Msami, Donald Mmari and Peter A.G. van Bergeijk

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Abstract

Productivity development is a key issue for export-driven growth and development. We use East African Community (EAC) firm-level data. Instead of focusing on single EAC partners, using the World Bank Enterprise Surveys, investigate firm-level productivity difference for seven countries that are part of the COMESA-EAC-SADC tripartite free trade area (TFTA). Using export and ownership dimensions, we identify four types of firms: National Domestic, National Exporters, Foreign Domestic and Foreign Exporters. We find a clear export productivity premium for national manufacturing firms and service sectors, but not for foreign owned firms. We also find clear foreign-ownership productivity premium for both domestic and exporting firms in manufacturing sectors but less clear in services sectors. The gap between national export premium and foreign-ownership premium is stronger in manufacturing firms as opposed to service sectors. Moreover, we find clear and strong productivity premia in size, training programmes and level of development in the manufacturing firms. In the services sector, these premia are always smaller and only significant for medium-sized firms. There is no difference in experience premium between sectors in terms of both significance and magnitude of the estimated coefficients.

Keywords

Productivity, exports, firm heterogeneity, FDI, sub-Saharan Africa, EAC.

JEL Codes: O12, J24, F23, D20, O55.

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Affiliations

Binyam Afewerk Demena and Peter A.G. van Bergeijk are in the International Institute of Social Studies at Erasmus University, The Hague, The Netherlands.

Jamal Msami and Donald Mmari are in REPOA Policy Research for Development, Dar es Salaam, United Republic of Tanzania.

Productivity premia and firm heterogeneity in Eastern Africa

1 Introduction

The economic debate on the benefits and cost of globalization has been ongoing for many years based on traditional macroeconomic analyses and reasoning. The perspective on this issue changed importantly due to applications and extensions of the New International Trade Theory building on the seminal work of Helpman and Krugman (1985) and Melitz (2003) and the focus has become the Micro-Economics of International Firm Activities. Accordingly, the relevance of heterogeneity across firms has become the heart of both the Micro-Economics of International Firm Activities and the New International Trade Theory (Wagner, 2011).

In the past 25 years the international trade literature radically changed by paying attention to individual firm characteristics. This literature started in 1995 by Bernard and Jensen with US firm-level data who investigate the difference between exporters and non-exporters.[1] They found significant economic performance differences between these two types of firms. The ensuing literature on heterogeneous firms has been booming for other countries with majority of empirical studies confirming their findings. However, the evolving discourse remains notable for under-representation of important questions including the degree of firm heterogeneity and development in developing countries (van Bergeijk and van Marrewijk, 2013). Underlying such lacunae has been the availability of reliable and periodic data. Recent efforts to improve the reliability of microeconomic data such as those by the World Bank Enterprise Surveys (WBES) on regional development, have enabled the microeconomic analysis of firm-level productivity for many countries (e.g., Mebratie and Bedi, 2013).

In this study we use East African Community (EAC) firm-level data. Instead of focusing on single EAC partners, we construct a panel using WBES data and investigate the seven major intra-regional trading partners in the so-called tripartite free trade area (TFTA) that constitutes of countries that are part of in both the Common Market for Eastern and Southern Africa

[1] See Wanger (2012) for extensive survey of the empirical research on firm heterogeneity and productivity. He, summarizing studies published from 1995 to 2011, argues that the big picture that emerges after the first decade of micro-econometric research on the relationship between exporting and productivity is that exporting does not necessarily increase productivity whereas exporters are more productive than non-exporters, the latter leading to self-select of more productive firms into export markets. However, underlying this partial picture is a lot of heterogeneity (regarding data characteristics, methodologies, statistical power, and coverage), and this leads Wagner (2011) to his recommendation to use a meta-analysis as a useful tool to explain heterogeneity and establish the overall underlying empirical effect (see also ISGEP, 2008 for similar recommendation).

(COMESA) and the Southern African Development Community (SADC).[2] Using the WBES data, we analyse firm-level productivity for seven major intra-regional trading countries. We construct this dataset to contribute to the literature on productivity development and firm-level heterogeneity in five different ways.

First, this is the first study that explores whether EAC and major intra-regional trading partner exporting firms are more productive than non-exporting firms.[3] The relationship between firm-level productivity and exporting is one dimension that has received close attention (Greenaway and Kneller, 2007). The existing literature on export and productivity dimension alone can be divided into two theoretical strands, which are well recognized. The first theoretical strand focuses on self-selection: only the most productive firms enter into export markets because higher productivity is necessary to overcome the additional trade costs in exporting to foreign countries.[4] The findings on balance suggest that *pre-entry differences* between exporters and their counterparts which trade on the domestic market only support the hypothesis that more productive firms trade more. In the second strand, learning-by-exporting, firms that engage in foreign markets become more productive only after they begin to export, suggesting that *post-entry differences* should be the focus of the analysis.[5] The argument is that knowledge and information is tapped from and developed on international markets improving the export performance of the starters. In addition, firms operating in the international markets face more intense competition and thus must improve their performance to be competitive and sell their products.

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[2] In identifying major EAC intra-regional trading partner countries that are both in the COMESA and SADC communities, we use the World Bank's World Integrated Trade Solution (WITS) statistics for trading partners, available at: https://wits.worldbank.org/CountryProfile/en/Country/TZA/Year/2018/TradeFlow/EXPIMP#.
The WITS Trade Stats is a database created by the World Bank Group using data UN COMTRADE and UNCTAD TRAINS database. It has a wide range of information for bilateral trade exports, imports and tariffs covering 180 countries and regions. This construction brings together three of Africa's major intra-regional trading blocs, COMESA-EAC-SADC, hence the tripartite free trade area (TFTA).

[3] In developed countries: Canada (1974 -1996) Baldwin and Gu (2003); Germany (1978 – 1992) Bernard and Wagner (1997); Italy (1996) Castellani and Zanfei (2007); Ireland (2000) Girma et al. (2004); Spain (1991 – 1996) Delgado et al. (2002); Sweden (1980 – 1997) Greenaway et al. (2005); UK (1988 – 1999) Girma et al. (2004); USA (1983 – 1992) Bernard and Jensen (2004). In developing countries: Chile (1990 – 1996) Alvarez and López (2005); Colombia (1981 – 1991) Fernandes and Isgut (2005); Indonesia (1990 – 1996) Blalock and Gertler (2004); Mexico (1986 – 1990) & Morocco (1984 – 1991) Clerides et al. (1998); Nine sub-Saharan African (1992 – 1996) van Biesebroeck (2005); Cameroon (1992 – 1995), Ghana (1991 – 1993), Kenya (1992 – 1994) & Zimbabwe (1992 – 1994) Bigsten et al. (2000).

[4] This theoretical strand of the empirical literature includes among others Melitz (2003), Helpman et al. (2004), Baldwin (2005), Bernard et al. (2007), Melitz and Ottaviano (2008), Eliasson et al. (2012).

[5] The empirical literature includes among others Clerides et al. (1998), De Loecker (2007), Greenaway and Kneller (2008), Chongvilaivan (2012).

Second, we extend a firm's international organization incorporating ownership dimensions, rather than putting all firms into one dimension only (i.e., export orientation only). Foreign direct investment (FDI) is another dimension of firm-level globalization strategy. FDI become less attractive compared to exporting when costs of entry and operation of foreign production increase, and more favourable when the foreign market size grows and costs of exporting rise (Greenaway and Kneller, 2007). As argued in Chang and van Marrewijk (2013), the FDI or the foreign-ownership dimension is less recognized in the research of productivity premia. Thus, we extend the exporting internationalization literature and combine with ownership status to create or identify four types of firms, namely: National Domestic, National Exporters, Foreign Domestic and Foreign Exporters.

Third, our analysis also covers the level of country development and four basic firm characteristics (namely: capital intensity, formal training programs, the firm size and age). It has been argued, for instance, that heterogeneity with respect to internalization and firm-level productivity tend to be strongest at the lowest country's development level (Mebratie and van Bergeijk, 2013; Chang and van Marrewijk, 2013). However, as indicated by van Bergeijk and van Marrewijk (2013) the relationship between development and firm-level heterogeneity is underexplored in the literature. They also argued that the degree of basic firm characteristics in developing countries is the other big question that is still underexplored, a point also stressed by Demena and Murshed (2018) regarding the development of productivity and different measures of firm heterogeneity (see Section 2).

Fourth, we extend our analysis to the service sectors as well. This is a broader approach than usually found in the literature as the majority of existing empirical studies regarding firm-level heterogeneity focus on the manufacturing sector only (see e.g., Lewis and Peng, 2018; Chongvilaivan, 2012; Mahmood, 2008; van Biesebroeck, 2005; Baldwin and Gu, 2003; Bigsten et al., 2000). Services sectors are, however, very important for the countries in our sample: "in the majority of East African countries, real GDP growth from the supply side is driven primarily by growth in services" (African Development Bank 2019).

