Exporting to Fragile States in Africa: Firm Level Evidence*

Peter W Chacha and Lawrence Edwards

This version date: 5th October 2017

DRAFT – PLEASE DO NOT QUOTE

Abstract

This study analyses the effect of fragility in destination markets on firm export behaviour and the role of firm size in mediating adverse outcome. The analysis is conducted using firm transaction data on Kenyan exports to Africa over the period 2004 to 2013. The empirical strategy controls for endogeneity of destination choice by the firm through firm-destination country fixed effects. The analysis reveals that fragility negatively affects a firm's decision to enter a given destination market, reducing Kenya's bilateral trade through the number of firms willing to export to fragile states in Africa. The results show that larger firms are less likely to exit in response to destination shocks in fragility. Decompositions of the fragility indicator into parts reveal that the effect of business fragility dominates political fragility, although both effects are negative and significant.

Keywords: State Fragility, Market Access Costs, Kenya, sub-Saharan Africa
JEL classification: F12, F14, E02

* This paper has been submitted as a framework paper under the AERC project on Growth in Fragile States in Africa. We would like to thank Prof. Anke Hoeffler for comments on an earlier draft and comments received from participants in the Final Review Workshop held on 4-5th March 2017, in Nairobi Kenya.

1.0 Introduction

In this paper, we ask if fragility in a destination market reduces the likelihood of a Kenyan firm exporting to that destination. For the exporting firm, a change in destination country fragility can be viewed as a set of exogenous shocks to entering and remaining in that market. This is particularly relevant in the case of firm exports to sub-Saharan African (SSA) countries, many of which are characterised by high degrees of fragility. Understanding the effect of destination fragility on a firm's export decisions and the mechanisms through which firms mediate this effect is thus important for trade within SSA countries.

Destination country fragility is a multi-dimensional concept that is hard to define and measure precisely. There is no globally accepted definition of fragility and nations do not like this label (Chauvet & Collier, 2008). Chauvet and Collier (2008) define a fragile country as a low-income country in which economic policies, institutions and governance are so poor that growth is highly unlikely. In the World Bank's Development Report on Conflict, Insecurity and Development (WDR)(World Bank, 2011), fragile situations are defined as "periods when states or institutions lack the capacity, accountability or legitimacy to mediate relations between citizen groups and between citizens and the state, making them vulnerable to violence" (p.18).

There are numerous studies that have investigated the economic consequences of spatial diffusion of fragility and its extreme version of conflict on neighbouring countries (Qureshi, 2013; Murdoch & Sandler, 2004; Collier & Hoeffler, 2004; Fearon & Laitin, 2003; Sambanis, 2001). They document large negative spillovers of fragility on neighbouring states. Reduction of bilateral trade between neighbouring countries is one of the primary channels through which fragility hinders economic growth both in the source and neighbouring country (Martin, Mayer & Thoenig, 2008). This paper adds to this literature and explores the role of destination country fragility in curtailing bilateral trade in Africa.

The overall objective is to examine the effect of destination country fragility on Kenyan firm's decision to export to a given destination in Africa, along with firm attributes that mediate this effect. Specifically, we ask the following research questions:

- What is the effect of destination country fragility in Africa on Kenyan exporter's decision to export to that country?

- What firm attributes mediate the effect of destination fragility?
- What is the effect of destination country fragility on Kenya's export trade margins to Africa?

In addressing the above questions, this paper contributes to existing literature in three main ways. Firstly, existing models in the new trade literature currently provide little insight into how fragile situations in a destination market affect a firm's export decision. By working with a frictionless environment that permits efficient allocation of resources across and within firms, the Melitz (2003) model and related extensions may fail to account for the market conditions in destinations that are important for SSA countries exporters. We exploit the richness of transactions data that enable us to observe firm's destination-choice for their exports to Africa. This allows us to evaluate the effect of destination fragility on the firm's decision to serve a given destination in Africa with exports as well as the role of firm size in export market in mediating this outcome.

