A Portrait of Kenya's Product and Destination Mix and Performance in Export Markets

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Abstract

This paper documents the important role of multi-product and multi-destination exporters in the expansion of exports for a low income country. This is made possible by access to a new and unique transaction level data for Kenya, enabling decomposition of both firm level and aggregate exports into intensive and extensive margins. The transaction level data is complemented with detailed firm characteristics information from a comprehensive census of industrial production, allowing the opportunity to examine the correlation between trade margins and measures for firm productivity.

The findings highlight the significance of nurturing and owning multi-product and multi-destination types of exporters for low income countries. Multi-product exporters in Kenya consist of about 28 percent of the entire population of exporters but were responsible for approximately 87.5 percent of the total value of exports in 2005. Combining the shares of firms that exported more than five products to more than five destinations, they explain approximately 85 percent of the entire value of exports in a year.

Across manufacturing firms, productivity is positively associated with the number of products exported, the number of countries served and the total value of firm level exports. A one percent increase in the value added per worker translates to a 0.05 percent increase in the number of products exported. This paper confirms recent findings on the importance of multi-product and multi-destination exporters and their ability to export many products to many destinations, in a low income context.

Key words: multi-product exporters, multi-product exporters, export trade margins, low income countries

JEL codes: F12, F13, F14

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1. Introduction

Developing countries, worldwide, value a healthy growth in the external sector of their economies. This is important for a sustainable balance of payments position, maintaining a stable expansion in output, job creation and improvement of the livelihoods of their nationals. Kenya expects to debut middle income status by the year 2030 (GoK, 2008). One of the key pillars to realizing this growth trajectory is the attainment of mature, middle to large sized exporters that will spearhead a robust export oriented growth. There is urgency therefore, within relevant players in both public and private sectors, to restructure the current trade policy to yield a desirable response in growth and diversification of Kenya's exports (see Were, Sichei, & Milner, 2010).

Policy and other intervention programmes are useful in influencing exports but ultimately exporting decisions are taken at the firm level. Unfortunately, there is limited information on the behaviour of firms at the point of that decision. Very limited attention has been given to firm level export activity in order to understand key decisions taken by exporters regarding product and destination of their exports (portfolio of export mix). Basic questions such as; how many products does a firm export, with how many countries does it transact, what is the value of exports and changes of these variables over time remain unanswered. This is largely due to restrictions on access to micro level data. Yet, understanding firms' decisions along these dimensions and the interactions with firm characteristics is important for formulation, prioritizing and differentiation of policy interventions to enhance export growth and firm participation in foreign markets.

More importantly, decisions regarding the number of products and the number of countries to serve (extensive margins) as well as the average export value per product /destination (intensive margins) have implications for the resources of the firm involved. For example, the fixed costs of selling a new brand of Kenyan tea to an established trade partner in the United Kingdom are lower, relative to selling the brand to a new customer in a new partner country, such as Afghanistan. These are critical boardroom decisions that have implications on cost as well as firm profitability and growth, industry level productivity and country growth and employment. It would require the commitment of considerably more resources to establish contact and sell in

new markets relative to adding products in an established market. Thus exporting strategy and policies to support such a decision may vary.

The recent literature on heterogeneous firms and trade credited to Melitz (2003) has provided clear guidance on the important role of ex-ante productivity and self-selection into exporting. High productivity level among firms is a necessary condition to overcome the sunk costs of entry into exporting. There is plenty of evidence in support for this phenomenon in the micro-level trade data and this has been widely documented for both developed and developing jurisdictions. What is not known, especially within low income countries are the adjustments taking place within exporting firms. In particular, there is little attention into choices made by multi-product and multi-destination exporters regarding the mix of their export products and destinations served and variation of the same. These short-run to medium term variation has implications on firm productivity, employment and investment decisions.

This study seeks to fill this gap by utilising a unique new Kenyan transaction-level data on international trade to investigate the patterns and mixture of Kenya's exports. This is done through a measurement approach in which we dissect firm's decision in expanding into a foreign market along destination, product and volume perspectives. These observable outputs are highly correlated with unobservable firm ability and decisions regarding exporting. This type of analysis is new for low income countries but has been documented extensively for advanced economies such as the US, France, Germany, Belgium and Netherlands, among others. In exploration of the patterns of Kenya's product and destination mix and performance in export markets, this paper is guided by the following research hypothesis.

Research hypothesis

- The extensive margins of export trade account for a large share of Kenya's variation in export trade across all destinations.
- The share of extensive margins for trade within the EAC sub region is larger, relative to rest of the world.
- The extensive and intensive margins have a negative relation with bilateral trade costs between Kenya and her trading partners.
- Kenya's export trade is concentrated among very few firms (multi-product exporters).

- The intensive margin accounts for the largest share of firm-level total exports, but the extensive margins along product and destinations is also important.
- There is a positive correlation between the margins of export trade and proxy for firm productivity.

Kenya is in an advantage position for this type of study because of its industrial base. Although basic, it is fairly diversified within Africa and does not rely heavily on mineral exports. Furthermore, Kenya is considered a regional hub for trade within Eastern and Central Africa and the main markets for her industrial exports are other low income countries, some of which are considered fragile. This makes the country an excellent case study on the performance of exporters, measured from the point of observable outputs such as the number of products, the number of unique destinations and the average export value per product/destination from a low income context.

The remainder of this paper is organized as follows: the second section describes the data and construction of the database, the third section presents the conceptual framework and the decomposition methodology, the fourth section documents the key stylized facts (at aggregate and firm level), section five presents the main results and discussion and finally, section six concludes with a proposal for further research.

2. Data and data Sources

This paper utilises the product level transaction data obtained from the Kenya Revenue Authority's Customs Department. The Customs export data is a new and unique panel data containing the overall flow of Kenya's exports at the point of exit from 2004 to 2013. Each transaction contains information on the product being exported at the highest level of disaggregation (Harmonised System-HS8), the name of exporter, the month of shipment, the destination of shipment, the free on board (FoB) value in Kenya shillings, and the quantity and units of measurement.

This data enables the decomposition of both aggregate and firm level exports into extensive and intensive margins. At the aggregate level, the extensive margin correspond to the number of firms serving a particular destination market and the number of products exported to that market, while the intensive margin is associated with the average exports per firm-product. At the firm

level, exports may be decomposed into the unique number of countries with which they trade , the number of products shipped (firm extensive margin) and the average value of exports in each transaction (firm intensive margin). It is possible, therefore, to observe product and geographic scope of the aggregate and firms' exports and how these change over time.

To identify the key manufacturing firm attributes associated with export trade margins, the transactional data for the manufacturers is merged with the 2010 census of industrial production data that contains manufacturing firms' characteristics and output information. This dataset contains variables such as: the name of the firm, firm ownership, number of employees, wages paid, production and installed capacity, expenditure on goods and services (intermediate inputs), sales revenue (including exports) and fixed assets. A total of 2,252 firms were counted, out of which manufacturing took the largest share of 2,096 firms (93.1%).

In the first stage, the study selects manufacturing exporters from the transaction data and then hand match them using the name of the firm (which is common across the two datasets) with data from the census (manufacturing only). This matching yielded 432 matches, which is approximately (20% of manufacturing firms). The key firm level characteristics of interest include: the total output, the value added, the number of employees, the sales revenue, the age of the firm, the location of the firm, the ownership structure, and the capital intensity.

In addition, gravity type variables are used to capture destination characteristics. Current GDP in US dollars is used as proxy for market size, while distance between trading partners' capital cities is used as proxy for variable trade costs. Information on distance is obtained from CEPII website, while current GDP information is obtained from the World Bank's World Development Indicators (WDI) database.

Database Construction

Monthly exports by destination and product category are obtained from the KRA Customs database in which the global flow of all exports from January 2004 to December 2013 is observed. Exporters ship products, in one or more product categories, at the HS8-digit level. In addition, each category of product exported by a given exporter can be shipped to one or more markets. Thus, the most elementary unit of observation available is; "the value exported each

month by a Kenyan exporter at HS8 digit level product classification to each destination country". The study undertakes the following manipulations on the data.

Cleaning for destinations

The study omits destinations that are not countries (i.e. those not elsewhere classified such as export flow into aircraft and ship stores, export processing zones and duty free shops). The elimination of these transactions means disaggregated export data may fall short of what is published by the Kenya National Bureau of Statistics. This cleaning results in the loss of a small number of observations (about 4%) relative to the total number of observations over the whole sample period.

Dealing with origin of exports and re-exports

An export is defined as a transaction that involves a true ownership change accompanied by compensation and that originates from Kenya. This means the exclusion of re-exports, goods returned for repairs and exports meant for neighbouring landlocked countries, such as Uganda, South Sudan and DR. Congo that use Kenya's Mombasa port to export. The ability to identify the origin of an export is captured in the Customs database, using the variable "origin" which is a two digit ISO code for the relevant country where the export originates. This restriction leads to yet another loss of observations, which are technically not Kenyan exports (estimated at 10%) over the entire sample period. The final exports flow data is further checked for consistency with the published Kenya National Bureau of Statistics (KNBS) data on annual export value (obtained from various economic surveys). Since customs data forms the source data for the KNBS, the expectation is to have as close a match as possible. In this case, the deviation of customs data lies within one percent from the published data (see table 5).

Dealing with export flow to Sudan (South Sudan) in 2012 and 2013

As early as 2012, South-Sudan was preparing for a break-away from the larger Sudan. This gave the country an ISO2 code of "SS" and was adopted for customs statistics. However, most of the transactions between Kenya and Sudan (South Sudan) were entered with the correct ISO2 code but were attributed to Serbia as the destination country. This resulted in a big jump in Kenya's export to Serbia and a requisite dip in exports to Sudan (including South-Sudan). After

consultation with the customs officials, the study corrects for this anomaly by renaming the destination country for 2012 exports to Serbia, as Sudan. This yielded a consistent flow of exports to Sudan similar to historical flows. In 2013, South Sudan became independent and export flow from Kenya into South-Sudan and Sudan were recorded separately. However, to make comparisons with the historical export flow, the study adds up the value of exports to the two countries for 2013 and attributes it to the original Sudan.