Fifthly, we focus on Sub-Saharan Africa (SSA) countries, a region that due to lack of periodic data availability has been under researched. Chang and van Marrewijk (2013) like our paper studies firm heterogeneity and development, but for 15 developing Latin American countries for the year 2006. SSA is a very relevant area as it comprises most of the low-income countries (23 of the 29 low-income economises according to the World Bank current classification by income).[6] There is a clear need to investigate productivity development and firm-level heterogeneity to understand what kind of productivity premia is most appropriate in general for SSA and in particular TFTA partner countries.

This paper is structured as follows. Section 2 investigates the relationship between productivity development and firm heterogeneity using a review of 69

[6] The World Bank full list of current classification by income is available at: World Bank Country and Lending Groups – World Bank Data Help Desk

empirical studies associated with foreign ownership. Section 3 extensively discusses the source of the data, characteristics of the data along various dimensions and section 4 introduces the empirical approach. Section 5 starts with the main results followed by further investigations and robustness checks. We run a set of different specifications as further investigations and robustness checks to shed light on the sensitivity of our main findings to different classifications. Finally, section 6 concludes.

2 The relationship between productivity and firm heterogeneity

The empirical and theoretical literature recognized that firm heterogeneity regarding the degree of basic firm characteristics has been important in the development of firm productivity. In this section we explored the influence of basic firm characteristics on the outcome of firm productivity. We have reviewed the large numbers of published and unpublished empirical studies emphasizing foreign ownership dimension alone carried out in developing countries. This review has identified 1,450 reported productivity effects associated with foreign ownership from 69 empirical dealing with 31 developing countries[7] (for detailed review, see Demena, 2017).

TABLE 1
Firm-level heterogeneity and firm productivity

Variable	Positive & significant at 10%		Insignificant at 10%		Negative & significant at 10%		Total No.
	No.	*%*	*No.*	*%*	*No.*	*%*	
Firm size	131	28	239	52	94	20	464
Export	109	40	141	52	23	8	273
Foreign ownership	466	32	740	51	244	17	1450
Capital intensity	311	33	447	48	179	19	937
R&D	39	30	67	50	26	19	132
Labour quality	346	33	499	48	202	19	1047

Source: Authors' review of productivity effects reported in 1450 regressions of primary studies.

Using this structured review, Table 1 reports how the outcome of firm productivity is associated with firm heterogeneity, illustrating how the nature of firm-specific factors play a role in enhancing the productivity effect provided that included in the empirical design of the reviewed studies. For instance, 40% of the regression that control for export status result in the importance of firm-

[7] These are: Argentina, Bangladesh, Bolivia, Cambodia, Chile, Colombia, Ecuador, Ethiopia, Ghana, Guatemala, India, Indonesia, Kenya, Malaysia, Mexico, Morocco, Panama, Paraguay, Peru, Philippine, South Africa, Thailand, Taiwan, Tanzania, Turkey, Uganda, Uruguay, Venezuela, Vietnam, Zambia, and Zimbabwe.

level exporting to enhance productivity. In contrast, the results are insignificant in 52% of the reported effects (8% for negative productivity effects). The size of the firm appears to positively influence the productivity development in 28% of the reported effects. Similarly, other basic firm characteristics related to capital intensity and the quality of labor are important factors to explain the productivity development – two-third of the reviewed studies report positive and significant effect. The result from R&D suggest similar trend, however we have very small samples on this.

Table 1 also shows the extent of disagreement in terms of the direction and significance of the reported effects related to foreign ownership dimension alone on productivity development. About one-third of the estimates (32%) find a positive and significant productivity effect, whereas about one in six reports a negative and significant productivity effect. The other 51% show both positive and negative but insignificant effects. Hence, despite the huge literature concerned with investigating the foreign ownership related productivity effects, findings in the empirical studies have generated substantially divergent results. This might be the case that some foreign firms export while others do not, hence lumping exporter and non-exporter into ownership dimension alone might hide the actual relation between heterogeneity and firm productivity development.

Another important message is that most of the reviewed studies attempted to test the productivity development associated with foreign ownership regardless of the nature of some basic firm-level heterogeneity. For instance, the reviewed studies largely ignore the heterogeneity characteristics related to the R&D, as only about 9% of the regressions control for this difference (see also the meta-analysis of Mebratie and van Bergeijk, 2013, for comparable findings). Therefore, the empirical design of the 69 studies reviewed recognizes the importance of the input factors and their qualities in a production function framework but fails to include some important firm-level heterogeneity factors. Thus, the characteristics of domestic firms cannot be ignored, but rather, seem to mediate the expected magnitude, significance and sign of the productivity development. That is, the extent to which the development of productivity emerge may not appear evenly across all firms.

3 Data

3.1 Data source and construction

We use data obtained from the WBES. The WBES is an ongoing World Bank project designed to provide datasets using standard survey instruments. The WBES is based on a stratified random sampling of firms in participating countries. For all countries, samples are stratified along three dimensions: geographical regions, sector and firm size. The survey is administered to cover sample of representative firms from the non-agricultural formal private sector. The surveys are conducted across all geographical regions and establishment size (small, medium, and large) on sample of firms from the entire manufacturing sectors, the services sectors, and the transportation and

construction.[8] The standardized format (i.e., the same sampling methodology and survey instruments) uses a standard set of questions, allowing for better comparisons across country and time (World Bank, 2017). In sum, the global format of the survey consists of a core questionnaire, a uniform population and uniform methodology.

The WBES focuses on the provision of data that allow researchers to investigate how changes in business environment affect firm-level productivity at both over time and across countries (Demena, 2007). For this purpose, the data contains information on a set of individual variables, such as productivity performance, ownership status, market orientation (export status), technological behaviour and some other basic firm characteristics. Based on the objective of the study, we use data from seven major intra-regional trading countries that are part of the TFTA. These are the Democratic Republic of Congo (DRC), Kenya, Malawi, Rwanda, Tanzania, Uganda and Zambia. The data covers the period 2013–2014 and consists of firm-level information for 4,488 observations.

Table 2 gives the number of firm-level observations by country and sector. Leaving aside the relatively small sample from Rwanda, approximately all the countries have similar sample distribution, 12 – 18%. Tanzania represents the highest number of observations with 813 firm-level information, representing 18% of the overall sample. Table 2 also provides industrial stratification designed into manufacturing industry and service sector. Manufacturing represents 48% and service sector accounts for 52%. The former consists of firm level information for ten manufacturing industries and the latter represents six service sectors. Within these industrial stratifications, sectors are classified based on the International Standard Industrial Classification (ISIC) Rev. 3.1 2-digit classification. In total the surveys contain 27 2-digit industries.[9] There are strong similarities in terms of industrial distribution across countries. Manufacturing of Food products and beverage, furniture, other manufacturing,[10] retail, hotel and restaurants are the biggest sectors in the countries under study.

[8] Public utilities, government services, health care, and financial services sectors are not included in the universe.

[9] The full list of the 2-digit industry classification is available at: https://www.enterprisesurveys.org/content/dam/enterprisesurveys/documents/methodology/ES_QuestionnaireManual_2019.pdf

[10] Other manufacturing includes manufacture of tobacco (16), leather (19), paper (21), refined petroleum products (23), plastic and rubber (25), basic metals (27), machinery and equipment (29), electronics and electrical machinery (31), precisions instruments (33), transport machines (34) and recycling (37).

TABLE 2
Distribution of Firms across countries and Industries

ISIC code	Two-digit Industry	Tanzania	DRC	Kenya	Malawi	Rwanda	Uganda	Zambia	Total
		No. of Firms							
15	Food	91	37	163	45	65	118	62	581
17	Textile	37	3	38	12	1	41	9	141
18	Garment	57	37	12	16	-	13	31	166
20	Wood	20	20	8	12	9	22	24	115
22	Publishing, printing and recorded media	19	10	14	26	4	14	31	118
24	Chemicals	12	29	37	16	2	9	28	133
26	Non-Metallic	14	6	12	5	3	15	40	95
28	Fabricated Metal	32	32	16	4	4	52	33	173
30	Furniture	114	44	15	14	16	54	50	308
	Other Manufacturing	75	42	87	76	41	64	90	462
Total Manufacturing		*441*	*243*	*414*	*197*	*120*	*382*	*368*	*2171*
52	Retail	121	136	166	117	79	165	123	907
51	Wholesale	43	39	55	32	20	49	22	260
55	Hotel and restaurants	157	49	58	38	79	102	122	605
50	Services of motor vehicles	30	15	35	62	31	33	31	237
60	Transport storage & communication	12	26	35	24	17	9	17	140
45, 72	Other Services	9	21	18	52	14	22	31	167
Total Services		*372*	*286*	*367*	*326*	*240*	*380*	*346*	*2317*
Total manufacturing and services		*813*	*529*	*781*	*523*	*360*	*762*	*720*	*4488*

Source: Authors' compilation using World Bank Enterprise Surveys.