Secondly, a study on the effect of destination country fragility on firm export behaviour is extremely important for SSA countries. Although a marginalized topic in international trade and treated sometimes as an indirect/or a hidden tax on trade (Blomberg & Hess, 2006; Anderson & Marcouiller, 2002) fragility might play a role in explaining low bilateral trade among neighbouring countries and may be a source of low intra-African regional trade (Martin, Mayer & Thoenig, 2008; Yeats, 1998). Yeats (1998) argues that the potential for intra-African trade is yet to be fully exploited, especially in food products. This is puzzling despite popular embracing of regional integration initiatives by governments as a core part of trade policy in Africa (Carrere, 2004).

Literature exploring the role of destination fragility in curtailing bilateral trade is, in our view, relatively scarce and yields inconsistent results. Much of the literature has made use of gravity models. While some of these studies find that fragility and its extreme version, namely conflict, reduce bilateral trade (Glick & Taylor, 2010; Mansfield & Bronson, 1997; Pollins, 1989), others find insignificant relationships (Mansfield & Pevehouse, 2000; Penubarti & Ward, 2000; Morrow, Siverson & Tabares, 1998).

A common weakness in these cross-country studies is that they are based on aggregate trade data that conceals potentially diverse adjustments to destination fragility taking place at the firm and product level. This includes entry and exit of exporters from a given destination,

reductions in the number of products exported and changes in volume of shipments to fragile countries. The literature on firms in international trade (Bernard & Jensen, 1999) reveals that firm responses are likely to be heterogeneous. Yet studies looking at the effect of fragility on firm level export decisions are very few (Crozet, Koenig & Rebeyrol, 2007). This paper adds to this literature.

Third and lastly, most recent analysis of the effect of destination fragility on bilateral trade tend to use either a dummy variable indicator for fragility (Glick & Taylor, 2010; Anderson & Marcouiller, 2002; Mansfield & Bronson, 1997; Pollins, 1989) or an aggregate index of destination fragility (Crozet, Koenig & Rebeyrol, 2007; Blomberg & Hess, 2006). In this paper we decompose the aggregate fragility index into parts to better understand the channels through which it affects a firm's export decision. This makes it possible to obtain precise policy implications of the results, given the broad interpretations of the term 'fragility' in the literature.

The results reveal that fragility negatively affects a firm's decision of being active in a destination market, reducing Kenya's bilateral trade through the number of firms willing to export to fragile states in Africa. We also find that larger firms are less likely to exit in response to destination shocks in fragility. These results are robust to alternative measurement of destination fragility and to controlling for all possible standard time varying gravity variables. We relate the results to findings in the recent trade theory that emphasize firm heterogeneity and trade costs in international markets. This literature shows that market access costs are persistent and varying across destination markets (Arkolakis, 2016; Kamal & Sundaram, 2016; Das, Roberts & Tybout, 2007; Bernard & Jensen, 1999; Clerides, Lach & Tybout, 1998). Our results provide additional insights for a specific market access cost, demonstrating how fragility of the destination market limits both entry and exacerbate exit of smaller firms due to an increase in operation costs in the affected destination.

The decomposition of the aggregate destination fragility into parts reveal that the effect of business fragility (regulatory quality, government effectiveness, and control of corruption) dominates political fragility (voice and accountability, rule of law, and political stability), although both effects are negative and significant. These results are related to the literature examining the importance of trade facilitation and successful performance of firms in international trade (Fernandes, Freund & Pierola, 2016; Feenstra & Ma, 2014; Dennis & Shepherd, 2011; Kee, Nicita & Olarreaga, 2009; Iwanow & Kirkpatrick, 2007; Clark, Dollar

& Micco, 2004). For the case of Kenya, the disaggregation results underscore that business risks rather than political risks provide the greatest hurdle. This may call for differentiated policies to address business risks and political risks associated with exporting within the African continent.

The rest of this paper is organized as follows. Section 2.0 reviews related literature while section 3.0 discusses the data and presents descriptive statistics. Section 4.0 contains the empirical strategy and estimation of results and concludes with section 5.0.

2.0 Related Literature Review

The Melitz (2003) model provides theoretical insight into the behaviour of firms breaking into international trade in light of fixed costs of entry. This model explains how the interaction between fixed costs of entry and heterogeneity in productivity across firms induces self-selection into an industry. Firms produce a unique horizontally differentiated product for the domestic market if productivity is above some threshold and export if their productivity is above a higher threshold. Entry into the export market requires additional fixed costs and only the most productive firms self-select into exports because of their ability to overcome costs of entry.