Assigning a unique firm identifier

In the customs database, it is possible to identify the exporter by name. This information was used to generate random number exporter identifiers to maintain confidentiality of the data. The name is essential to enable matching of the transactional data with the census data, yielding a rich database for the analysis in the subsequent part of the thesis. Using firm names to obtain a unique identifier poses a challenge as any change in the name (i.e. capital for the first letter or not, spacing, or ltd instead of ending with limited) will be reflected in a new firm identification. The study takes comfort in the fact that the name entry rule and customs declaration requires that the names be entered as per the official registration with the company's registry. However, one cannot rule out human error in the recording of names. The study undertook a visual check for at least a sub-set of the data to verify how the names are recorded and whether there are suspect changes. However, the uniqueness of a firm identifier over time and the product classification changes over time are not an issue, if the analysis is at the cross-section. This paper credits Ilke Van Beveren[1] for bringing this to attention.

Aggregating "firm-product-destination" flow of exports into annual flow

The flow of firm-product-destination export was aggregated from monthly flows into an annual flow. For example, in 2012 exporter id number 02, exported 66 pieces of a product code "68052000" (HS8) described as "on base of paper or paper board only" valued at Ksh.382,912 to Rwanda. It is preferable to work with annual flows rather than monthly flows to go around data challenges associated with high frequency data such as seasonality and differences in the numbers of working days per month (Bricongne, Fontagne', Gaulier, Taglioni, & Vicard, 2010).

[1] Together with Andrew Bernard and Vandenbussche, they study multi-product exporters and margins of trade for Belgium

Furthermore, transactions that do not involve transfer of ownership with compensations will be considered for exclusion. Transactions for exclusion include; products belonging to the HS2 chapter 97 (works of art, collectors pieces and antiques); chapter 98 (special classification provisions) and chapter 99 (special Transaction Trade), as well as monetary gold. There is also a need to eliminate exports by NGOs and Aid related exports (i.e. UN). This portion of work is still pending.

Incorporating external files on destination and product characteristics

The traffic flow of exports alone does reveal interesting dynamics of exporting, at least at the firm level. However, to make it even more illuminating, the dynamics must be examined against variation in firm, product and destination characteristics. This requires incorporation of other external data files obtained from various sources.

ISO2 to ISO3

The ISO country code is an internationally recognized code that designates a two letter (ISO2) or a three letter combination code (ISO3) for each country. For example, a two letter combination code for the United States is US, FR for France and DE for Germany. A three letter ISO combination for the same countries is, USA, FRA and DEU, respectively. The Kenyan customs database uses an ISO2 combination to designate the final destination of exports. We use a concordance provided by the World Integrated Trade Solution (WITS)[2] to map the ISO2 codes into ISO3 codes. This is important to enable merging with the World Development Indicators (WDI), such as the World Bank income classification of countries, current GDP and gravity type variables (distance and common language) from the CEPII website.

Income classification and country current GDP in USD

The study follows the World Bank classification to place countries into income classes, namely: high income OECD, high income other, upper middle income, lower middle income and low income countries. The table 1 below presents the firm-product-destination combination per year and by income group.

[2] wits.worldbank.org/WITS/wits/WITSHELP/Content/Codes/Country_Codes.htm.

Table 1: Kenya's firm-product-destination flow to each income group

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Number of firm-product-destination relationship per Income classification									
High income: OECD	5,708	6,454	6,601	7,122	5,414	5,927	8,278	8,754	9,024	8,743
High income: nonOECD	1,434	1,193	1,227	1,261	1,144	1,230	2,000	2,364	2,176	2,419
Low income	12,797	16,165	17,487	19,879	19,609	22,432	23,673	27,751	26,273	24,702
Lower middle income	5,356	8,345	14,071	17,789	17,086	15,038	13,309	15,115	15,279	13,774
Upper middle income	1,364	1,429	1,694	1,574	1,272	1,488	2,315	2,827	2,678	2,893
	26,659	33,586	41,080	47,625	44,525	46,115	49,575	56,811	55,430	52,531
	Share of firm-product-destination relationship per income class(%)									
High income: OECD	21	19	16	15	12	13	17	15	16	17
High income: nonOECD	5	4	3	3	3	3	4	4	4	5
Low income	48	48	43	42	44	49	48	49	47	47
Lower middle income	20	25	34	37	38	33	27	27	28	26
Upper middle income	5	4	4	3	3	3	5	5	5	6
	100	100	100	100	100	100	100	100	100	100

Source: Own computation

The low income countries account for approximately 50 per cent of the firm-product-destination relationships and the shares have remained stable over the sample period. The high income countries account for about 20 percent.

Distance and other gravity type variables

Distance and other gravity type variables are obtained from the CEPII website. They include geographical distance between main capital cities of trading partners, dummy variables for the presence of a common border, common language, common colony and common ethnic group.

Product mapping from HS8 to HS6 and SITC to Lall and Rauch product classification

The first six digits of Kenya's HS8 product classification correspond to the HS6 system product classification of the World Customs Organization. The Harmonised System was created in 1988 and has since been updated four times; 1st January 1996, 1st January 2002, 1st January 2007 and 1st January 2012. Since the sample period in this study runs from 2004 to 2013, it is important to take into account these revisions to avoid attributing product reclassification as either dropping or adding to the export mix. To do that, the paper adjusts Kenya's HS8 product classification to HS6 for 2002 using crosswalks (concordances) from HS8 to HS6_2012 and HS6_2007. Thus HS6 for 2002 is used as the product classification baseline for the analysis. The crosswalks are obtained from WITS website.

Another set of product classification used for analysing customs data is the Standard International Trade Classifications (SITC) and International Standard Industrial Classification (ISIC). This study uses SITC rev2, digit 3 enabling mapping to the Lall technology classification, while SITC rev2, digit 4 maps to the Rauch product classification. The Rauch[3] classification groups goods according to differentiated goods (n), reference priced goods(r) and the homogeneous goods (w). Lall classification groups the products as per the technology imbedded in their production. ISIC classification is used to isolate manufacturing exports from non-manufacturing.

Classification of Countries into Fragile and Conflict States (FCS) or Non-FCS by the World Bank

The World Bank uses three criteria to classify countries as either fragile and conflict states or not. This classification is available for the period 2009 to 2013 and the number of countries classified as fragile and conflict states are indicated below[4]:

	2009	2010	2011	2012	2013
	# of countries classified as fragile and confict states				
Number of internally displaced high(idph)	36	30	29	31	57
Number of Internally displaced low(idpl)	19	17	16	17	0
Number of battle related deaths (battledth)	26	25	31	26	25
Number of UN peace keepers(unpeacepkp)	11	13	13	15	16

Source: WDI, World Bank

The above table is based on approximately 214 countries that are monitored for presence of any of the three indicators. Among these indictors, the study uses the number of reported internally displaced persons (high estimate) for the year 2013 to compute an indicator variable on whether or not a country is fragile or non-fragile. This year is selected purely for convenience and also due to the fact that it represents a large sample and is most recent. The distribution of countries in 2013 into either fragile or non-fragile is as follows:

[3] http://tradesift.com/about-ts/productGroups/Pg-rauch.aspx.
[4] http://databank.worldbank.org/data/views/ variableselection/selectvariables.aspx?source=world-development-indicators.

Fragile and Conflict State dummy(idph)	Freq.	Percent	Cum.
0	158	73.83	73.83
1	56	26.17	100
Total	214	100	

Source: Own computation

Out of the 214 countries monitored for presence of internally displaced persons, 56 countries had a positive number while 158 did not report any. Thus, the number of fragile and conflict states in 2013 were 56 as per the first indicator. Use of battle related deaths and presence of UN peace keepers for 2013 classified 25 and 16 countries, respectively as fragile and conflict states. These results are also available. The table 2 below provides the distribution of firm-product-destination flows of exports to jurisdictions considered as either fragile or non-fragile.

Table 2: Kenya firm-product-destination flow to fragile & non-fragile destinations

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	Distribution of firm-product-destination flow to fragile and non-fragile jurisditions									
Non-Fragile	14,393	16,454	16,977	17,961	16,304	18,203	22,383	25,242	24,327	23,389
Fragile	12,266	17,127	24,103	29,664	28,221	27,912	27,192	31,569	31,103	29,142
Total	26,659	33,581	41,080	47,625	44,525	46,115	49,575	56,811	55,430	52,531
	Shares of firm-product-destination flow to fragile and non-fragile jurisditions (Percent)									
Non-Fragile	54	49	41	38	37	39	45	44	44	45
Fragile	46	51	59	62	63	61	55	56	56	55
Total	100	100	100	100	100	100	100	100	100	100

Source: own computation

The dummy variable is constructed in such a way that the presence of internally displaced persons gives the country a one and if not it is given a zero. From the table above, the share of trade flow from Kenya to jurisdictions considered fragile is greater than those destined to non-fragile countries, with an exception of 2004.

Creating a mapping between transactional data and census data

This section is important to enable the study to relate the margins of export trade for manufactures with their firm characteristics at the cross-section[5]. First, the study makes use of the firm-product level transaction data and retains only exporters falling under International

[5] 2009 is the year of analysis for 4 reasons: the number of firms is close to the average for 2004-13, base year for KNBS data, census data reference period and is post –gfc of 2008.

Standard Industrial Classification (ISICrev3.2=15 to ISICrev3.2=37)[6]. This restriction retains only manufacturing exporters.

The unique firm identifier and the name of the exporter were used to match with the industrial production census for 2010, using manufacturers only. The names from the transactional database were checked for duplication. Furthermore, the way in which the names are entered in the two datasets is different, especially at the ending. For example, in the transaction database, a name could end with "ltd", while in the CIP, 2010 the name may have ended with "limited". A manual check-up helped to correct names that were mistyped (i.e. if the name was spelled wrongly or interchanged). The id and exporter name from the transactional database (map_x) is exported to excel, followed by an exportation of the id and firm name from the CIP, 2010 (map_m) to the same excel file (different sheet). The first worksheet (map_x) contained 12,952 exporters (2004-2013), while the second (map_m) contained 2,097 manufacturing firms (reference period 2009). The census data has a unique identifier for each of the firm names. This was used as a concordance to match by name, the dataset from map_x (transactional data). This is done in three rounds as indicated in the table below:

Rounds	Freq.	Percent	Cum.
1. Exact match by name	392	66.89	66.89
2. Exporter names end with ltd	155	26.45	93.34
3. Exporter names end with limited	39	6.66	100
	586	100	

Source: own computation

Round one simply matches the two datasets by name. This is done in excel using vlookup command. The command simply states that "vlookup firm name in the export data in the CIP data; if found, assign it its respective serial number (from the CIP data)". We sort and obtained unmatched data separate from matched ones. This step yields about 392 matches. The unmatched firms go through round two. In round two the firm name in the exporter ending with "limited" is changed to end with "ltd". We use find and replace functions in excel and end up with approximately 5,835 replacements. Matching by name again yields 155 matches. The data is sorted to obtain the final group of unmatched. The reverse to round two is done, where the name

[6] Contribution to total exports for each of the ISICrev3,2digit for 2009 is in the appendix.

of exporter ending with ltd is changed to end with limited. This yielded 39 matches in the final round (round three).