Note: Other manufacturing includes manufacture of tobacco (16), leather (19), paper (21), refined petroleum products (23), plastic and rubber (25), basic metals (27), machinery and equipment (29), electronics and electrical machinery (31), precisions instruments (33), transport machines (34) and recycling (37). Other services include construction (45) and IT (72).

3.2 Descriptive analysis

Performance in productivity

Our main variable of interest is productivity. The WBES data does not provide a direct measure of productivity. Productivity is measured using either a direct procedure based on labour productivity, output or value-added or an indirect estimate of total factor productivity (TFP).[11] There is no consensus on the appropriateness of the direct versus the indirect approach. In our case, estimation of TFP would be very much restricted due to the time dimension of

[11] Studies employ a production function to estimate a firm's TFP using firm's factor inputs.

our data. Thus, we opted for a direct procedure and follow Demena and Murshed (2018) and Chang and van Marrewijk (2013).[12]

We use two steps to standardize the data in local currency units (LCUs) across countries. First, we convert all monetary values to international currency – the US dollars. We use official exchange rate for all the countries for the period of the sample year. Next, we deflate the values using the GDP deflator (i.e., in US dollars with 2000 as the base year). All data were obtained from the World Development Indicators (WDI). In doing so, the productivity observations reduced from 4488 to 3,454 observations, due to missing data for sales value (970 observations) and total number of employees (additional 64 observations).

TABLE 3
Summary statistics for productivity by country

Country	Mean	Standard deviation	Min	Median	Max	Total No. of firms
Log of Productivity						
Tanzania	6.932	1.749	1.808	6.819	16.211	476
DRC	7.521	2.359	2.315	7.157	15.732	481
Kenya	8.506	1.721	2.062	8.494	15.324	660
Malawi	7.327	1.774	1.509	7.213	13.413	348
Rwanda	7.309	2.019	2.605	7.126	15.325	360
Uganda	7.168	2.104	0.849	7.020	15.150	496
Zambia	13.866	1.333	8.285	13.001	18.147	633
Normalized Productivity						
Tanzania	0.454	0.246	0	0.450	1	476
DRC	0.417	0.239	0	0.388	1	481
Kenya	0.504	0.236	0	0.508	1	660
Malawi	0.491	0.278	0	0.478	1	348
Rwanda	0.490	0.272	0	0.481	1	360
Uganda	0.488	0.269	0	0.490	1	496
Zambia	0.474	0.237	0	0.447	1	633

Source: Authors' compilation using World Bank Enterprise Surveys.

Tables 3 and 4 report the summary statistics of productivity by country and sector, respectively. The upper part of both tables (log of productivity) show substantial difference of productivity measures across countries and sectors. As a result of this, we employ normalized productivity (NP_{isc}) by sector and country, as given in equation 1.

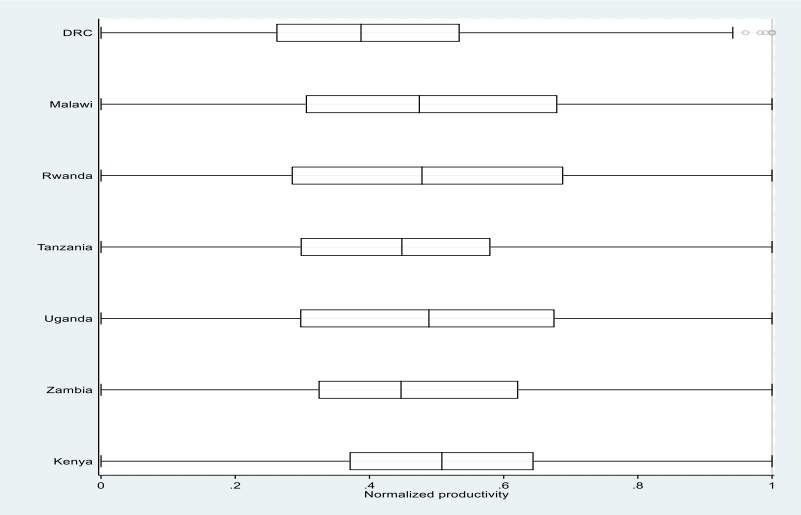
[12] Demena and van Bergeijk (2017) meta-analysis of empirical studies published in period 1986 – 2013 suggests the popularity of the direct procedure, with two out of five of the empirical estimates employing the direct approach. Other researchers, for instance Mahmood (2008) point out that the relevance of the direct approach (labour productivity) as it is important for living standards and wages in African context.

$$NP_{isc} = \frac{log(P_{isc}) - \min \log (P_{isc})}{\max \log (P_{isc}) - \min \log (P_{isc})} \quad (1)$$

where P is the reported sales per total worker employed. The subscripts i, s, and c, represent firm, industry and country respectively. In this case, log P_{isc} implies log of productivity for firm i in sector s and country c. NP_{isc} is therefore measures normalized productivity for firm i in sector s and country c with the scale from zero to one - firms are scaled in terms of the worst and best performing for a given sector in a given country. The logic of the indicator is viewed as forming a line segment with length equal to the distance between best and worst performing countries. The TFTA countries are therefore placed along this line segment revealing their relative potions of the indicator.

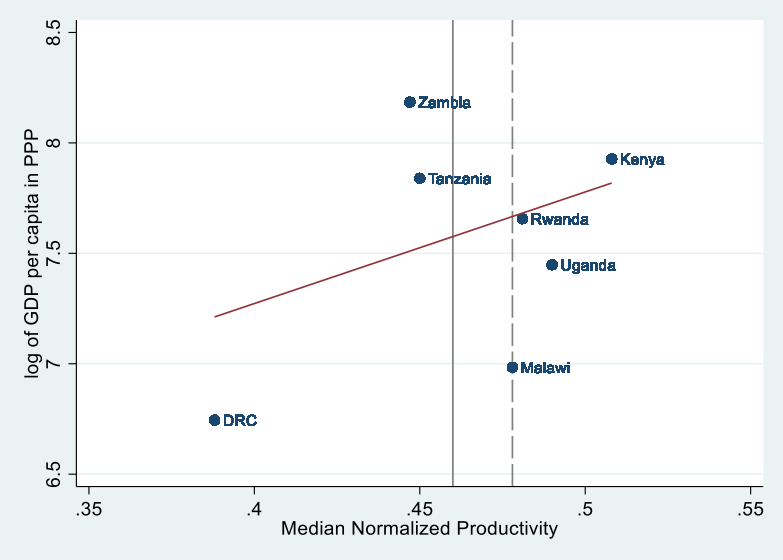
This indicator is presented in lower part of Tables 3 and 4, allows for a comparison of normalized productivity across sectors and countries (Chang and van Marrewijk, 2013). The statistics are based on a clustered computation of seven countries (Table 3) and 27 industries (Table 4). This provides an indication of the difference in productivity distribution. For instance, countrywide, firms in Kenya are on average the most productive, whereas those in DRC are least productive (Table 3, and Figure 1). Kenya is also the country with the least productivity variation across the sectors. In contrast, Malawi is the country with the highest productivity variation, suggesting the presence of larger productivity gap between firms.

FIGURE 1
Box plot of Firm productivity across the TFTA countries



Notes: The figure shows a box plot of the estimates of the normalized productivity distribution reported across the TFTA countries. Following Tukey (1977), the box shows interquartile range (P25–P75), the lower limit the P25 (Q1) and the upper limit the P75 (Q3) with median represented by vertical line within the boxes. Horizontal whiskers cover the interval from (P25 - 1.5 times the interquartile range) to (P75 + 1.5 times the interquartile range) (Tukey, 1977). Any dots should show the remaining (outlying) normalized productivity, which is observed only for DRC in 4 cases on the right top corner.

FIGURE 2
Firm productivity and development level across the TFTA countries



Notes: The figure shows the relationship between firm productivity and a country's level of development. The solid vertical line represents median of all the productivity distribution. The long-dashed line represents the median of median productivity distribution from the TFTA countries.