Although formalized by Melitz (2003) through a general equilibrium trade model with heterogeneous firms, the idea of fixed costs of entry to foreign markets has been around for some time (Bernard & Jensen, 1999; Clerides, Lach & Tybout, 1998; Roberts & Tybout, 1997; Dixit, 1989; Baldwin & Krugman, 1989). Using a dynamic model over the period 1981 to 1991, Das, Roberts and Tybout (2007) quantified the fixed costs of entry for a sample of Colombian exporters, finding that the costs ranged between US$300,000 and US$500,000 per firm. This represent a significant and expensive venture and only a small proportion of firms from most countries can afford[1] it(Arkolakis & Muendler, 2010; Greenaway & Kneller, 2007; Bernard & Jensen, 1999).

The Melitz model is flexible and closely explains firm level export behaviour in both developed and developing economies. However, the model has been criticized by Crozet et

[1] Fixed costs of trade refer to one-time market entry costs firms face. In a static model, the modelling is equivalent to one-time market entry costs of trade amortized per period (Arkolakis & Muendler, 2010).

al. (2007) for not accounting for significant market frictions in trading with fragile and insecure countries. They show that insecurity affects firms differently, resulting in disruption of the belief that firms largely self-select into exporting based on their productivity levels only. These authors argue that insecurity, unlike other trade barriers (i.e. tariffs) does not affect all firms in a similar way. This is because incidents such as corruption, loss of sales proceeds and abdication on contracts affects firms in a random way, introducing another level of heterogeneity across firms in the same industry.

Crozet et al. (2007) modify the basic Melitz model to incorporate insecurity. They show that ex-ante, insecurity affects all firms since all of them face the same risk. However, ex-post some of the firms are not affected. Only a random subset of firms is subject to predation while others are lucky and export without misfortune. In addition, a high level of insecurity may dissuade unlucky productive firms from exporting, while some lucky unproductive ones may succeed. There are two testable hypotheses in this framework. Firstly, the prevalence of insecurity will decrease bilateral exports by reducing the number of exporters. Secondly, insecurity in a market may dissuade unlucky productive firms from exporting to that destination while some lucky unproductive ones may succeed in exporting to insecure markets.

The authors test the predictions from their model using individual French firm level export data to more than 100 destinations. They used a measure of political instability obtained from data on International Country Risk Guide (ICRG) as a proxy for insecurity. The coefficient on the political insecurity variable is found to be negative and significant. A 10% increase in the ICRG index for a country reduces the probability that a French firm export to this destination by 0.53%. They also found that firm productivity positively influenced the probability that a firm would export. They interacted firm productivity and a dummy for high risk countries and found a negative and significant coefficient indicating that firm productivity level had a less predominant role on the probability of exporting to insecure markets than to more secure ones. Their results suggested that insecurity in the destination market induces some randomness into export success, diluting the role of firm productivity differences as key in enabling firms to break into foreign markets.

A majority of the previous literature on the impact of fragility on trade, estimate gravity models using country level data. In addition to the standard gravity variables (distance, GDP, common border, etc.), these studies generally include a dummy variable indicating the

fragility status of a country to capture its conditional impact on bilateral trade. The leading papers includes, Pollins (1989), Mansfield and Bronson (1997), Anderson and Marcouiller (2002), Blomberg and Hess (2006), Martin et al. (2008) and Glick and Taylor (2010) all of whom find negative effects of fragility on bilateral trade. At the same time, a few papers find insignificant relationships (Mansfield & Pevehouse, 2000; Penubarti & Ward, 2000; Morrow, Siverson & Tabares, 1998).

Amongst those that find significant negative effect, Mansfield and Bronson (1997) used data for a panel of countries over the period 1960-1990. The presence of fragility is captured by a dummy variable equal to 1, if a trade partner is fragile and zero otherwise. Their results show that fragility substantially reduced trade by as much as 6.5 times between countries that are fragile (in conflict) relative to non-fragile countries (countries not in conflict). In a different approach, Anderson and Marcouiller (2002) used a structural model to estimate the impact of corruption and imperfect contract enforcement on international trade. They found a reduction in import demand with corruption acting as a hidden tax on trade.