Matched against unmatched manufacturing exporters

The transaction data is restricted to the manufacturing exports only and matched with the census data. Since the transaction data is a panel while the census data is cross-section the study transforms the panel data into a cross-section before the matching. This study computed the average, the median, the standard deviation, minimum and a maximum value for each observation in the sample period 2008-2010. This period is selected based on the assumption that firm characteristics that were collected during the census in the period end 2009 to early 2010 remain fairly constant[7]. The following tables compare the characteristics of matched against unmatched firms in both the transaction and the census data base. Table 3 shows the number of matches in the transactional data base.

Table 3: Two sample ttest with equal variance: number of products exported

	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
Not Matched	5958	5.941703	0.178562	13.78286	5.591657	6.291749
Matched	224	5.53497	0.636949	9.532986	4.27976	6.79018
Combined	6182	5.926965	0.173628	13.65164	5.586594	6.267337
diff		0.406733	0.929188		-1.4148	2.228264

diff = mean(Not Matched) - mean(Matched) t = 0.4377

Ho: diff = 0 degrees of freedom = 6180

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.6692 Pr(|T| > |t|) = 0.6616 Pr(T > t) = 0.3308

Notes: transaction data is for ISIC rev3, digit 2 numbers 15 to 37 (manufacture only) for 2008, 2009, and 2010.This gives a total number of 6,182 firms out of which 224 matches with the census data base. The census data was collected in 2009/2010. The transaction database is transformed into a cross-section by collapsing observations into mean, median, minimum and maximum values over the three years 2008-2010.

From table 3, the difference in the mean is not statistically significant, thus one can conclude that the two samples are comparable in terms of the average number of products exported[8]. With

[7] For robust test we also computed the average, median and maximum for the whole panel.

[8] The same conclusion is established for the number of destination of exports, the average value of exports and firm product destination fobvalue exports.

regard to the census data, the study identifies 582 firms from the transaction data (whole panel) that can be matched to the census data. An examination of the differences in characteristics between firms that match against those that do not match is also done. Table 4 provides the test for one key variable, namely labour productivity.

Table 4: Differences in Labour productivity

	Obs	Mean	Std. Err.	Std. Dev.	95% Conf.	Interval]
Not Matched	1515	17.24212	0.057489	2.237648	17.12935	17.35489
Matched	582	18.89192	0.083697	2.019169	18.72753	19.0563
combined	2097	17.7	0.05024	2.30063	17.60148	17.79853
diff		-1.6498	0.106277		-1.85822	-1.441377
diff = mean(Not Matched) - mean(Matched)					t = -15.5236	
Ho: diff = 0				degrees of freedom =	2095	
Ha: diff < 0		Ha: diff != 0				Ha: diff > 0
Pr(T < t) = 0.0000		Pr(|T| > |t|) = 0.0000		Pr(T > t) = 1.0000		

Notes: The census data was collected in 2009/2010, covering 2,097 manufacturing firms. Out of this 582 firms are found to be exporters in at least one year of the panel transaction data base. Labour productivity is measured as output divided by the number of employees and is in logs. The null of no differences in means is rejected.

This table shows that matched firms are more productive relative to their comparators or in familiar terms, exporters are more productive that non-exporters. Exporters also report higher average sales, employ more labour and capital, pay more wages and spend more on raw materials relative to non-exporters. The differences also extend to expenditure on utilities, capacity utilization and on importation of raw materials. Looking at the age of the firms in either sample, there was no reported differences with the average age standing at 24 years for non-exporters and 23 years for exporters. These evidence are similar to those documented by Abala et al., (2013) and Graner & Isacksson (2007) both using plant level data for Kenya. Bernard and Jensen (1999) were the first to highlight the same features for the US firms.

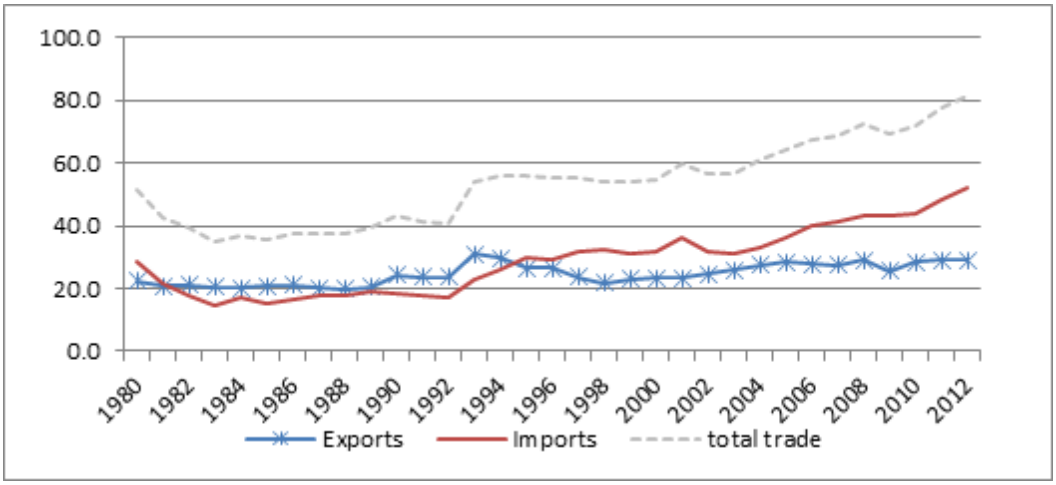
This database was used to investigate each of the research hypothesis set out in section one. First the study begins by exploring the patterns and decomposition of aggregate trade into extensive and intensive margins before narrowing down to perform the same analysis at the firm level.

3. Kenya's exports trade

Export trade flows at the National and firm level

Kenya is a relatively open economy compared to her peers in the sub-Saharan region (Graner & Isaksson, 2007). The ratio of total trade to GDP is currently estimated at 81 percent compared to sub-Sahara regional average of 60 percent. Figure 1 shows the evolution of Kenya's trade as a percent of GDP from the 1980 to 2012.

Figure 1: Trade in percent of GDP (constant 2005 US$)



Source: WDI, World Bank

The overall trend shows a steady climb in imports relative to its levels in the early 1980s when imports were largely restricted through quotas and high tariffs. It is striking to note that export growth has been timid, growing gradually from 20 percent of GDP in 1998 to 29 percent in 2012. This level of expansion remains low, yet, attaining a consistent export growth is especially critical for Kenya, where focus on export led growth strategy shines a light of hope as a policy handle to deliver needed growth, jobs and poverty reduction. At the same time, Kenya's exporters (firms), who are expected to play a leading role in this quest, continue to record low performance, especially in manufacturing exports. Table 5 reports the structure of Kenya's exports for 2009[9].

[9] The structure remains the same for all other years in the sample.

Table 5: Structure of Kenya's exports, 2009

isic revision 3 _2digit code industrial class	# of firms	% of pop	export value(Ksh)	% of export
Agriculture, hunting and related services	946	20.2	159,183,400,480	48.3
Electricity, gas, steam and hot water supply	3	0.1	62,664,260	0.0
Extra-territorial organizations and bodies	45	1.0	842,191,656	0.3
Extraction of crude petroleum and natural gas	8	0.2	2,304,815,439	0.7
Fishing, operation of fish hatcheries an	32	0.7	2,903,197,091	0.9
Forestry, logging and related service ac	46	1.0	5,887,440,393	1.8
Manufacture of basic metals	89	1.9	4,327,313,835	1.3
Manufacture of chemicals and chemical pr	565	12.1	32,944,784,723	10.0
Manufacture of coke, refined petroleum p	90	1.9	10,333,261,679	3.1
Manufacture of electrical machinery and	72	1.5	216,876,776	0.1
Manufacture of fabricated metal products	166	3.6	1,801,212,940	0.6
Manufacture of food products and beverages	507	10.9	52,430,880,170	15.9
Manufacture of furniture	106	2.3	301,667,787	0.1
Manufacture of machinery and equipment	207	4.4	940,272,642	0.3
Manufacture of medical equipments	40	0.9	108,951,186	0.0
Manufacture of motor vehicles	93	2.0	224,287,159	0.1
Manufacture of office, accounting and computing	76	1.6	400,237,022	0.1
Manufacture of other non-metallic minerals	161	3.4	3,940,735,472	1.2
Manufacture of other transport equipment	31	0.7	22,071,085	0.0
Manufacture of paper and paper products	90	1.9	1,648,343,506	0.5
Manufacture of radio, television and communication	61	1.3	307,928,625	0.1
Manufacture of rubber and plastics products	366	7.8	15,011,179,337	4.6
Manufacture of textiles	143	3.1	2,262,782,107	0.7
Manufacture of tobacco products	3	0.1	1,109,225	0.0
Manufacture of wearing apparel	51	1.1	6,091,125,578	1.9
Manufacture of wood products	229	4.9	763,555,895	0.2
Mining of coal and lignite	2	0.0	261,139,054	0.1
Mining of metal ores	7	0.2	686,502,939	0.2
Other business activities	1	0.0	45,491	0.0
Other mining and quarrying	129	2.8	18,413,538,030	5.6
Other service activities	1	0.0	157,000	0.0
Publishing & printing media	183	3.9	1,815,472,374	0.6
Recreational, cultural and sporting	38	0.8	37,827,340	0.0
Tanning and dressing of leather	87	1.9	2,844,882,121	0.9
Total	**4,674**	**100**	**329,321,850,416**	**100**

Source: own computation from data

In 2009, there were 4,674 total exporters out of which manufacturing exporters were 3,416 (73.1%) while the balance, (1,258) were non-manufacturers exporters. However, this huge number of manufacturer exporters was only responsible for 42.1 percent of total exports, while the non-manufacturing exporters (26.9%) accounted for 57.9 percent of total exports. This study investigates this structure further by focusing on firm level decisions regarding their mix of

products and destination of exports and the average value of export flow (extensive and intensive margins). Table 6 reports the summary statistics of Kenya's exports along the three dimensions: firms, products and destinations and average export value both at the firm and aggregate levels.