The statistics across sectors (Table 4) indicate that firms in the manufacture of food products and beverages are the most productive. More than half of the firms in this sector are more productive than the average firm in any sector. On average the most productive firms for food products and beverages are in Zambia and at least half of these firms have stronger productivity than firms in any country on average (Table A1). Only eight firms in this sector in Tanzania are as productive as the average Zambian firms. Again, firms in this sector in DRC are the worst performing with Tanzanian firms, the second least productive. Comparisons of Tables 3 and A1 show that firms in the manufacture of food products and beverages are best performing than the average firms in any country, suggesting the relevance of this sector for TFTA countries under study (exceptions are firms located in DRC). Figure 2 shows further relationship between firm productivity (median normalized productivity) and the level of country's development (the log of GDP per capita in PPP). As can be seen from the upward slopping line, there is a positive relationship between productivity and a country's development level – DRC in the lower-left corner, Kenya in right-upper corner and the other 5 countries in between. The upward slopping line is an initial indication of a positive association between the level of country's development and productivity – countries with higher income level (more developed countries) are populated with higher productive firms. The median productivity estimates of the median productivity reported in individual countries (represented by the long-dashed line) equals 0.478, which is close to the mean of the productivity

level across countries (0.474). The solid line denotes the median of all the productivity estimates. The closeness of the mean and median (Tables 3 and 4, Figures 1 and 2) is an indication that that there are no serious outliers in our dataset, so we do not exclude any normalized productivity estimates across the TFTA from the analysis.

TABLE 4
Summary statistics for productivity by industry

Industry	Mean	Standard deviation	Min	Median	Max
		Log of productivity			
Food	8.596	2.771	1.583	8.274	16.829
Textile	7.897	2.514	3.600	7.584	16.224
Garment	7.445	3.027	2.566	6.560	14.565
Wood	9.132	2.772	5.783	8.336	15.192
Publishing, printing and recorded media	7.445	3.027	2.556	6.560	14.565
Chemicals	9.524	3.428	3.242	8.458	16.984
Non-Metallic	10.563	3.498	2.843	11.004	17.677
Fabricated Metal	8.533	3.136	2.276	7.536	17.677
Furniture	7.904	3.216	1.808	6.819	17.899
Other manufacturing	9.594	3.094	1.583	9.015	16.761
Average manufacturing	8.732	3.155	1.509	8.164	17.899
Retail	8.404	3.005	1.857	7.776	18.147
Hotel and restaurants	8.671	3.190	2.276	7.634	17.860
Wholesale	8.762	2.902	2.315	8.334	17.716
Transport, storage & communication	8.862	3.267	0.849	8.429	17.225
Services of motor vehicles	8.732	2.977	2.681	8.153	14.527
Other Services	9.625	3.131	4.537	9.004	18.028
Average services	8.665	3.076	0.849	7.951	18.147
		Normalized productivity			
Food	0.537	0.206	0	0.530	1
Textile	0.427	0.274	0	0.371	1
Garment	0.463	0.262	0	0.433	1
Wood	0.469	0.280	0	0.458	1
Publishing, printing and recorded media	0.487	0.299	0	0.477	1
Chemicals	0.504	0.288	0	0.490	1
Non-Metallic	0.414	0.284	0	0.379	1
Fabricated Metal	0.510	0.278	1	0.525	1
Furniture	0.456	0.243	0	0.406	1
Other manufacturing	0.476	0.352	0	0.503	1
Average manufacturing	0.487	0.273	0	0.481	1
Retail	0.448	0.205	0	0.432	1
Hotel and restaurants	0.489	0.200	0	0.454	1
Wholesale	0.462	0.245	0	0.455	1
Transport, storage & communication	0.490	0.278	0	0.479	1
Services of motor vehicles	0.471	0.253	0	0.444	1
Other Services	0.472	0.317	0	0.453	1
Average services	0.461	0.229	0	0.445	1

Source: Authors' compilation using World Bank Enterprise Surveys.

Export intensity, firm ownership and firm type

Table 5 gives the export intensity of the sampled firms. A firm is classified as an exporter if it exports at least 10% of its output (World Bank Enterprise, 2017). Applying this threshold there are only 480 exporting firms, equivalent to 11.4% of the overall sample. Considering the sampled firms within each country (which depends on the relative size of the economy), Kenya and Rwanda have higher percentages of exporting firms with 21% and 23%, respectively. Conversely, the DRC and Tanzania have the lowest percentage of exporting firms with 4% and 7% respectively. The number of exporting firms in Kenya is about three-fold than in any of the countries under study. To put this figure in to comparison: the total share of exporters (11.4%) is higher than the 8.0 % for eight sub-Saharan African countries for the period 2006-2014 reported in Demena and Murshed (2018) and similar to the 11.5% for the 15 Latin American Countries sampled in 2006 reported in Chang and van Marrewijk (2013).

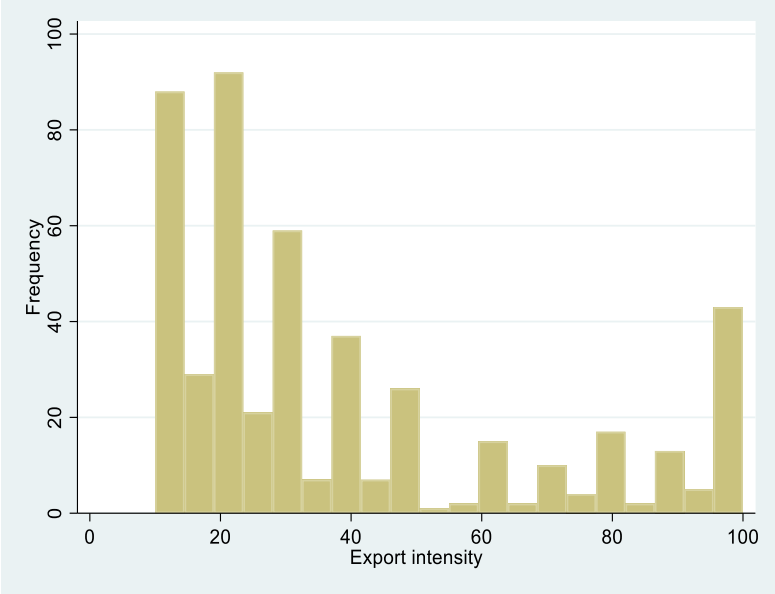
TABLE 5
Distribution of Export intensity by country

Country	Export intensity (%)			Total No. of exporters	Total No. of firms	% of exporters
	10 - 20	21 – 60	61 – 100			
Tanzania	24	28	7	59	681	8.7
DRC	12	9	1	22	528	4.2
Kenya	64	60	47	171	759	22.5
Malawi	19	15	6	40	462	8.7
Rwanda	28	33	14	75	360	20.8
Uganda	37	19	8	64	733	8.7
Zambia	22	14	13	49	706	6.9
Average	29	25	14	69	604	-
Total	206	178	96	480	4229	11.4

Source: Authors' compilation using World Bank Enterprise Surveys.

For each country, Table 5 also provides the export intensity in terms of the number of firms exporting certain shares of their output. Among the 480 exporters, more than two fifth export between 10 – 20% of their output, while one third export between 21 – 60% of their output (Figure 3). The other one fifth export more than 60% of their output. The export intensity greatly varies across countries. Firms in the highest exporting country, Kenya, exhibit roughly similar distribution in the three categories of the percentages of firms exporting. When we look at the other countries, the export intensity pattern is slightly different for Tanzania and Rwanda. Most exporting firms in these countries are at the middle of export intensity - relatively larger proportion of firms export between 21 – 61% of their output. Moreover, the result with the lowest export share, DRC, is quite different as more than 90% of the firms export up to 60% only.

FIGURE 3
Export intensity across the TFTA countries



Source: Authors' compilation using World Bank Enterprise Surveys.

TABLE 6
Summary statistics for firm types in manufacturing and service sectors

Firm type	All firms	%	Manufacturing	%	Services	%
National Domestic	3162	76.4	1483	72.9	1679	79.8
National Exporter	320	7.7	194	9.5	126	6.0
Foreign Domestic	508	12.3	254	12.5	254	12.1
Foreign Exporter	148	3.6	104	5.1	44	2.1
Total	4138	100	2035	100	2103	100

Source: Authors' compilation using World Bank Enterprise Surveys.

In addition to the export status, we also classify firms by ownership characteristics, i.e., whether a firm classifies as foreign or local owned. According to the IMF (2009), an investment by foreign investor is regarded as foreign owned in which a direct investor owns at least a 10% of the ordinary share of equity or voting power in an enterprise. Our classification follows this cut-off percentage in that a firm is classified as foreign if it has at least 10% of its shares are held by non-nationals. Using this classification, there are 3482 (84.1%) national and 656 (15.9%) foreign firms. Combining the two firm dimensions, i.e., export status and ownership, we distinguish four types of firms, see Table 6. Among the 4138 firms, most are National Domestic (76.4%) and sell their output to the domestic market. This is followed by Foreign Domestic firm in which 12.3% of the foreign firms are national/domestic market oriented. National Exporters represent 7.7%, i.e., nationally owned and export market oriented. The last 3.6% belong to Foreign

Exporters – foreign owned and sales to foreign market. In terms of sector, the ordering and percentage shares are analogous when we classify firms into manufacturing and service sectors (Table 6).