Related, Blomberg and Hess (2006) broaden the concept of fragility and its impact on bilateral trade by obtaining a synthetic measure of violence through factor analysis that includes terrorism, external war, revolutions and inter-ethnic fighting. They find that the presence of fragility is equivalent to a 30% tariff on trade, which is larger than conventional tariff barriers. Similarly, Martin et al. (2008) built a theoretical framework that combines game theory and a standard new trade theory to explain the effects of fragility on bilateral trade. They test their model using a gravity estimation finding that the impact of fragility (conflict) was negative and significant. For instance, during a conflict, trade fell by about 22% relative to the traditional gravity predictions.

A small set of studies, also using gravity models find no significant relationship between fragility and trade flow (Mansfield & Pavehouse, 2000; Penubarti &Ward, 2000; Morrow et al. 1998). Morrow et al. (1998) used a gravity estimation to examine trade flows between major powers over the period 1907 to 1990, testing the prediction that trade flows are greater between allies relative to non-allies. However, they found no significant relationship between trade flows and political alliances. Similarly, Mansfield and Pavehouse (2000) examine whether states in the same preferential trade arrangement (PTA) were less prone to dispute than other states. They find that the relationship between trade flows and the likelihood of a dispute was insignificant.

This paper is also related to the literature on trade facilitation and performance of firms in international markets (Feenstra & Ma, 2014; Dennis & Shepherd, 2011; Kee, Nicita & Olarreaga, 2009; Iwanow & Kirkpatrick, 2007; Clark, Dollar & Micco, 2004). The main idea here is that trade facilitation, including improving the regulatory quality (Iwanow & Kirkpatrick, 2007), efficiency in port handling (Feenstra & Ma, 2014; Clark, Dollar & Micco, 2004), a reduction in transport costs (Dennis & Shepherd, 2011) can result in improved export performance through the extensive margin (both new exporters and more varieties). Kee, Nicita & Olarreaga (2009) shows that international trade policy has shifted focus from lowering of tariffs to trade facilitation and tackling non-tariff barriers to access international markets. Iwanow and Kirkpatrick (2007) quantify the potential gains in trade performance from implementation of trade reform. Using a gravity model augmented with indicators for regulatory quality they find that a 10% improvement in the regulatory environment was associated with a 9-11% increase in export performance.

In conclusion, the recent new trade theory models provide invaluable insights into the behaviour of firms breaking into foreign markets with exports. Intuitively, destination fragility raises per period trade costs (Martin, Mayer & Thoenig, 2008) but does not affect all exporters in a way similar to a tariff increase (Crozet, Koenig & Rebeyrol, 2007). A common weakness in cross-country studies is in the level of their analysis of the effect of fragility, which is based on aggregate trade data. While this conveys useful information on the average effects of fragility on trade, it conceals the potential for richer adjustments taking place at the firm level such as the entry of exporters to a given destination, reduction in the number of exporters and changes in average export value per firm due to destination fragility.

Studies looking at the effect of fragility on firm level export decisions are very few in international trade literature (Crozet, Koenig & Rebeyrol, 2007) and, to our knowledge, there are none in SSA. The empirical test for the prediction of Crozet et al. (2007) model is applied to France, a developed country. On the contrary, we look at Kenya, a country that neighbours and trades with some of the most fragile states including Somalia, Sudan, South Sudan Burundi and the Democratic Republic of Congo. This provides a suitable setting to test the effect of destination fragility on firms' export decisions.

3.0 Data and descriptive statistics

3.1 Data and data sources

Transaction level dataset

The study makes use of a detailed transaction level dataset obtained from the Kenya Revenue Authority (KRA) through the National Treasury. This is a new and unique panel data containing the flow of exports at the point of exit from 2004 to 2013. Each transaction contains information on the product being exported at the 8-digit Harmonized System (HS) of product classification, the month of shipment, the destination of shipment, the free on board (FOB) value in Kenya shillings, the quantity and units of measurement and the identity of the exporter.

Table 1 reports the average export value per exporter, the number of exporters, the number of 6-digit HS products (HS6), the number of countries and the total export value using the KRA data. For a consistency check against published data, it presents the value of exports (excluding re-exports) by the Kenya National Bureau of Statistics (KNBS) in the second last column.