Table 6: Summary Statistics, selected years

Firm Level	2005	2007	2009	2012
Number of products				
Mean	6.0	7.6	7.3	7.7
Median	2.0	2.0	2.0	2.0
Standard deviation	14.6	19.5	16.9	21.6
Number of destinations				
Mean	2.8	2.6	2.6	2.8
Median	1.0	1.0	1.0	1.0
Standard deviation	3.9	3.5	3.3	3.7
Exports(KSh million)				
Mean	49.65	55.08	70.46	93.91
Median	1.16	1.20	1.32	1.60
Standard deviation	303.01	306.11	425.99	572.85
Aggregate level				
Number of exporters	3,916	4,721	4,674	5,170
Number of products	3,251	3,537	3,354	3,456
Number of destinations	173	169	155	162
Number of FPD	33,581	47,625	46,115	55,430
Export (Ksh.million)	194,449	260,034	329,322	485,521
Export(KNBS)(Ksh. million)	209,918	261,685	323,571	479,706
Deviation from KNBS	(7.4)	(0.6)	1.8	1.2

Top panel shows firm-level summary statistics, while bottom panel shows country-level statistics. Computation is from the customs, export data while the Kenya National Bureau of Statistics (KNBS) data is obtained from various annual surveys. FPD means firm-product-destination combination. A product is defined as HS 6-digit in 2002.

At the aggregate level, the volume of exports has increased from Ksh. 209,918 million to Ksh. 479,706 million (approximately 129%) between 2005 and 2012. The number of exporters increased from 3,916 in 2005 to 5,170 in 2012 (about 32%) while the number of products have remained broadly stable over the sample period. In 2005, for example, there were about 3,916 exporters exporting 3,251 products to 173 destinations.

At the firm level, the average exporter in 2005 shipped 6.0 products to 2.8 destinations and earned on average Ksh. 49.65 million (or US$ 0.5 million at Ksh per 1US$ of 100). The average earnings have increased from Ksh. 49.65 million in 2005 to Ksh. 93.9 million in 2012 (more than 89%). The number of products exported per firm is highly skewed to the right [10](positive

[10] Mean is greater than the mode and the median.

skewness). This implies the presence of huge exporter heterogeneity in which some firms export more products, while others ship just a few. The positive skewness is even greater over the years with data in 2012 showing a more skewed distribution relative to 2005. This suggests that multi-product exporters play an important role in growth of Kenya's exports. The next series of tables narrows down the analysis to firm level and examines the importance of multi-product and multi-destination exporters for Kenya.

Patterns and trends of product and destination scope at the firm level

According to Bernard et al. (2013) multi-product multi-destination exporters account for the largest share of export, employ more workers, ship to more destinations and to richer markets. These features are also confirmed among Kenya's multi-product exporters. Table 7 shows that in 2005, multi product exporters consisted of 55.3 percent of all exporters and were responsible for 87.5 percent of total export value. Exporters who shipped more than 5 products (28% of population) command approximately 65.1 percent of total export value. This is evidence that exports are concentrated among a small number of multi-product exporters.

Table 7: Multi-product exporters

	Number of exporters				Value of exports			
	2005		2012		2005		2012	
Number of products exported	N	% of pop	N	% of pop	Ksh. million	% of total	Ksh. million	% of total
1	1,751	44.7	1,914	37.0	24,342	12.5	77,611	16.0
2	572	14.6	812	15.7	24,037	12.4	59,573	12.3
3	322	8.2	453	8.8	14,233	7.3	42,965	8.9
4	192	4.9	292	5.7	5,375	2.8	35,421	7.3
5	161	4.1	236	4.6	9,705	5.0	20,031	4.1
6-10	433	11.1	612	11.8	39,173	20.2	54,742	11.3
11-20	267	6.8	433	8.4	32,980	17.0	97,496	20.1
21-30	82	2.1	173	3.4	15,788	8.1	24,315	5.0
>31	136	3.5	245	4.7	28,816	14.8	73,367	15.1
Total	**3,916**	**100**	**5170**	**100.0**	**194,449**	**100**	**485,521**	**100**

Notes: Computed from customs data. Pop stands for population of all exporters. N gives the number of exporters per category of products exported. Exports are in nominal Kenya shilling million. % of total gives the share of each group of exporters (N) in total export value for the year.

It is also noted in 2005; approximately 1,751 exporters were single product exporters and were responsible for approximately 12.5 percent of total exports. In 2012, however, single product exporters increased to 1,914 and were accountable for approximately 16 percent of the export value for that year. For the period between 2005 and 2012, the number of single product

exporters increased from 1,751 to 1,914 (or 9.3%) while the number of multi-product exporters increased from 2,165 to 3,256 (50%). This is tremendous, showing that once one starts exporting, adding more products is far easier than making a decision to start exporting. These is evidence of the need to differentiate export promotion policies, partly to increase new (brand) of products to existing destination but also helping exporters access new markets.

In terms of value of exports, the export value for single product exporters increased from Ksh. 24,342 million to Ksh. 77,611 million (219 percent), while the value for the multi-product exporters increased from Ksh. 170,107 million to Ksh. 407,910 million (140 percent) over the two periods. Multi-product exporters push a large magnitude in expansion of exports but single product exporters record a faster growth rate in export value. The above story is also echoed among multi-destination exporters. These types of exporters ship products to more than one market. For example, rose flowers are exported to several EU countries. Table 8 delineates exports into single destination exporters and multi-destination exporters.

Table 8: Multi-destination exporters

	Number of exporters				Value of exports			
	2005		2012		2005		2012	
Number of destinations served	N	% of pop	N	% of pop	Ksh. million	% of total	Ksh. million	% of total
1	2,219	56.7	2,855	55.2	9,517	4.9	39,321	8.1
2	594	15.2	838	16.2	9,558	4.9	19,195	4.0
3	311	7.9	434	8.4	7,647	3.9	17,065	3.5
4	208	5.3	256	5.0	7,476	3.8	25,386	5.2
5	132	3.4	166	3.2	11,228	5.8	31,110	6.4
6-11	296	7.6	405	7.8	37,874	19.5	114,326	23.6
>11	156	4.0	216	4.2	111,150	57.2	239,118	49.3
Total	**3,916**	**100**	**5170**	**100**	**194,449**	**100**	**485,521**	**100**

Notes: Computed from customs data. Pop stands for population of all exporters. N gives the number of exporters per category of destinations. Exports are in nominal Kenya shilling million. % of total gives the share of each group of exporters (N) in total export value for the year.

In 2005, a total of 2,219 exporters exported to only one destination, accounting for 4.9 percent of total exports. Multi-destination exporters, totalling to 1,697 in number, accounted for 95.1 percent of total exports. Spectacular performers are those that ship to more than 11 destinations. These happy few (156) accounted for approximately 57.2 percent of total exports. Trends overtime show that the number of single destination exporters rose from 2,219 in 2005 to 2,855 in 2012 (29 percent). Furthermore, single destination exporters account for approximately 8.1

percent of the total value of exports, up from 4.9 percent in 2005. The multi-destination exporters (44.8 percent of the population of exporters) continue to enjoy the lion's share of the total value of exports (91.9 percent). Thus multi-destination exporters drive export growth for Kenya but the role of single destination exporters is also increasing over time. Finally, multi-product exporters are not necessarily multi-destination exporters. Table 9 presents the interaction between the two types. i.e the joint distribution of exporters and total exported value for 2012 over the number of products and the number of destinations.

Table 9: Distribution of exporters over the number of products and destination, 2012

Number of products exported	Number of destinations served							
	1	2	3	4	5	6-11	>11	Total
1	31.1	2.8	1.2	0.5	0.3	0.7	0.4	37.0
2	8.5	4.3	1.0	0.5	0.2	0.8	0.4	15.7
3	4.2	2.1	1.1	0.3	0.3	0.4	0.4	8.8
4	2.3	1.2	0.8	0.5	0.3	0.4	0.2	5.6
5	1.7	1.1	0.5	0.4	0.2	0.5	0.2	4.6
6-10	3.8	2.2	1.7	1.2	0.9	1.6	0.4	11.8
11-20	2.0	1.2	1.0	1.0	0.6	1.6	1.0	8.4
21-30	0.8	0.5	0.4	0.3	0.1	0.8	0.4	3.4
>31	0.8	0.7	0.7	0.3	0.4	1.0	0.8	4.8
Total	55.2	16.2	8.4	5.0	3.2	7.8	4.2	100.0

Distribution of total export value over the number of products and destination, 2012

Number of products exported	Number of destinations served							
	1	2	3	4	5	6-11	>11	Total
1	5.1	0.7	0.6	1.9	1.4	3.4	2.9	16.0
2	1.4	0.9	0.2	1.1	1.2	3.1	4.4	12.3
3	0.3	0.2	0.5	0.2	1.0	1.3	5.4	8.9
4	0.5	0.4	0.2	0.3	1.0	0.6	4.4	7.3
5	0.1	0.4	0.0	0.5	0.2	1.9	1.1	4.1
6-10	0.4	0.9	1.0	0.3	0.9	3.3	4.5	11.3
11-20	0.2	0.3	0.4	0.5	0.5	5.1	13.2	20.1
21-30	0.1	0.1	0.1	0.2	0.1	2.4	2.0	5.0
>31	0.1	0.2	0.5	0.2	0.2	2.5	11.4	15.1
Total	8.1	4.0	3.5	5.2	6.4	23.5	49.3	100.0

Notes: own computation. The totals for rows capture the marginal distribution along the destination dimension, while the totals for columns capture the marginal distribution along the product dimension.

Starting with the rows total, approximately 55.2 percent of exporters ship to one destination and account for approximately 8.1 percent of total exports. This means that 44.8 percent of exporters are multi-destination exporters and are responsible for 91.9 percent of total exports in 2012. The column total shows that 37 percent of all exporters exported a single product and account for

about 16 percent of total export value in 2012. Multi-product exporters constitute 63 percent of the population and are responsible for 84 percent of total export value in the same year.

Single product and single-destination exporters consisted of 31.1 percent of all exporters in 2012 and only account for 5.1 percent of total exports in that year. Firms that export more than 5 products to more than 5 destinations constitute 38 percent of the population of exporters but are responsible for over 85 percent of total exports.