TABLE 7
Summary statistics for firm types by productivity and firm size

Firm type	N	Mean	S.D.	Min	Median	Max
			Normalized productivity			
National Domestic	2515	0.448	0.241	0	0.437	1
National Exporter	290	0.535	0.269	0	0.514	1
Foreign Domestic	407	0.567	0.256	0	0.565	1
Foreign Exporter	128	0.598	0.287	0	0.629	1
			Size by the number of workers			
National Domestic	3094	31.8	127.6	1	10	4000
National Exporter	314	162.5	534.1	3	50	8000
Foreign Domestic	503	79.4	227.9	2	23	3500
Foreign Exporter	146	211.3	543.5	5	84	5500

Source: Authors' compilation using World Bank Enterprise Surveys.

Next, we discuss the four types of firms in terms of their productivity distribution. Exporting firms (irrespective of ownership type) are more productive than non-exporting firms (e.g., see Lin and Weng, 2019; Davies and Jeppesen, 2015), whereas locally-owned firms are less productive than foreign-owned firms (Demena, 2017). Our sampled firms confirmed this, suggesting domestic market-oriented firms (locally-owned firms) are less productive than exporting firms (foreign-owned firms). The existing literature of international trade and heterogeneous firms further suggested that there is monotonic performance hierarchy among the four types of firms identified (Kox and Rojas-Romagosa, 2010). The latter is also confirmed in our sampled firms, our main hypotheses are therefore as follows:

- **Hypothesis 1**: National Exporters are more productive than National Domestic.

- **Hypothesis 2**: Foreign Domestic firms are more productive than National firms (Domestic and Exporter).

- **Hypothesis 3**: Foreign Exporters are more productive than any of the other three firm types.

Incorporating ownership status offers a more comprehensive picture of the productivity distribution. As indicated, we also find that Foreign Domestic firms are more likely to be productive than National Exporters. In this regard, the ranking of the productivity distribution suggests that the ownership type (foreign-owned) premium is more relevant than the export premium. This ranking of productivity and firm type pattern is similar with the Dutch sampled firms in 1999 – 2005 reported in Kox and Rojas-Romagosa (2010) or for the 15 Latin American Countries sampled in 2006 reported in Chang and van

Marrewijk (2013). We also find a similar pattern when we disaggregate the firms by the industrial type (see, Table A2 in the appendix). In both the upper and bottom parts of Table A2 a clear pattern emerges also when we deal with the manufacturing and service sectors separately. All the figures in productivity differences are statistically significant at 1%. The information in Table A2, also suggests that on average the manufacturing sector tends to be more productive than service sector. This leads to our fourth hypothesis which compares the impact of the identified four types of firms on the development of productivity premia is significantly higher for manufacturing than services sectors.

WBES measures firm size by the number of employees (Table 8, definition of variables). In general, in terms of firm size, foreign-owned firms appear to be larger (Demena and Murshed, 2018). In our sampled firms, we also find uniformity with this observation. The bottom part of Table 7 presents the identified firm types by size. One average, exporters tend to be larger in size than non-exporters. Moreover, on average Foreign Exporters tend to be larger than any other firm type. Using Table 7, bottom part, therefore, we find a similar ranking patter as the case with productivity distribution by firm type (Table 7 upper part), except the reversal ranking between National Exporters and Foreign Domestic firms. Thus, our fifth hypothesis is that the larger the size of the firm the higher the productivity premia.

4 Empirical approach

To develop our empirical approach of the relationship between productivity development and firm heterogeneity, we started investigating our data. The discussion of the data above suggests that there is no single dimension that can fully elucidate the difference in productivity performance of the sampled firms. In this regard, we need to simultaneously control for various other firm heterogeneities before we fully explain the productivity performance difference. We first analyse whether exporters have significant productivity performance premium as compared to non-exporters, while controlling for various firm-level characteristics, industry and country fixed effects. Next, we distinguish the analyses according to the four identified types firms to include foreign-ownership productivity premium along the export productivity premium. Finally, we also investigate the difference in productivity performance involving other firm characteristics (e.g., firm size, development levels). The latter is vital to fully explain the difference in productivity performance incorporating various sources of productivity premia. Doing so, we separate the model between manufacturing and service sectors throughout the analyses and discussions.

The empirical approach is estimated using the following equation:

$$NP_{isc} = \beta_0 + \beta_1 \mathrm{NE}_{isc} + \beta_2 \mathrm{FD}_{isc} + \beta_3 \mathrm{FE}_{isc} + \beta_4 \mathrm{MS}_{isc} + \beta_5 \mathrm{LS}_{isc} + \beta_6 \mathrm{GDP}_{isc} + \alpha \sum X_{isc} + \beta_7 I_s + \beta_8 C_c + \varepsilon_{isc} \quad (2)$$

The subscripts *i*, *s*, and *c*, represent firm, sector and country, respectively. We include industry fixed-effects (I_s) and country fixed- effects (C_c) to account for unobservable time-invariant heterogeneity in industries and countries, respectively. This addresses the econometric concerns induced by potential omission of unobserved variables to obtain unbiased and consistent estimates (Demena, 2017). We also include dummy variables for firm size ($\mathbf{MS}_{isc}$ and $\mathbf{LS}_{isc}$), a measure of country level of development ($\mathbf{GDP}_{isc}$) and a set of control variables (X_{isc}) as outlined in Table 8. We use the WBES classification of firm size in terms of the number employees with the small size of the firm (SS) as a reference. Focusing on the relationship between firm heterogeneity and development, we include information related to the per capita income levels (PPP corrected) as an indicator for level of development (ISGEP, 2008; van Bergeijk and van Marrewijk, 2013). We follow these studies to test our sixth hypothesis that heterogeneity in firm-level productivity tend to be strongest at the lowest GDP per capita level, underlying the relevance of this indicator for countries under investigation. Mebratie and van Bergeijk (2013) in their meta-analysis of 30 developing and emerging markets, also find that heterogeneity is the highest at low GDP per capita levels.

Our most important variables under study are the identified four types of firms using dummy variable for the National Domestic firms as a reference, testing the first three hypotheses. The estimated coefficients for β_1, β_2, and β_3 reflect the export productivity premium among national firms, foreign-ownership productivity premium among local firms, and foreign-ownership productivity premium for exporting firms among domestic firms, respectively. Moreover, we investigate the export premium for foreign firms comparing the coefficients estimated for Foreign Exporters (β_3) and Foreign Domestic firms (β_2). In the same pattern, we examine exporting firms' foreign-ownership productivity comparing the coefficients estimated for Foreign Exporters (β_3) and National Exporters (β_1). We test our fourth hypothesis by analysing our regression of Eq. (2) separately for manufacturing and services sectors. Furthermore, we use estimated coefficients of β_4, β_5, and β_6 to test our fifth and sixth hypotheses, investigating size productivity premium for medium- and large-sized enterprises and premium for level of development, respectively. We also extend the fifth hypothesis analysing premium for size effect comparing the estimated coefficients for medium-sized firm (β_4) and large-sized firm (β_5). Finally, we also include a set additional variable (X_{isc}) to complement our hypotheses testing by examining whether on-the-job training programmes and firm experience are an important component of productivity development. Accordingly, we expect that firms with formal training programme and longer experience in years since establishment to positively influence the development of productivity premia, as Demena (2017) argued they may likely to have adequate production scale and space.

TABLE 8
Definition of Variables

Variables	Description
Normalized productivity (NP_{isc})	Logarithm of a firm's annual total sales per worker (Chang and van Marrewijk, 2013; van den Berg and van Marrewijk, 2017), normalized by sector and country
Normalized value added (NVA_{isc})	Logarithm of value added (sales – total cost of raw material and intermediate inputs) per worker (Chang and van Marrewijk, 2013; Demena and Murshed, 2018), normalized by sector and country
Exports (Ex)	Firm exports (firm exports at least 10% of its outputs) (Lu et al., 2017; Demena and Murshed, 2018).
National Domestic (ND)	Dummy variable for nationally owned firms with domestic market oriented (foreign participation/ownership is less than 10% with domestic sales more than 90%) (Chang and van Marrewijk, 2013;
National Exporter (NE)	Dummy variable for nationally owned firms with foreign market oriented (foreign participation/ownership is less than 10% with export at least 10%) (Chang and van Marrewijk, 2013;
Foreign Domestic (FD)	Dummy variable for foreign-owned firms with domestic market oriented (foreign participation/ownership is at least 10% with domestic sales more than 90%) (Chang and van Marrewijk, 2013;
Foreign Exporter (FE)	Dummy variable for foreign-owned firms with foreign market oriented (both foreign participation/ownership and export are at least 10%) (Chang and van Marrewijk, 2013;
Firm size - SS (5-19 workers)	Dummy variable if the size of the firm is small (Mebratie and Bedi, 2013; Demena, 2017)
Firm size – MS (20-99 workers)	Dummy variable if the size of the firm is medium (Chang and van Marrewijk, 2013; Mebratie and Bedi, 2013; Demena and Murshed, 2018)
Firm size – LS (100+ workers)	Dummy variable if the size of the firm is large (Chang and van Marrewijk, 2013; Mebratie and Bedi, 2013; Demena and Murshed, 2018).
GDP per capita	Logarithm of GDP per capita, PPP corrected (ISGEP, 2008; van Bergeijk and van Marrewijk, 2013)
Conglomerate	Dummy if establishment is part of a large firm (subsidiary firm) (Chang and van Marrewijk, 2013; Demena, 2017)
Capital city	Dummy if firms located in the capital city (Mebratie and Bedi, 2013; Demena, 2017).
Firm age	Number of years in operation (Mebratie and Bedi, 2013; Demena and van Bergeijk, 2019)
Formal training	Formal training programmes for employees (Chung and Lee, 2015; Demena and van Bergeijk, 2019)
Capital intensity (*K/L*)	The logarithm of expenditure on machinery, vehicles, and equipment per worker, normalized by sector and country (Lu et al., 2017; Mebratie and Bedi, 2013; Demena and Murshed, 2018)

Source: Authors' compilation using World Bank Enterprise Surveys.