Table 1: Summary statistics of Kenya's exports over time

	Mean Exports in US$	Standard Dev.	# of Exporters	# of HS6 Products	# of Countries	Total in US$ mn Data	Total US$ mn KNBS	Dev. from KNBS
2004	616,775	3,536,010	3250	3006	179	2,005	2,056	-2.5
2005	686,931	4,193,324	3918	3250	172	2,691	2,899	-7.2
2006	719,102	4,201,505	4580	3439	169	3,293	3,288	0.2
2007	882,964	4,909,878	4722	3539	168	4,169	4,187	-0.4
2008	931,313	6,049,724	4563	3403	159	4,250	4,153	2.3
2009	929,226	5,617,960	4678	3354	157	4,347	4,269	1.8
2010	912,695	5,562,038	4851	3398	160	4,427	4,770	-7.2
2011	1,078,075	6,651,990	5319	3517	166	5,734	5,693	0.7
2012	1,091,542	6,658,711	5175	3456	163	5,649	5,578	1.3
2013	1,102,140	6,318,799	4968	3419	164	5,475	5,280	3.7
2004-2013	895,076	5,369,994	4602	3378	166	4,204	4,217	-0.7

Notes: Computed from the Customs data. Deviations are in % from KNBS data.

Except for 2005 and 2010, the deviations of customs data lie within 2% of the KNBS data. The customs data is therefore, reasonably consistent with the published data. It can be noted that, on average, over the sample period 2004 to 2013, 4,602 exporters, shipped goods valued

at US$ 895,076 to 166 countries worldwide. The value of exports has increased by approximately 103% over the period, rising from US$ 2,691 million in 2005 to US$ 5,475 million in 2013. This is equivalent to an annual average growth rate of 11.5%, barring the effect of price and the exchange rate.

A crucial attribute of this dataset is the ability to observe the destination of shipment of exports. In this paper, we restrict the data to exports to Africa only. We utilise the restricted dataset to identify the destination choice for exporters from Kenya to Africa and how these choices are affected by destination country fragility. We observe the first time a firm export to a given destination market in Africa and define a binary variable taking 1 if the firm exports to destination j in period t and zero otherwise over the sample period.

The dataset is also used to compute proxies for firm trade characteristics to each destination country, such as export value per firm, the number of products, the number of firms exporting to a given destination and the number of positive firm-product relationship to a given destination-country. The data also allows a disaggregation of Kenya's exports to a given country into extensive (number of firms, products, and density) and intensive (the average export value per firm) margins.

Destination country fragility

We follow the World Development Report on Conflict, Insecurity and Development (World Bank, 2011) to define fragility as periods when states or institutions lack the capacity, accountability or legitimacy to mediate relations between citizen groups and between citizens and the state, making them vulnerable to violence. From this definition, we require objective measurement of periods when states lack the capacity, accountability or legitimacy to mediate relations (World Bank, 2011:18). One popular set of indicators that closely reflects this definition is the Worldwide Governance Indicators (WGI) compiled by Kaufmann et al. (2011).

Kaufmann et al. (2011:222) defines governance as "the traditions and institutions by which authority in a country is exercised. This includes (a) the process by which governments are selected, monitored and replaced; (b) the capacity of the government to effectively formulate and implement sound policies; and (c) the respect of citizens and the state for the institutions that govern economic and social interactions." Within each component, the authors develop two indicators that measure that aspect. Table 2 presents the three components and associated

pairs of indicators. It also shows which indicator goes into calculating the proxy fragility index (political risk versus business risk) using the Principal Component Analysis (PCA) method (Blomberg & Hess, 2006; Wold, Esbensen & Geladi, 1987).

Table 2: Worldwide Governance Indicators and allocation to risk type in PCA

Component	Indicators	Included in PCA
(a) The process by which governments are selected, monitored and replaced.	(i) Voice and accountability	Political risk
	(ii) Political stability and absence of violence/terrorism	Political risk
(b) The capacity of government to effectively formulate and implement sound policies.	(i) Government effectiveness	Business risk
	(ii) Regulatory quality	Business risk
(c) The respect of citizens and the state for the institutions that govern economic and social interactions.	(i) Rule of law	Political risk
	(ii) Control of corruption	Business risk

Notes: obtained from Kaufmann et al. (2011).