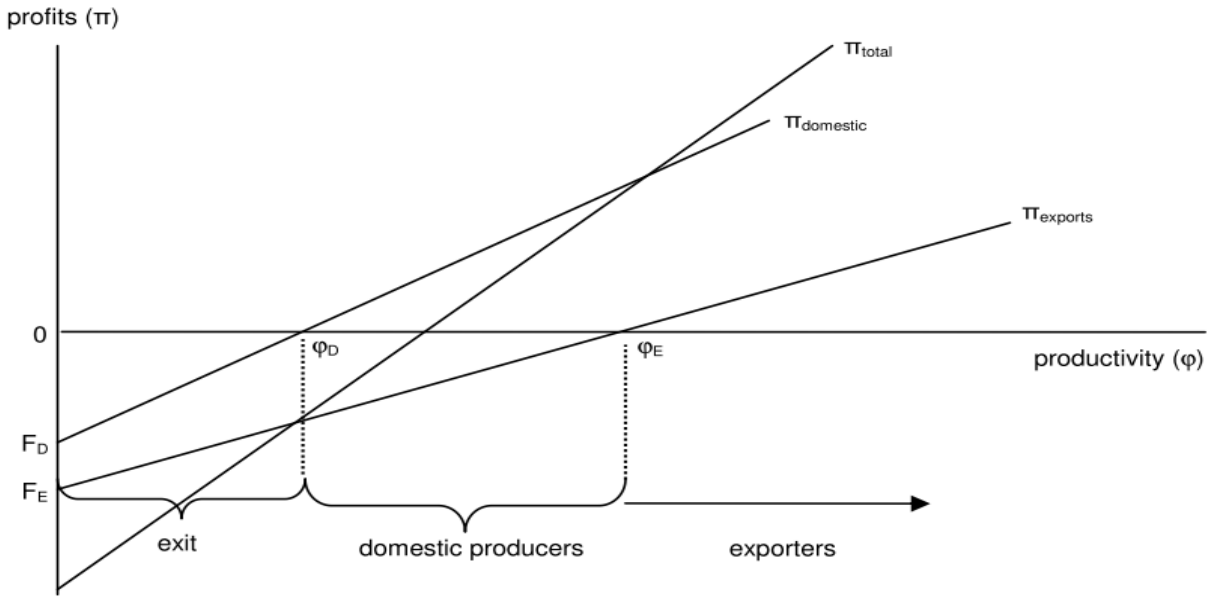
This is evidence of the importance of multi-product and multi-destination exporters for the case of a low income country, as has been established for advanced economies. In particular, these findings are close to the one established for Belgium by Bernard et al. (2013), where over 65 percent of all exporters are multi-product exporters and account for over 98 percent of the total exports. It is also similar to that found for the US where 58 percent of US exporters are multi-product exporters and account for more than 99 percent of exports (Bernard et al., 2009). These results are also in line with those reported by Bernard Redding and Schott (2011) for the US, Mayer and Ottaviano (2008) for France and Goldberg et al (2010) for India. They confirm the notion of heterogeneity across firms and that multi product and multi-destination exporters account for the large majority of exports for a low income country as is the case for developed and developing countries.

4. Methodology

Conceptual framework

The conceptual framework borrows from the Melitz (2003) model of heterogeneous firms and trade and the extensions by Bernard et al.,(2011). The Melitz model accounts for the fact that, within a given industry, there is firm level heterogeneity[11] and fixed costs (or sunk costs) matter in export related decisions. Only more productive firms are likely to export and trade liberalization leads to intra-industry reallocation of resources across firms. Less productive firms exit, giving room for the surviving and more productive ones to grow and expand which raises the aggregate productivity for an economy. Figure 2, below highlights the underlying mechanism.

Figure 2: Firm heterogeneity and fixed export costs



Source: Smeets et al., (2010)

The figure depicts a mechanism in which only the most productive firms are able to overcome the fixed costs of entry(domestic) and fixed costs of exporting (foreign entry) and survive. The three curves labelled ∏ identifies firms that serve the domestic market only ($\prod_{domestic}$), additional profits for firms that also export ($\prod_{export}$) and total profit ($\prod_{total}$). These profits are positively related to firm productivity, which implies an increase in firm productivity is fully passed on to consumers in terms of low prices and capturing of the market share and high revenue, ceteris

[11] Heterogeneous firms differ from each other in terms of their productivity.

paribus. The intercepts of the $\prod_{domestic}$ curve is smaller in absolute terms than the $\prod_{export}$ curve because the fixed cost of exporting (F_E) is greater than the fixed cost (F_D) of supplying the domestic market. In addition, the slope of the $\prod_{domestic}$ curve is steeper than the slope of the $\prod_{export}$ curve. This implies exporters incur variable trade costs on every unit they export which lowers the marginal increase in profit following productivity increase compared to supplying to the domestic market. This model has been taken to data and shown that it fits the micro level trade data very well. Many studies have established that ex-ante firm productivity is the key determinant of the decision to export. The following table provides a summary of some of the studies:

Study	Sample	productivity premia (ex-ante)			
		TFP	LP	ΔTFP	ΔLP
Bernard and Jensen(1999)	United States : 1984-1992	6%	8%	--	
Isgut (2001)	Columbia : 1981-1991	--	20%	--	4%
Wagner (2002)	Germany : 1978-1989	--	0%	--	
Baldwin and Gu (2003)	Canada : 1974-1996	--	--	0%	3%
Hahn (2004)	Korea: 1990-1998	4%	--	--	--
Blalock and Gertler (2004)	Indonesia : 1990-1996	3%	--	--	--
Kox and Rojas-Romagosa (2010)	Netherlands: 1999-2005	--	6.2%	--	--

In Bernard, Reddings & Schott., (2011), there is an extension to the basic Melitz (2003) model to account for heterogeneity within the firm (i.e. product and destination mix). Here too, firms have to incur a sunk cost before knowing how profitable they are in the export market but there is also a product specific fixed cost. Firm profitability depends on the interaction between firm ability and product attributes. The firm component generates selection across firms into exporting, while the product attribute component generates selection within products. In this model high ability firms can generate sufficient variable profits to cover the product attributes, and therefore supply a wider range of products to each market. Using this framework, multi-product exporters are analysed for France, by Mayer et al., (2010), for Brazil and Chile, by Arkolakis and Muendler (2010), for Belgium by Bernard et al. (2013), for Mexico, by Iacovone and Javorcik (2010) and for India, by Goldberg et al. (2010).

Three sets of core implications arise in these analyses. Firstly, trade liberalization causes firms to drop their least successful products, which induces compositional changes within firms (Bernard, Reddings & Schott., 2011, Goldberg et al., 2006, Eckle and Neary., 2010; Mayer et al., 2010).

Secondly, high variable costs reduce the number of exporting firms, the number of products exported by each firm, and the export of a given product by a given firm but have an ambiguous effect on average exports per firm and product (see Bernard, Reddings & Schott., 2011, Mayer et al., 2010, Arkolakis and Muendler., 2010). Thirdly, superstar firms reign in the world of exporting. High ability firms command a large share of products exported to a given country (within-firm product extensive margin) and increase the number of countries to which a given product is exported by the firm (see Nockle and Yeaple, 2006).

Decomposition of trade margins

Decomposition of Kenya's export trade, both at the aggregate and firm level, follows the methods proposed by Bernard et al. (2007) and (2013). In that framework one is able to decompose both aggregate and firm level exports into their respective margins of export trade (see Bernard et al. 2013). The following section highlights this decomposition.

At the aggregate level, the extensive margins correspond to the number of firms serving a given destination market and the number of products exported to that market, while the intensive margin is associated with the average exports per firm-product. Let the aggregate Kenya's exports with a partner country c be X_c . This value can be decomposed into the unique number of firms that trade with the country (F_c), the unique number of products traded with the country (P_c), and the average value of exports per firm-product, (X_c/F_cP_c). Since firms generally are active in a small subset of the overall number of products exported by the country, Bernard et al (2013) defines an additional term in the decomposition to account for the density of trade (D_C) (i.e. the fraction of all possible firm-product combinations for country c for which trade is positive).

$$X_c = F_c P_c D_C \bar{X}_c \qquad (1)$$

$$D_c = \frac{O_C}{F_c P_c}$$

$O_c =$ is the number of firm-product observations for which trade with country c is above zero and $\bar{X}_c = X_c/O_c$ is the intensive margin, which is the average value per observation with positive trade. The density ranges from min $\{1/F_c, 1/P_c\}$ to unity as the number of observations

approaches the product of F_c and P_c. Since firms generally are active in only a small subset of the overall number of products traded, density is typically negatively correlated with the numbers of trading firms and the number of traded products.

Equation (1) provides the basis for a regression decomposing Kenya's export trade across countries (or regions) for a particular year. This paper uses OLS to regress the logarithm of each margin of trade on the logarithm of total exports trade to a country c. The coefficients for each set of regressions must necessarily sum to unity, with each coefficient representing the share of the overall variation in exports trade explained by each margin (see table 11). In the research hypothesis it was anticipated that the extensive margin will account for the largest share in export flow at the aggregate level, but even play a greater role for exports into the EAC sub-region. This evidence is in line with the predictions of the Melitz (2003) model, in which ability to jump fixed costs and remain profitable is the key to extensive margin of export growth. Fixed costs of entry are assumed to be lower for the EAC region and thus a large number of entries of firms as well as the number of exported products.

At the firm level, total firm's exports in a given year can be decomposed into the number of unique destinations served by the firm, (C_f), the number of distinct products exported, (P_f), a measure of coverage or density which corresponds to the share of the firms exported products sent to the average destination, (D_f) and the average value of exports per product-country served, ($\overline{X}_f$).

$$X_f = C_f P_f D_f \bar{X}_f \qquad (2)$$

$D_f = \frac{O_{cpf}}{C_f P_f}$ and $\bar{X}_f = \frac{1}{O_{cpf}} \sum_c \sum_p X_{cpf}$

O_{cpf} = is the number of positive firm level export transactions at the product-country level.

The measure of density considers how many country-product combinations to a given destination are being actively served by the exporter. An example provided by Bernard et al., (2013) state that if a firm exports 10 unique products and it ships to 10 destination markets then the total possible number of country-product combinations is 100. If on average, the firm exports two

products to each market, the density of export activity for the firm is (20/100)=0.2. As shown in the aggregate level, the density ranges from $\{\frac{1}{C_f}, \frac{1}{P_f}\}$ to unity. Equation (2) forms the basis for the fixed effects regression between the logarithm of the margins of export trade and the logarithm of the proxy measure of firm productivity (i.e. labour productivity, firm size, sales revenue etc.). The regression includes the industry fixed effects to account for the industry unobserved heterogeneity.