5 Estimation results

5.1 Main results: productivity and heterogeneity

A set of several estimations is provided. We first apply the regression regarding exporters versus non-exporters to test the export performance premium regardless of firm ownership. Table 9, columns 1 and 5 report the results regarding the performance premium for exporters. Exporters enjoy a

significantly positive productivity premium than non-exporters in both manufacturing and service sectors – respectively, 6 and 4-percentage-points more likely than non-exporters. Comparing the point estimates, the gap between exporters and non-exporters is strong for the manufacturing sector. Export premium for manufacturing sector is almost about 35% as large as the service sector and the difference is statistically significant.

Next before we estimate equation (2) testing whether the three types of firms should be included simultaneously or separately (using the National Domestic firms as a reference). The Wald test suggests statistically significant differences at the highest confidence level, indicating the simultaneous estimation of the identified types of firms. Testing our three main hypotheses, Table 9 columns 2 – 4 and 6 – 8 report the results estimating Eq. (2) and applied to both manufacturing and service sectors separately to allow further comparison so as to test our fourth hypothesis. Regressions in columns 2 and 6 are without country and industry-fixed effects, whereas the regressions in columns 3 and 7 do have country and industry fixed effects. Columns 4 and 8 check our results in columns 3 and 7 respectively, while controlling for the age of the firms since establishment. All columns include both conglomerate and capital city as control variables. As specified in our empirical approach, we emphasize results while controlling for industry and country fixed effects to account for unobservable time-invariant heterogeneity (columns 3 and 7). To keep the table manageable and for clarity of illustration, we report results relating to the variables of interest.

Staring with the manufacturing firms, column 3 gives statistically positive significant effects of the three included firm types as compared to the National Domestic firms, corroborating our three main hypotheses more generally. National Domestic firms are less productive (6.2-percentage-points) than National Exporters, which are also less productive (11.6-percentage-points) than Foreign Domestic firms and (14.4-percentage-points) than Foreign Exporters. The point estimates of productivity are different, and the *F*-test (at the bottom of Table 9) suggested the differences in point estimates are also statistically significant. Exception is the difference between Foreign Domestic and Foreign Exporters, suggesting our third hypothesis is only partially valid as FE are not productive than any other firm but only ND and NE. For national manufacturing firms, we can therefore conclude that the export productivity premium is important. For foreign manufacturing firms, however, export productivity premium is less important than the foreign-ownership productivity premium (p-value 0.390). In other words, we can conclude that Foreign Exporters are not more productive than Foreign Domestic firms, suggesting the foreign-ownership productivity premium is more important than the export productivity premium. The conclusions are consistent when we control for firm age since establishment (see, column 4).

TABLE 9
Productivity Premia: Exports, foreign ownership, firm size and development level

Variables	1	2	3	4	5	6	7	8
	Manufacturers				Services			
Exports (Ex)	0.060***				0.039*			
	[0.019]				[0.019]			
National Exporter (NE)		0.042*	0.062**	0.055**		0.068***	0.055**	0.055**
		[0.022]	[0.023]	[0.023]		[0.022]	[0.023]	[0.023]
Foreign Domestic (FD)		0.107***	0.116**	0.118***		0.075***		
		[0.020]	[0.021]	[0.021]		[0.017]	0.085***	0.090***
							[0.018]	[0.018]
Foreign Export (FE)						0.094**	0.093**	0.084**
		0.144***	0.144***	0.150***		[0.037]	[0.037]	[0.037]
		[0.031]	[0.031]	[0.031]				
Medium Firm – MF	0.085***	0.071***	0.072***	0.063***	0.037**	0.037**	0.030**	0.029**
(20-99 workers)	[0.015]	[0.015]	[0.015]	[0.015]	[0.013]	[0.013]	[0.013]	[0.013]
Large Firm – LF	0.131***	0.110***	0.108***	0.093***	0.028	0.026	0.016	-0.001
(100+ workers)	[0.020]	[0.019]	[0.020]	[0.021]	[0.020]	[0.011]	[0.021]	[0.021]
GDP per capita	0.060**	-0.009	0.068**	0.066**	0.001**	0.035***	0.005	-0.003
	(0.022)	[0.013]	[0.022]	[0.022]	[0.021]	[0.011]	[0.020]	[0.020]
Firm age				0.002***				0.002***
				[0.0001]				[0.0004]
Sector Fixed Effect	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Country Fixed Effect	Yes	No	Yes	Yes	Yes	No	Yes	Yes
$\bar{R}^2$	0.08	0.08	0.10	0.11	0.06	0.06	0.08	0.08
Observations	1,709	1,739	1,739	1,706	1,663	1,700	1,700	1,661
Test if coefficients are significantly different: F-test (Prob > F)								
NE versus FD		0.018**	0.037**	0.014**		0.801	0.269	0.195
FD versus FE		0.283	0.390	0.358		0.628	0.847	0.868
NE versus FE		0.004**	0.012**	0.004**		0.537	0.365	0.493
MF versus LF	0.018**	0.045**	0.073*	0.122	0.670	0.589	0.510	0.173

Notes: Robust standard errors in [] are clustered at country level. * p<0.1; ** p<0.05; *** p<0.01. The dependent variable is normalized productivity. Columns 1 and 5 are regression for exporting firms regardless of ownership dimension. Regressions in columns 2 and 6 are without country and industry-fixed effects, whereas the regressions in columns 3 and 7 include both country and industry fixed effects. Finally, columns 4 and 8 check our results in columns 3 and 7 respectively, while controlling for the age of the firms since establishment. All columns include both conglomerate and capital city as control variables. NE versus FD reflect foreign-ownership productivity for domestic firms comparing the coefficients estimated for Foreign Domestic firm and National Exporters, whereas FD versus FE represent export premium for foreign firms comparing the coefficients estimated for Foreign Exporters and Foreign Domestic firms. NE versus FE provides foreign-ownership productivity for exporting firms comparing the coefficients estimated for Foreign Exporters and National Exporters, whereas MF versus LF signify size productivity premium comparing medium-sized and large-sized firms.

For service sector, column 7, we arrive at somehow different conclusions. Like manufacturing firms, we find that National Domestic firms are less productive (5.5-percentage-points) than National Exporters, which are also less productive (8.5-percentage-points) than Foreign Domestic firms and (9.3-percentage-points) than Foreign Exporters. Although the point estimates are somehow different and significant as compared to National Domestic firms, the comparison among the three types of firms included are not significantly different (see, *F*-test at the bottom of Table 9). This is in sharp contrast to the results of the manufacturing firms for NE versus FD and FE, thus our second

and third hypotheses are only partially valid as the findings support against ND only. In sum, there is export productivity premium for national manufacturing firms and service sectors, but not for foreign firms in both sectors. Regarding foreign-ownership, there is a significant productivity premium for both domestic and exporting firms in both manufacturing and service sectors as compared to National Domestic firms. Among exporters, foreign ownership productivity premium is not significant in service sectors. Moreover, the gap between export premium and foreign-ownership premium is stronger in manufacturing firms as opposed to service sectors, corroborating our fourth hypothesis.