The WGI database provides annual country ranking on each of the six indicators defined by Kaufmann et al. (2011). Each indicator is measured on a scale of -2.5 to 2.5 (worst to best performers) and they are highly correlated. The advantage with the WGI dataset is that it provides us with a wide coverage for all of Africa, approximately 51 countries. The available time series is also able to match perfectly the sample period (2004-2013) in the transaction data, allowing us to make use of panel estimations. The indicators also broadly capture the definition of fragility situations espoused in the WDR document (World Bank, 2011).

We follow Blomberg and Hess (2006) and use the Principal Component Analysis (PCA) method to obtain an average fragility indicator from the underlying six indicators of governance. We created three average indicators. The first is a composite index obtained as an amalgam of all the six WGI indicators. The index ranges from -0.91 (less fragile) to 1.83 (most fragile) for the African countries in our sample. Furthermore, to be able to take log transformation of the fragility index, the index is transformed to a positive scale ranging from 0 to 100[2].

[2] This transformation is done in stata using $gen\ n\_`v' = ((100-0)/(r(max)-r(min))) * (`v' - r(max)) + 100$, where v is the WGI index that is scaled between -2.5 and 2.5, and n_v is the new transformed index on a scale of 0 to 100. The fragility variable is created as an inverse $\left(\frac{1}{n\_v+1}\right)$ such that an increase in governance score reduces a destination fragility, it ranges between 0 (less fragile) to 1 (highly fragile).

The second composite index captures political risk and is made up of the indicators for voice and accountability, political stability and rule of law. These indictors capture periods when states lack the capacity, accountability or legitimacy to mediate relations. The third and final composite index captures fragility of the business environment and includes the indicators for regulatory quality, government effectiveness and control of corruption. This index is used to proxy business environment risks in the destination country.

Market size and other gravity variables

We used destination country GDP at 2005 constant prices (gdp_cons) as proxy for market size, real exchange rate as a proxy for relative competitiveness and days to import a container in a given destination market, as well as the number of documents required to import. These variables are obtained from the world development indicators (WDI) of the World Bank over the sample period 2004-2013. The real exchange rate is measured as Ksh to 1 unit of the destination *j* currency multiplied by the ratio of consumer price index (CPI) of destination *j* to Kenya's CPI such that a rise reflects a depreciation of the Kenyan shilling. We included common border, common language, common colonial history, and distance between Nairobi and the capital city of the partner country as controls, although these fall away when destination fixed effects are included. Table 3 contains the summary statistics for the variables of interest.

Table 3: Summary Statistics for the key variables

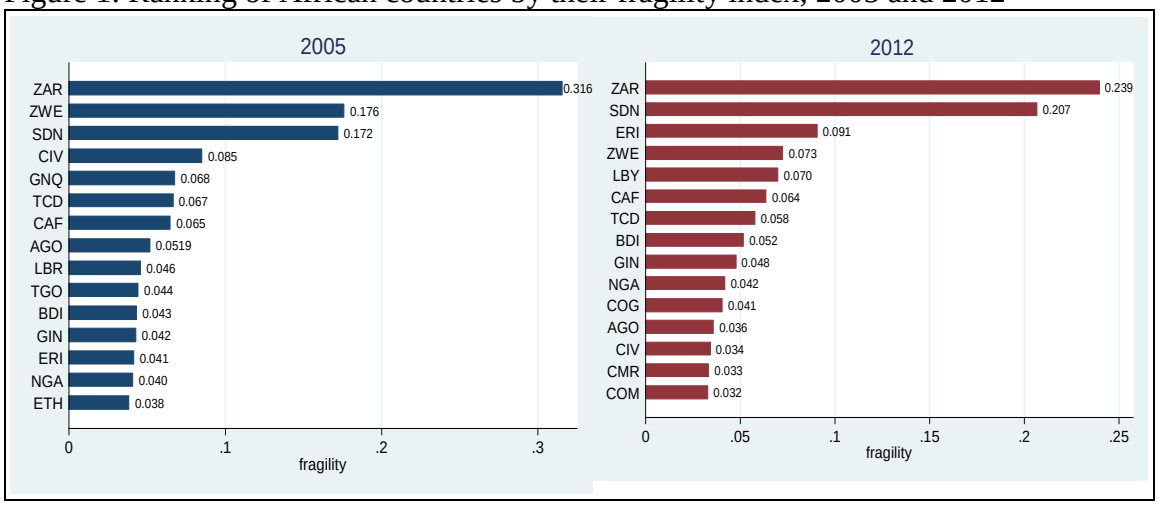
Variable	N	mean	sd	min	max
Exp_ ijt	4,345,836	0.01	0.12	0.00	1.00
Log(fragility_all)	4,345,836	-3.58	0.70	-4.62	0.00
Log(fragility_pol)	4,345,836	-3.67	0.64	-4.62	0.00
Log(fragility_buss)	4,345,836	-3.52	0.72	-4.62	0.00
Log(size)	4,345,836	8.87	2.36	0.00	18.23
Log(gdp cons)	4,327,878	22.70	1.55	18.74	26.50
Log(real exchange rate)	4,166,256	-0.17	2.30	-5.43	4.62
Log(days_import)	4,345,836	3.56	0.48	2.20	4.62
Log(doc_import)	4,166,256	2.17	0.29	1.61	3.04
Log(distance)	4,345,836	7.97	0.63	5.66	8.84
Common border	4,345,836	0.08	0.28	0.00	1.00
Common language	4,345,836	0.43	0.50	0.00	1.00
Common colony	4,345,836	0.33	0.47	0.00	1.00