A firm's ability is associated with increased exports of existing products to existing markets, new products exported to existing markets and new markets for the most profitable products. Following recent multi-product literature[12] this study relates firm's margins of export trade to firm characteristics. These margins of trade (four constituent components-logs of firm exports, extensive and intensive margins) are regressed at the cross-section against proxy for firm productivity and fixed effects of the major industry of the firm. The cross-sectional regression is specified as:

$$\ln Y_f = \propto_0 + \beta \ln \text{Prod}_f + \delta_i + \varepsilon_f \qquad (3)$$

Where: $\ln Y_f =$ is the four margins of trade (C_f, P_f, D_f and $\bar{X}_f$)

Prod_f= is a proxy measure of productivity (labour productivity);

$\delta_i =$ Fixed effects for the major industry of the firm; and

ε_f= is the random error term and $f = 1, 2, \ldots, n$.

The dependent variable is the margins of trade, as computed in (2) above. Equation (3) uses the known proxy measures for firm performance, namely, value added per worker (labour productivity). It also includes fixed effects for the major industry of the firms to take into account unobserved industry heterogeneity. *The sign for the β is expected to be positive for the extensive and intensive margins but negative in relation to density.*

[12] See Bernard et al.2011, Bernard et al. 2013

5. Results and Discussion

In this section the analysis is conducted at the cross-sectional level, with the year 2009 as the period of the analysis. The selection of the year is based on two main reasons. First, it is the base year for Kenya's National accounts data and therefore taken to be, broadly, a stable year. Second, the census data matched with transactional data to obtain firm level characteristics was collected with the reference period of 2009. The empirical strategy draws from fast growing theoretical papers on multi-product exporters where high firm productivity leads the firm to serve more destinations and export more products per destination. Models of multiproduct exporters include Eckle and Neary (2010), Bernard Redding and Schott (2011), Arkolakis and Muendler (2010), Mayer, Melitz and Ottaviano (2010) and Feenstra and Ma (2009). The results presented begin with the country level analysis and narrows down to firm level.

Cross-section variation in Kenya's Export Trade

Large cross-section variation in export trade across partner countries is a striking feature of international trade (Bernard et al., 2009). Table 10, reports the results of the regression decomposition of the variation in Kenya's exports across trading partners along four margins in 2009.

Table 10: Regression decomposition of Kenya's export trade, 2009

Margins	Full Sample	EAC	Row	Fragile	Non-Fragile
Number of Exporters	0.526***	0.698***	0.489***	0.474***	0.549***
	[0.0227]	[0.0940]	[0.0208]	[0.0586]	[0.0206]
Number of Products	0.519***	0.578***	0.467***	0.452***	0.546***
	[0.0287]	[0.0984]	[0.0254]	[0.0737]	[0.0254]
Density	-0.433***	-0.409***	-0.402***	-0.375***	-0.458***
	[0.0208]	[0.0547]	[0.0203]	[0.0504]	[0.0198]
Intensive	0.389***	0.133	0.446***	0.450***	0.363***
	[0.0307]	[0.189]	[0.0252]	[0.0829]	[0.0254]
Number of obs	149	7	142	43	106

Notes: Each cell contains the result of a separate regression of the log margins on the log of total exports to a given destination, with the coefficient and robust standard errors in the squared brackets. The asterisks denotes the level of significance *** p<0.01, ** p<0.05, * p<0.1. The constants are not reported. Column one provides results for full sample while the other columns are restricted. The sum of the four coefficients must sum to unity.

Each coefficient for each regression in table 10 represents the share of the overall variation in export trade by each margin and must sum to unity. Starting with the full sample regression (i.e. all export destinations in 2009), the results show that variation in the number of exporters and the number of products exported accounted for 52.6 percent and 51.9 percent of the cross-sectional variation in Kenya's exports, respectively. The importance of the extensive margins in Kenya is slightly lower, relative to the percentages obtained by Bernard et al.,(2009) for the US, in which the number of firms and the number of products exported accounted for 69.8 percent and 58.8 percent, respectively.

The intensive margin explains, on average, 38.9 percent of the variation in overall Kenyan exports across destinations. This percentage is high, compared to the US, where the intensive margin accounts for approximately 22.6 percent (see Bernard et al.,2009). The results are also close to other findings in the literature covering advanced economies. For instance, Eaton, Kortum and Kramarz (2008) find a cross-country elasticity of the number of French exporters with respect to market size of 0.65. Hummels and Klenow (2005) find a cross-country elasticity of the number of products exported with respect to importer country GDP of 0.61.

With regard to density, literature finds it to be negatively correlated with the number of products traded, the number of trading firms and the aggregate value of exports (see Bernard et al., 2009). This is also confirmed in the case of Kenya. The sum of the three extensive margin terms accounts for the majority (61.2 percent) of the variation in overall exports in Kenya. The intensive margin accounts for the balance (38.8 percent). In the US, extensive margin terms accounts for the vast majority of exports (approximately 77.4 percent).

The third column provides the results for the EAC sub region in which exports to Tanzania, Uganda, Rwanda, and Burundi as well as the border countries of Sudan, Somalia and Ethiopia and DR. Congo are separated from the rest of the World. The key hypothesis here is that the extensive margins must play a more substantive role in the variation of export trade to the EAC sub-region. The results show that, indeed, the extensive margin trounces the intensive margin, accounting for 86.7 percent of the variation in export trade to the EAC sub region. The extensive margins are also larger than that obtained for the full model in which the firm and product

extensive margins are greater. This indicates that the EAC sub region plays an important role in expansion into exporting for Kenya.

The paper accords a special interest in trade with the fragile and conflict states. The last two columns investigate the decomposition of the export trade to partners largely classified as fragile and conflict states. It is noted that the extensive margins in this case account for only 54.5 percent of the variation in cross-sectional exports; while the intensive margin now accounts for approximately 45 percent. This suggests that some firms have curved a niche in this type of a market and a further analysis of firm level trade to fragile states will be interesting. Taken together, the extensive margins for export trade to fragile countries are the lowest relative to rest of the models, which points to presence of higher fixed effects in accessing these markets. However, the intensive margin to the fragile is the largest among all models, indicating that once a firm establishes contact the volume of exports increases substantially.

Trade costs and Kenya's bilateral exports

In this section we use a simple cross-country gravity regression to examine relationship between distance to Kenya (i.e. a proxy for trade costs) and the variation of the extensive and intensive margins of trade (see Bernard et al.,2011 and 2013). Distance refers to the great circle distance in kilometres from Kenya. Table 11 reports the regression results using 2009 data.[13]

Table 11: Gravity and the margins of Kenya bilateral exports

	Log(fobvalue_c)	Log(#firms_c)	Log(#products_c)	Log(density_c)	Log(average value_c)	Log(Firm _PD_f)
	(1)	(2)	(3)	(4)	(5)	(6)
Log distance	-2.921***	-1.847***	-2.048***	1.624***	-0.650***	-0.655***
	[0.226]	[0.139]	[0.143]	[0.111]	[0.167]	[0.0329]
Log nominal GDP	0.844***	0.475***	0.408***	-0.372***	0.333***	0.231***
	[0.0775]	[0.0497]	[0.0506]	[0.0417]	[0.0398]	[0.0136]
Constant	22.91***	7.015***	10.45***	-7.260***	12.70***	10.91***
	[2.047]	[1.276]	[1.472]	[1.118]	[1.385]	[0.321]
Fixed effects	none	none	none	none	none	Yes
Observations	149	149	149	149	149	44,041
R-squared	0.604	0.627	0.592	0.614	0.245	0.874

Notes: Results are obtained by running regressions at the country (1-5) and at the firm-product-country level (6). The dependent variable used is reported on top of each column. Reported values are coefficients [robust standard errors]. The asterisks denotes the level of significance *** p<0.01, ** p<0.05, * p<0.1. Column 6 includes firm-product fixed effects.

[13] Results for other years are similar and available upon request.

In column one, aggregate bilateral exports have a strong negative relationship with distance and are increasing in the destination market size (nominal GDP measured in USD). These findings are not surprising as it is the norm and expectation of all gravity type regressions. The next three columns report the effects of distance and GDP on the extensive margins of trade. Both the number of exporters and the number of products exported increase as trade costs fall across countries, while the density of trade is increasing with distance. The density is expected to be lower for markets that are served by more exporters and that receive more products. One would, for example, expect that density is lower for exports destined to the EAC sub region[14]. This is because, as the number of products exported rises, each exporter will be exporting a smaller share of the range of the products, since exporters are active in a limited subset of products (Bernard et al.2013).

Taken together, the combined effect of the extensive margins obtained by adding up the coefficients on distance across columns (2-4), almost completely explains the cross-country variation in export value (-2.3 against -2.92). These findings are similar to those found by Bernard et al.,(2013) for Belgium in which the effects of distance on bilateral trade was near one (-0.966) and the combined effects of extensive margins was 1.018. However, our findings document a larger effect of distance on bilateral exports.

Column five shows that the effects of distance on the average value of exports per firm-product to a given destination are negative and statistically significant. This is contrary to the findings by Bernard et al., (2013) in which they find a small and insignificant positive coefficient. Our finding can be explained. In a situation where you have firms exporting a single product to multiple destinations, this coefficient is expected to be negative and statistically significant[15] (Bernard et al., 2009). This is because exports of any given product should increase if trade costs are lower. This seems to be the case for Kenya. Recalling the conclusion from multi-destination exporters (see table 7), it was found that multi-destination exporters play an even bigger role, relative to multi-product exporters, accounting for approximately 91 percent of exports.

[14] See appendix in the robustness test. The coefficient on density for the overall model is 3.4 times larger relative to restricted EAC model.

[15] In a world with multi-product exporters the relationship between distance and average shipments per firm-product is ambiguous. This is because, new marginal exporters are able to enter less costly markets and also because existing exporters are able to ship lower profit products to closer markets.

Finally, in column 6, the innovation is to control for firm-product fixed effects, so that the coefficients on distance and market size are identified from variation across countries, within firm-product pairs. The firm-product-destination exports are negatively correlated with variable trade costs (distance) to the destination country.

Cross-section variation in firm-level Exports Trade

In this section we decompose firm level export data into extensive and intensive margins and examine the role played by each margin in expansion of firm level exports. Table 12 reports the results of this decomposition.