Regarding the size effects, thus testing our fifth hypothesis, for manufacturing sectors, medium-sized firms are more productive as opposed to small-sized firms and large-sized firms are even more productive. For the service sectors, results were mixed. Medium-sized firms are more productive than small-sized firms, but for large-sized firms the effect is not significant. In addition, the point estimate difference between medium-sized and large-sized firms are statistically significant for manufacturing firms but not in services. Thus, for service sectors our fifth hypothesis is valid for medium-sized firms only. Furthermore, the effect of medium-sized firms is stronger for manufacturing firms (the estimated magnitude is less than half in services and the difference is statistically significant, consistent with the fourth hypothesis). Looking at development levels, and thus testing the sixth hypothesis, the country's development level premium is statistically significant and larger for the manufacturing firms, but the effect in service sectors is insignificant. The latter is even negative but insignificant when we control for experience of the firm in years (age). Regarding the experience productivity premium (columns 4 and 8), the magnitudes are small but positive and significant, and equally important for the manufacturing and service sectors. In sum, there are clear and strong productivity premia in size and level of development in the manufacturing firms. In service sector, these premia are always smaller and only significant for medium-sized firms. There is no difference in age productive premium between manufacturing and service sectors in terms of both significance and magnitude of the estimated coefficients.

5.2 Further investigations and robustness analyses

In this section we run a set of different specifications both as further investigations and as robustness checks. This section in particular deals with the sensitivity of our main findings to the: (a) introduction of additional variables; (b) construction of the outcome variable; (c) introduction of a set of country-industry interaction fixed effects; and (D) construction of the foreign ownership structure.

Introduction of additional variables, country-industry interaction and construction of the outcome variable

In this robustness checks we repeat estimation of equation (2) for three additional or alternative specifications. First, we introduce capital intensity

using the logarithm of expenditure on machinery, vehicles, and equipment per worker, normalized by sector and country. The normalization procedure followed the same procedure as in equation (1) and given below:

$$Nk/l_{isc} = \frac{log(k/l_{isc}) - \min \log (k/l_{isc})}{\max \log (k/l_{isc}) - \min \log (k/l_{isc})} \quad (3)$$

where k/l is the reported capital (expenditure on machinery, vehicles, and equipment) per total worker employed. The subscripts i, s, and c, represent firm, industry and country respectively. Nk/l_{isc} is measuring the normalized capital intensity in firm i for sector s and country c. The statistics are based on a clustered computation of seven countries (Table 3) and 27 industries (Table 4).

In an observational study of Ugandan firms, Demena and van Bergeijk (2019) find that a formal training programme is an important component of productivity development. Testing our last hypothesis, we therefore include whether firms undertake formal training programmes for employees result in additional productivity premium. Next, we include a set of country-industry interaction fixed effects to the separate industry and country dummies. Finally, we test an alternative definition to our outcome variable. This is done by replacing the sales per worker definition of labour productivity with the value added per worker. Like the labour productivity, we also adopted normalized value added per worker clustered by the seven countries and 27 sectors. We apply this only for the manufacturing firms as the WBES does not provide data on the total cost of raw material and intermediate inputs used in production for the service sectors.

Table 10 gives the estimated coefficients for the various specifications outlined above. Our main findings in relation to the various productivity premium results are confirmed. Regarding capital intensity[13], we find that more capital-intensive firms have a higher productivity level (Column 2). Similarly, firms undertaking formal employees training, as expected, have a higher productivity level (column 3), concurring the results of existing studies. Furthermore, including country-sector interaction fixed effects, in columns 4 and 7 mimic the findings of columns 3 and 7 in Table 9. Regarding value added instead of labour productivity, generally, the results in column 5 suggest that the use of either of the definitions of labour productivity does not make much difference for productivity analysis (which this is consistent with Demena and Murshed, 2018). Importantly, it should be noted that value added data is more applicable for industrialized economies than in developing economies as more value additions are realized in industrialized economies

[13] Since introducing the capital intensity variable reduces the sample size by about half, we first run the main specification of Column 3 in Table 9 excluding firms that do not report capital intensity (K/L) data. The result of this exercise reported in Column 1 of Table 10. Next, Column 2 introduces the robustness checks including capital intensity (K/L). Although this gives better comparison as opposed to with large sample difference, the results are consistent (compare Column 3, Table 9 and Column 1, Table 10).

(Lewis and Peng, 2018). This may be attributable as we find somehow different results from value added data - column 5 reports insignificant premium for National Exporters and development levels.

TABLE 10
Robustness Checks I: Capital intensity, Formal training programmes and Value added

Variables	1	2	3	4	5	6	7
	Manufacturers					Services	
National Exporter (NE)	0.056*	0.040*	0.053**	0.092***	0.041	0.052**	0.063**
	[0.028]	[0.020]	[0.022]	[0.022]	[0.072]	[0.023]	[0.023]
Foreign Domestic (FD)	0.136***	0.120***	0.113***	0.116***	0.146**	0.080***	0.093***
	[0.029]	[0.027]	[0.021]	[0.021]	[0.067]	[0.018]	[0.018]
Foreign Export (FE)	0.197***	0.185***	0.142***	0.164***	0.178*	0.084**	0.095**
	[0.031]	[0.036]	[0.031]	[0.031]	[0.100]	[0.037]	[0.037]
Medium Firm – MF	0.072***	0.064**	.072***	0.069***	0.094*	0.027**	0.031**
(20-99 workers)	[0.021]	[0.020]	[0.015]	[0.015]	[0.049]	[0.013]	[0.013]
Large Firm – LF	0.079***	0.086**	0.100***	0.105***	0.068	0.005	0.046**
(100+ workers)	[0.026]	[0.025]	[0.021]	[0.020]	[0.066]	[0.021]	[0.021]
GDP per capita	0.137***	0.085**	0.062**	0.181***	0.052	0.001	0.181
	[0.031]	[0.029]	[0.022]	[0.435]	[0.071]	[0.020]	[1.664]
Capital intensity (K/L)		0.321***					
		[0.027]					
Formal training						0.039**	
			0.052***			[0.012]	
			[0.014]				
$\bar{R}^2$	0.15	0.25	0.11	0.16	0.31	0.07	0.14
Observations	886	886	1,727	1,739	1,713	1,689	1,700
	Test if coefficients are significantly different: F-test (Prob > F)						
NE versus FD	0.030**		0.022**	0.402	0.242	0.313	0.265
		0.020**					
FD versus FE	0.169	0.114	0.372	0.157	0.773	0.911	0.967
NE versus FE	0.012**		0.007**	0.004**	0.224	0.442	0.440
		0.000***					
MF versus LF	0.076*	0.347	0.128	0.060**	0.672	0.293	0.476

Notes: Robust standard errors in [] are clustered at country level. * p<0.1; ** p<0.05; *** p<0.01. The dependent variable is normalized productivity, except column 5, which is normalized value added per worker. Introducing capital intensity reduces the sample size by about half. Hence, for the sake of comparison with Column 2, Column 1 repeats the Column 3 in Table 9 but excluding firms that do not report capital intensity (K/L) data. Columns 2 and 3 control for capital intensity and formal training programmes, respectively. Columns 4 and 7 include a set of country-sector interaction fixed effects, whereas column 5 introduces an alternative measure of productivity. Column 6 gives the additional training productivity premium for the service sector. All columns include both conglomerate and capital city as control variables as well as country and industry fixed effects.

Construction of the foreign-ownership structure

TABLE 11
Robustness Checks II: Productivity and foreign ownership intensity

Variables	1	2	3	4	5	6	7
	Manufacturers					Services	
National Exporter (NE)	0.064**	0.038	0.091***	0.076**	0.064*	0.053**	0.061**
	[0.023]	[0.026]	[0.022]	[0.029]	[0.037]	[0.023]	[0.023]
Minority foreign owned	0.075**	0.135***	0.087**	0.078**	0.149**	0.021	0.032
	[0.030]	[0.038]	[0.030]	[0.039]	[0.052]	[0.034]	[0.033]
Majority foreign owned	0.136***	0.147***	0.149***	0.145***	0.127***	0.097***	0.103***
	[0.021]	[0.026]	[0.020]	[0.027]	[0.035]	[0.018]	[0.017]
Medium Firm – MF	0.071***	0.063**	0.069***	0.069***	0.081**	0.030**	0.031**
(20-99 workers)	[0.015]	[0.020]	[0.015]	[0.020]	[0.027]	[0.013]	[0.013]
Large Firm – LF	0.106***	0.090***	0.110***	0.108***	0.189**	0.018	0.048**
(100+ workers)	[0.020]	[0.025]	[0.020]	[0.026]	[0.033]	[0.021]	[0.021]
GDP per capita	0.070**	0.088**	0.185	0.177	-0.189	0.007	0.182
	[0.022]	[0.029]	[0.434]	[0.577]	[0.733]	[0.020]	[1.663]
Capital intensity (K/L)		0.320***			0.249***		
		[0.027]			[0.036]		
$\bar{R}^2$	0.10	0.25	0.18	0.89	0.82	0.07	0.11
Observations	1,739	886	1,739	1,713	883	1,700	1,700
	Test if coefficients are significantly different: F-test **(**Prob > F**)**						
NE versus Minority	0.744	0.026**	0.902	0.957	0.148	0.415	0.313
Minority versus Majority	0.073*	0.778	0.059*	0.129	0.703	0.038**	0.911
NE versus Majority	0.009**	0.001**	0.032**	0.054**	0.167	0.111	0.442
MF versus LF	0.072*	0.238	0.035**	0.126	0.809	0.586	0.293

Notes: Robust standard errors in [] are clustered at country level. * p<0.1; ** p<0.05; *** p<0.01. The dependent variable is normalized productivity, except columns 4 and 5, which is normalized value added per worker. We divide the previous version of foreign ownership into two variables – majority and minority ownership. Majority foreign ownership defined as 50 per cent or more ownership and set the variable to zero if ownership is less than 50 per cent. Similarly, minority foreign ownership defined as less than 50 per cent ownership (but at least 10 per cent). The first result of this presented in column 1. Column 2 and 5 account for capital intensity, whereas column 3 include a set of country-sector interaction fixed effects. Columns 4 and 5 replace the measure of productivity with value added. Columns 6 and 7 uses the same specification as in columns 1 and 3, respectively for service sector. All columns include both conglomerate and capital city as control variables as well as country and industry fixed effects.