Source: Customs dataset, WDI and CEPII database. Exp_ijt is a dummy variable equal to 1 if a firm export to a given destination country in Africa. fragility_all is the composite index, fragility_pol is the political risk index while fragility_buss is the business environment risk.

3.2 Descriptive statistics

In this section, we present observable features in our dataset on the relationship between exporters' trade activity and destination country fragility. We start off by exploring the relative differences in fragility across countries and changes in fragility within African countries over time. Figure 1 shows the ranking of the top 15 most fragile African countries, together with their fragility index in 2005 and 2012.

Figure 1: Ranking of African countries by their fragility index, 2005 and 2012



Notes: ZAR: DR Congo, ZWE: Zimbabwe, SDN: Sudan, CIV: Cote d'Ivoire, GNQ: Equatorial Guinea, TCD: Chad, CAF: Central African, AGO: Angola, LBR: Liberia, TGO: Togo, BDI: Burundi, GIN: Guinea, ERI: Eritrea, NGA: Nigeria, ETH: Ethiopia, CMR: Cameroon and COM: Comoros. Fragility ranges between -0.033(less fragile) to 0.32(most fragile).

We observe that the top seven fragile states in 2005[DR Congo (ZAR), Zimbabwe (ZWE), Sudan (SDN), Cote d'Ivoire (CIV), Equatorial Guinea (GNQ), Chad (TCD) and Central African Republic (CAR)] account for the top 5 slots in the ranking of fragile states in 2012 [DR Congo, Sudan, Zimbabwe, and CAR]. This implies that changes in the relative ranking of countries are very small among the top 15 fragile states. Within countries, however, there is more variation in fragility score over time. For example, in Zimbabwe the fragility index decreased from 0.18 in 2005 to 0.073 in 2012 (58.5%), while it rose in Sudan from 0.172 in 2005 to 0.206 in 2012 (19.7%). In Cote d'Ivoire the index dropped significantly from 0.085 in 2005 to 0.034 in 2012 (59.7%).

To examine the importance of fragile states in Kenya's exports to the region, Table 4 presents Kenya's top 15 export destinations in Africa and each destination country's fragility index, in 2005 and 2012.

Table 4: Top 15 export destinations and the respective fragility index, 2005 and 2012