Table 12: Firm level share of intensive and extensive margins of exports, 2009

Margins	Full Sample	EAC	Row	Fragile	Non-Fragile
	(1)	(2)	(3)	(4)	(5)
Number of products_f	0.182***	0.247***	0.150***	0.242***	0.164***
	[0.00539]	[0.00827]	[0.00666]	[0.00998]	[0.00619]
Number of destination_f	0.181***	0.156***	0.192***	0.144***	0.193***
	[0.00344]	[0.00434]	[0.00481]	[0.00518]	[0.00431]
Density_f	-0.0966***	-0.102***	-0.0897***	-0.0934***	-0.0950***
	[0.00256]	[0.00330]	[0.00369]	[0.00394]	[0.00330]
Intensive_f	0.734***	0.699***	0.748***	0.708***	0.738***
	[0.00503]	[0.00809]	[0.00639]	[0.00975]	[0.00585]
Number of obs	4,667	2,749	1,918	2100	2,567

Notes: Each cell contains the result of a separate regression of the log margins on the log of total firm exports in a given year, with the coefficient and robust standard errors in the squared brackets. The asterisks denotes the level of significance *** p<0.01, ** p<0.05, * p<0.1. The constants are not reported. Column one provides results for full sample while the other columns are restricted. The sum of the four coefficients must sum to unity.

The sign on each of the coefficients is as expected and all are large and statistically significant. Firm intensive margin accounts for approximately 70 percent of expansion in exports across the five regressions. The role of extensive margins is about 30 percent. In particular, the extensive margins in exports to the EAC sub-region account for 31 percent of which, product extensive margin accounts for approximately 25 percent. The EAC region, therefore, provides opportunity for growth in exports by providing markets for brand new export products. Exports into markets classified as fragile also indicate scope for growth in product extensive margins with its share at 24.2 percent.

Firm productivity and Exports trade margins

There is an underlying positive correlation between firm productivity and the margins of trad**e** (Bernard et al .2013). This section uses labour productivity as a proxy for firm ability and control

for fixed effects (firm size, industry and location) to examine the correlation between productivity and the margins of trade.

A working assumption is that an increase in firm productivity is expected to raise exports of existing products to existing destinations, allow firms to expand into new markets with existing products and make profitable the export of new, previously marginal products (Bernard et al., 2013). As such, total firm level exports, the number of products and the number of markets served are expected to increase in response to higher firm productivity. However, the average firm exports may or may not rise due to the confounding effects of increasing exports within product-country and the arrival of new and marginal products. Table 13 presents the summary statistics for the main dependent variables (margins of trade) and other explanatory variables in the matched baseline data.

Table 13: Summary statistics of trade margins and other firm level explanatory variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Firm product destination fobvalue (Ksh)	224	1,369,206	3,765,803	378	31,700,000
Number of products (count)	224	6	10	1	64
Number of destinations (count)	224	2	3	1	35
Density term (fraction)	224	0.9	0.3	0.1	2.0
Average export value (Ksh)	224	2,067,181	7,041,663	403	78,300,000
Total firm export (Ksh)	224	20,400,000	107,000,000	403	1,240,000,000
Total firm production (Ksh)	224	870,000,000	3,050,000,000	500,000	40,000,000,000
Expenses on rawmaterials (Ksh)	224	478,000,000	1,380,000,000	1,700	15,200,000,000
Expense on imported rawmaterial (Ksh)	80	477,000,000	1,110,000,000	78,000	6,460,000,000
Expenses on utilities (Ksh)	224	31,100,000	97,100,000	7,550	1,200,000,000
Total sales revenue (Ksh)	224	835,000,000	2,410,000,000	108,000	26,200,000,000
Capacity utilization (%)	149	65	21	1	101
Expenses on wages (Ksh)	224	8,612,900	20,700,000	0	133,000,000
Total number of employees (count)	224	230	468	0	4,481
Gross value added (Ksh)	224	392,000,000	1,820,000,000	(451,000,000)	24,800,000,000
Labour productivity (Ksh)	221	3,543,886	23,700,000	(4,460,553)	344,000,000
Average earnings per worker (Ksh)	221	86,875	488,278	-	7,049,931
Physical capital (Ksh)	45	1,544,363	2,318,305	948	11,000,000
Firm age(years)	154	24	22	1	108

Notes: Reports the summary statistics of matched firms between transaction data is for ISIC rev3, digit 2 numbers 15 to 37 (manufacture only) for 2008, 2009, and 2010 and the census data collected in 2009/2010.This yielded a total number of 224 firms used in the analysis.

The distribution of the dependent variables, namely; the number of products, the number of destinations, density (broadly extensive margins) and the average export value per firm (intensive margin) are presented. The average number of products exported per firm is 6

products, while the average number of destinations served is 2. But, there is huge heterogeneity[16] with a standard deviation of 10 and 3 for products and destinations respectively. The maximum number of products exported in the sample is 64 products. This implies that the number of products exported per firm is positively skewed. Modelling this type of distribution using OLS may be problematic since the OLS assumptions are violated. The use of count data models that take into account this skewness becomes appropriate. In the robustness test, an application of the count data estimation procedure is used and the sign on productivity remains positive and statistically significant.

Table 14 presents the baseline results on the effects of firm level productivity on aggregate firm exports, the product and destination extensive margins, as well as the average shipments per product-country.

Table 14: Relationship between firm productivity and margins of trade

	ln(#products_f)	ln(#destination_f)	ln(density_f)	ln(ftotexports_f)	ln(avval_f)
	(1)	(2)	(3)	(4)	(5)
log(va/worker)	0.0724*	0.0175	-0.0129	-0.105	-0.0943
	[0.0380]	[0.0271]	[0.0176]	[0.105]	[0.0851]
Fixed effects	Industry	None	Industry	Industry	Industry
Observations	199	199	199	199	199
R-squared	0.257	0.002	0.105	0.098	0.072

Notes: Each cell contains the result of a separate regression of the log margins on the log of labour productivity for the cross-sectional sample. The dependent variables are on the columns. The coefficients and robust standard errors in the squared brackets are shown. The constant is not reported and industry fixed effects are included. The asterisks denotes the level of significance *** p<0.01, ** p<0.05, * p<0.1.

The dependent variables are on the columns while log labour productivity and fixed effects are included as regressors. The sign on equations one, two and three is, as expected, apriori but not for equation four, in which the study expects a positive and statistically significant relation. The sign on the last equation is ambiguous.

[16] Kernel density plots argument this points further. See appendix.

Robustness tests

To complement these baseline results the study undertakes several robustness tests. Firstly, the baseline sample is expanded by collapsing the entire panel 2004-2013 into a cross-section and then matching with the census data. Table 15 presents the results for an expanded sample size.

Table 15: Relationship between firm productivity and margins of trade

	ln(#products_f)	ln(#destination_f)	ln(density_f)	ln(ftotexports_f)	ln(avval_f)
	(1)	(2)	(3)	(4)	(5)
log(va/worker)	0.0488742 *	0.0235	-0.0141	0.0198	-0.06294
	[0.0277]	[.0175]	[0.0103]	[0.0799]	[0.0758]
Fixed effects	Industry, firmsize	Industry, firmsize	Industry, firmsize	Industry, firmsize	Industry, firmsize
Observations	374	374	374	374	374
R-squared	0.18	0.105	0.096	0.132	0.07

Notes: Each cell contains the result of a separate regression of the log margins on the log of labour productivity for the cross-sectional sample. The dependent variables are on the columns. The coefficients and robust standard errors in the squared brackets are shown. The constant is not reported and industry-firm fixed effects are included. The asterisks denotes the level of significance *** p<0.01, ** p<0.05, * p<0.1.

This table shows that the signs on all five models are consistent with the apriori expectation, but they are not statistically significant if one uses 95 percent level as the threshold.

A second robustness test to the baseline results is to model the distribution of the dependent variable, for both the number of products and the number of destinations, as count data. Counts are non-negative integers. Use of ordinary least square (OLS) models is unsuitable since the normality assumption for linear regression is violated and prediction of a negative number of products shipped is possible (Wooldridge (2002). There are a number of ways to model counts data specifications but Poisson and negative binomial forms are popular (Glassman and Rao, 2011). Also, zero inflated probability (ZIP) models can be used under certain circumstance, such as, whenever many zero products are reported in the sample. Since exporters must have shipped at least one product to a destination to be in the transaction database, the study does not consider ZIP type model.

The Poisson model is ideal for count data and Winkelmann and Zimmermann, (1998) suggest this as the natural first step for all count data models. However, it has been criticized for its implicit assumption that the variance of the dependent variable is equal to its mean (i.e. there is no over-dispersion, Green 2002). This restriction rarely holds because of event occurrence

dependence or due to unobserved heterogeneity[17]. Therefore, before one accepts the Poisson results, a test for the presence of over-dispersion is needed. The negative binomial regression is often used whenever over-dispersion is present (Greene, 2002). The negative binomial model has an additional parameter alpha, which is used to test for the presence of over-dispersion, such that when alpha=0, the model collapses to the Poisson model. As such, this study runs both the Poisson and negative binomial equations and prefers the Poisson over the negative binomial whenever over-dispersion is shown to be absent. Table 16 presents the results.

Table 16: Results of count data regression

	Number of products		Number of destinations	
	Poisson	Negbin	Poisson	Negbin
	(1)	(2)	(1)	(2)
ln(VA/Worker)	0.0899***	0.1235**	0.0632**	0.0747*
	[0.0173]	[0.0537]	[0.028]	[0.041]
Constant	0.398*	-0.06	-0.185	-0.544
	[0.239]	[0.731]	[0.384]	[0.5837]
Likelihood ratio test for alpha	-	0.139**	-	-1.048**
	-	[0.0943]	-	[0.1734]
Log likelihood Ratio	-1343.6	-664.04	-505.11	-420.17
Observations	246	246	246	237

Notes: Dependent variables are the number of products and the number of destinations. The explanatory variable is the log of labour productivity. Alpha measures over dispersion. The sample size is large as we include four years (2008-2011) for the transactional data before matching with the census data. The interpretation of results is as semi elasticity (or lin-log).

To interpret count data models, the marginal effects are essential to pin down the exact percentage change in dependent variable with respect to one unit change in a given explanatory variable from the mean, while holding other factors constant at the mean (Wooldridge, 2002; Winkelmann and Zimmermann, 1998). At this juncture however, we assume no causal interpretation and do not report the marginal effects. Rather, the interest is on the sign between labour productivity and the number of products exported, as well as the number of destinations served. All the coefficients are found to be positive and statistically significant.

17 The variance accommodated in the model does not sufficiently capture variations across units

6. Conclusion

This paper studies the important role of multi-product and multi-destination exporters in the expansion of export trade for a low income country. This is made possible by access to new and unique transaction level data for Kenya, enabling decomposition of both firm level and aggregate exports into intensive and extensive margins. We go a step further and complement the transaction level data with a detailed census of manufacturing firms, giving us an opportunity to examine the correlation between trade margins and proxy measures for firm productivity.