In Table 9 we find the relevance of export productivity premium for national firms but only in the manufacturing sectors. We also find that foreign-ownership productivity premium is relevant for both exporting and domestic firms in both manufacturing and service sectors. The next question to ask is therefore whether the intensity of the foreign-ownership structure matter for the productivity premium. This is done by allowing broader variation in foreign-ownership in terms of majority and minority ownership. Majority foreign ownership defined as 50% or more ownership and set the variable to

zero if ownership is less than 50%. Similarly, minority foreign ownership defined as less than 50 per cent ownership (but at least 10%).[14]

We keep the National Domestic firms as a base specification and thus we still have four types of firms except now we replace the two foreign types of firms based on the intensity of the foreign ownership. The results are presented in Table 11. Estimated coefficients of the three types of firms are statistically significant, suggesting the National Exporter, Minority Foreign-owned and Majority foreign-owned firms have higher productivity premium than Domestic firms in all sectors (exception is minority-owned firms in services). In general, we continued to find similar results of the main analysis (compare with Table 9). In addition, we find a more nuanced picture of the productivity premium. In our main results, the difference between Foreign Domestic and Foreign Exporters were never been significant, but now our findings in column 1 of Table 11 corroborate the view that majority foreign-owned firms are the main drivers of productivity premium than the minority foreign-owned firms (*F*-test, p-value 0.073). According to Demena (2017), a possible explanation could be that foreign investors may be more inclined to bring their proprietary technology with them when they have majority ownership control over subsidiary operations. However, this statistical difference in ownership intensity holds true if we don't control for capital intensity. That is, in all the reported estimates the statistical difference disappears if reported estimates incorporate capital intensity, otherwise always significant. This could indicate that the main productivity premium difference between minority and majority owned firms is based on capital intensity. Majority foreign-owned firms are therefore more productive than minority foreign-owned firms, and this is fully due to the higher capital intensity rather than any other potential advantage. This conclusion is similar to Chang and van Marrewijk (2013) for developing Latin American countries.

6 Discussion and conclusion

We investigate firm-level productivity difference for seven intra-regional major trading partner countries that are part of the COMESA-EAC-SADC tripartite free trade area using the WBES. Incorporating export and ownership dimensions, we identify four types of firms: National Domestic, National Exporters, Foreign Domestic and Foreign Exporters. Doing so, we extend a firm's international organization incorporating ownership dimensions, rather than putting all firms into one dimension alone. This allows us to explore the export productivity and foreign-ownership premia separately. Moreover, we complement the analysis with additional productivity premia, namely: firm size effects, country's development levels, firm experience as well as training programmes. While most existing empirical studies only focus on the

[14] Note that we did not incorporate intensity into Foreign Domestic and Foreign Exporters as no export productivity premium was found for foreign firms (see, Table 9).

manufacturing sector, we separately incorporate the service sectors in our analysis.

We find a clear and significant export productivity premium for national manufacturing firms and service sectors, but not for foreign firms in both sectors. We also find clear foreign-ownership productivity premium for both domestic and exporting firms in manufacturing sectors but less clear in service sectors. For national manufacturing firms, we can conclude that the export productivity premium is important. For foreign manufacturing firms, however, export productivity premium is less important than the foreign-ownership productivity premium. Foreign Exporters are thus not more productive than Foreign Domestic firms, consequently the foreign-ownership productivity premium is more important than the export productivity premium.[15] In terms of the literature that focused on foreign-owned dimension alone, our foreign ownership findings contrasted with Mebratie and van Bergeijk (2013) and Mebratie and Bedi (2013), where 63 per cent of reported estimates are insignificant or negative or on average zero effects, respectively. However, our findings are consistent with the most recent body of the literature, who find that foreign ownership is likely to positively impact domestic productivity (e.g., Demena and van Bergeijk, 2017; Demena and Murshed, 2018).

Regarding other productivity premia, in manufacturing sectors medium-sized firms are more productive as compared to small-sized firms and large-sized firms are even more productive. For the service sectors, results were mixed. Medium-sized firms are more productive than small-sized firms, but for large-sized firms the effect is not significant. Furthermore, the effect of medium-sized firms is stronger for manufacturing firms. Looking at development levels, productivity premium is statistically significant and larger for the manufacturing firms, but the effect in service sectors is insignificant. Regarding the experience productivity premium, the results are small but positive and significant, and equally important for the manufacturing and service sectors. In sum, there are clear and strong productivity premia in size and level of development in the manufacturing firms, but results are mixed in service sector. Leaving aside some further insights and additional findings, overall, our results corroborate with Chang and van Marrewijk (2013), who like our paper specifically investigated firm heterogeneity and productivity development, but for 15 developing Latin American countries for the year 2006.

All the above effects are consistently robust, when we introduce additional variables (for instance capital intensity, formal training programmes); when we use value added per worker instead of labour productivity defined as sales per worker as our productivity measure; as well as the introduction of a set of country-industry interaction fixed effects rather than the separate industry and country dummies. The final question we investigate is whether the intensity of the foreign-ownership structure matter for the productivity premium. Allowing broader variation in foreign ownership, we identify intensity in terms of

[15] The gap between export premium and foreign-ownership premium is stronger in manufacturing firms as opposed to services.

majority and minority owned foreign firms. We continued to find similar results of the main analysis with more nuanced picture of the productivity premium. We add that the Majority foreign-owned firms are more productive than minority foreign-owned firms. Initially, in line with Demena and Murshed (2018), it appears that this was because foreign investors may be more inclined to bring their proprietary technology with them when they have majority ownership control over subsidiary operations. However, controlling for potential omitted variable bias, consistent with Chang and van Marrewijk (2013) this is fully due to the higher capital intensity rather than any other potential advantage.

Based on the main objective, the findings of this paper may also have policy implications. Productivity development is a key issue for export-driven growth and development. Trade policy environment of a country with heterogeneous firms influences the size of exporter premia differently across sectors. The paper mainly focuses on the link between exports and productivity development (including other firm heterogeneities and country's development level). This narrow focus enables us to provide more robust estimations and achieve greater sectoral (manufacturing versus service), market orientation (local versus export), and ownership dimension (national versus foreign) comparability. A solid understanding on the size of the export premium and drivers of productivity development are therefore a pre-requisite for any sound policy-oriented arguments and policy parameters for economic diplomacy and commercial trade policy.

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Appendices

Table A1
Normalized productivity by countries in the manufacture of food products and beverages

Country	Mean	Standard deviation	Min	Median	Max	Total No. of firms
Normalized productivity						
Tanzania	0.480	0.171	0	0.488	1	63
DRC	0.402	0.240	0	0.394	1	33
Kenya	0.529	0.149	0	0.528	1	139
Malawi	0.525	0.273	0	0.479	1	29
Rwanda	0.564	0.243	0	0.545	1	65
Uganda	0.586	0.204	0	0.577	1	81
Zambia	0.608	0.213	0	0.641	1	51

Table A2
Productivity summary statistics for firm types by sectors

Firm type	N	Mean	S.D.	Min	Median	Max
Normalized productivity – manufacturing						
National Domestic	1218	0.454	0.263	0	0.447	1
National Exporter	177	0.540	0.273	0	0.504	1
Foreign Domestic	210	0.593	0.281	0	0.608	1
Foreign Exporter	91	0.613	0.281	0	0.608	1
Normalized productivity – services						
National Domestic	1588	0.458	0.229	0	0.442	1
National Exporter	1049	0.472	0.244	0	0.455	1
Foreign Domestic	1093	0.474	0.240	0	0.455	1
Foreign Exporter	1037	0.471	0.243	0	0.454	1