The findings highlight the significance of nurturing and owning multi-product and multi-destination types of exporters for low income countries. Multi-product exporters in Kenya were estimated to consist of about 28 percent of the entire population of exporters but were responsible for approximately 87.5 percent of the total value of exports in 2005. Combining the shares of firms that exported more than five products to more than five destinations, they explain approximately 85 percent of the entire value of exports in the same year.

Multi-product and multi-destination exporters constituted 38 percent of all exporters but accounted for over 85 percent of total exports value. This provides strong evidence of concentration of exports among a small number of large firms. A comparison of the growth rates of multi-product exporters against single product exporters for 2005 and 2012 shows that multi-product exporters grew five times faster than single product exporters. This implies that once firms starts exporting, evolution into being multi-product exporters through addition of products is easier and cost friendlier than starting to export into a new destination. Thus export promotion programmes must be tailored to fit both product and destination extensive margins at the firm level.

At the national level, the extensive margins (i.e the number of exporters, the number of products and the density term) account for 61.2 percent of the cross-section variation in Kenya's export trade across trading partners. The extensive margins are particularly important for trade into the EAC sub region accounting for approximately 86.7 percent. This indicates the importance of the EAC sub region as a launch pad for firms into exporting. A detailed analysis on the impact of the trade within the region and readjustments within the firms to maintain their competitiveness will be a feasible area to extend the current study.

Trade with the fragile states is driven by the intensive margin, accounting for approximately 54.5 percent of the cross-sectional variation of Kenya's trade with jurisdictions classified as fragile. This suggests that some firms could have carved themselves a niche in these types of markets. When we consider across all country level decomposition, the extensive margin for export trade to fragile states is the lowest. This indicates the presence of higher fixed costs to entering markets that are fragile and prone to conflict. At the same time, the share of the intensive margin of trade into fragile jurisdiction is the largest (45.5%) indicating how these markets are important for the existing and continuing exporters. Policy may intervene to assist firms in overcoming the fixed costs of entry into these types of markets but also addressing the toughness of the business environment in the fragile and conflict states.

Across exporters, the role of productivity in driving trade margins is underscored. Productivity is positively correlated with the number of products exported, the number of destination served and the total firm level export value. Productivity has a negative relationship with density because as the number of products exported rises, each exporter is only exporting a small portion of the range of products. The negative relationship with the average firm level exports is as a result of the confounding effects of increasing exports within product-country and the arrival of new and marginal products. At the firm level decomposition, the intensive margin (average exports per firm/product) accounts for the largest share in the variation of exports across exporters.

Finally, the stylized facts presented above open a window for further research. Firstly, the role and impact of trade liberalization of the EAC market on product adjustment and productivity across firms can be examined if a clear identification strategy is found. Secondly, firm level trade and competition in destinations classified as fragile and conflict is potentially interesting. Kenya provides a suitable setting for analysing trade in tougher environment because the country is surrounded by countries that are fragile and dependent on Kenya for supplies of basic manufacturing exports. In future, a cross country study, covering a number of countries in sub Saharan Africa, may provide more insights into the topic of multi-product and multi-destination exporters.

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Appendix A1:

Figure 1: Kernel density distribution of the log of number of products

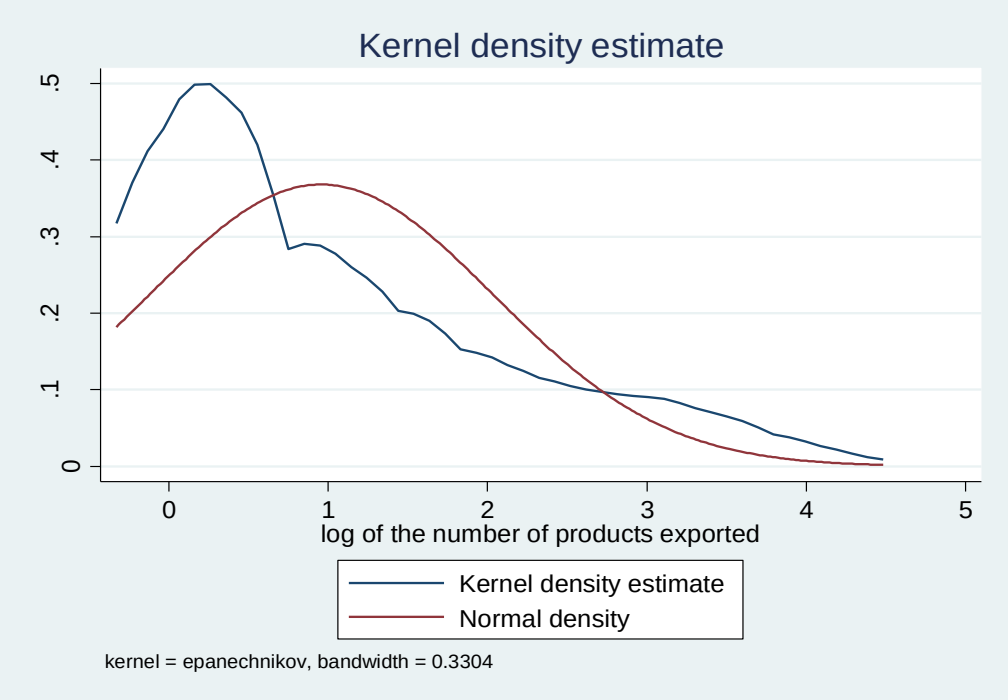
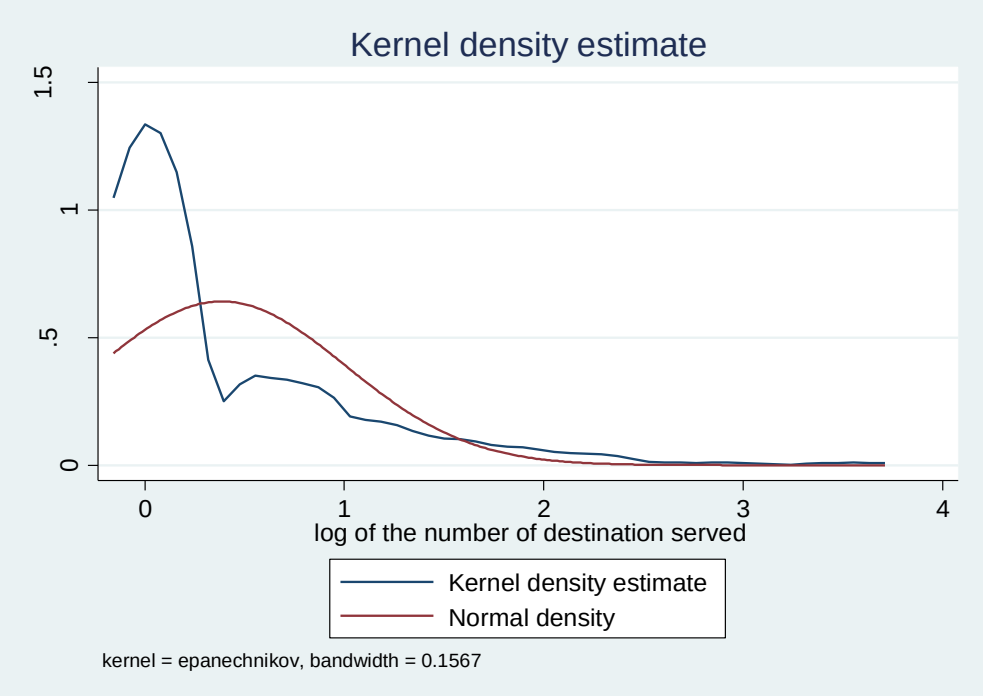
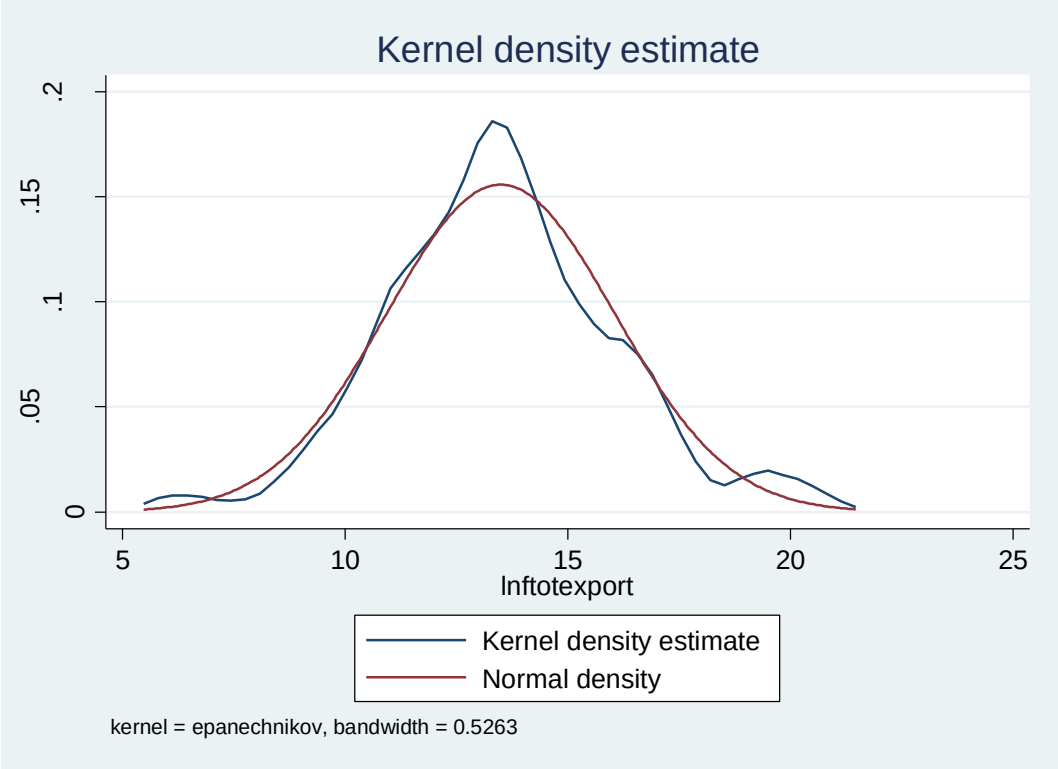


Figure 2A: Kernel density distribution of the log number of destinations




Kernel density estimate
.2
.15
.1
.05
0
5
10
15
20
25
lnftotexport
Kernel density estimate
Normal density
kernel = epanechnikov, bandwidth = 0.5263