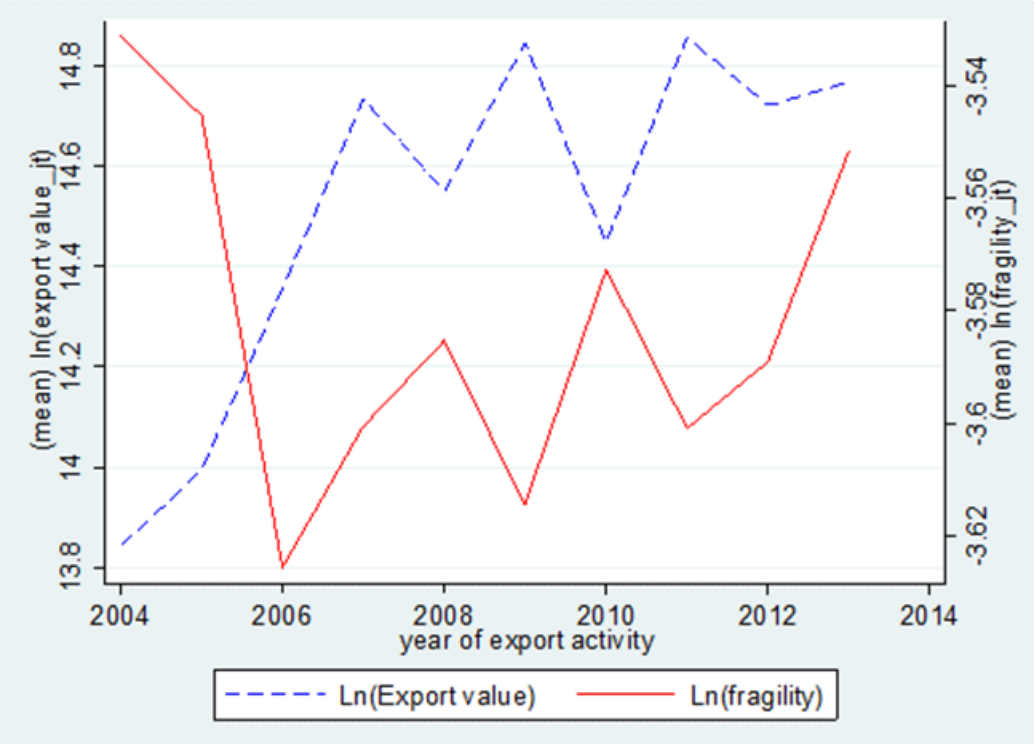
	2005			2012		
Rank	Country	share of export	ln(fragility_jt)	Country	share of export	ln(fragility_jt)
1	Uganda	0.31	-3.734	Uganda	0.28	-3.812
2	Tanzania	0.20	-3.933	Tanzania	0.19	-3.917
3	Egypt	0.10	-3.903	Sudan	0.11	-1.577
4	DR Congo	0.08	-1.153	Egypt	0.10	-3.665
5	Sudan	0.06	-1.759	DR Congo	0.08	-1.429
6	Rwanda	0.05	-3.444	Rwanda	0.07	-4.104
7	Zambia	0.03	-3.815	Zambia	0.03	-4.080
8	Ethiopia	0.03	-3.257	Burundi	0.02	-2.960
9	Burundi	0.03	-3.139	Malawi	0.02	-3.984
10	South Africa	0.03	-4.440	Ethiopia	0.02	-3.473
11	Malawi	0.02	-3.933	Nigeria	0.01	-3.171
12	Nigeria	0.01	-3.201	South Africa	0.01	-4.328
13	Eritrea	0.01	-3.180	Zimbabwe	0.01	-2.623
14	Mozambique	0.01	-3.967	Mauritius	0.01	-4.615
15	Mauritius	0.01	-4.568	Djibout	0.01	-3.730
		0.97			0.97	

Notes: The share of exports is calculated as a ratio of Kenya's exports to destination j relative to its total exports to Africa in 2005 and 2012. Fragility ranges between -4.62(less fragile) to -1.15(most fragile) on a log scale. The value of exports to Africa is US$ 1,130 million and US$ 2,400 million, respectively for 2005 and 2012.

It can be observed that the top 15 destinations account for over 97% of Kenya's exports to Africa in 2005 and 2012. Uganda, Tanzania, Rwanda, and Burundi account for approximately 59% of Kenya's exports to Africa, which is an indicator of the importance of the EAC trade block. Among the top 5 export destinations in 2005, DR Congo and Sudan had high fragility indexes of 0.316(=exp(-1.153)) and 0.172(=exp(-1.759)), respectively. These positions are maintained in 2012.

To observe how a given change in average fragility index affects Kenya's average export value to Africa over time, Figure 2 shows a time plot of the average export value across all destination countries relative to the mean destination fragility over time.

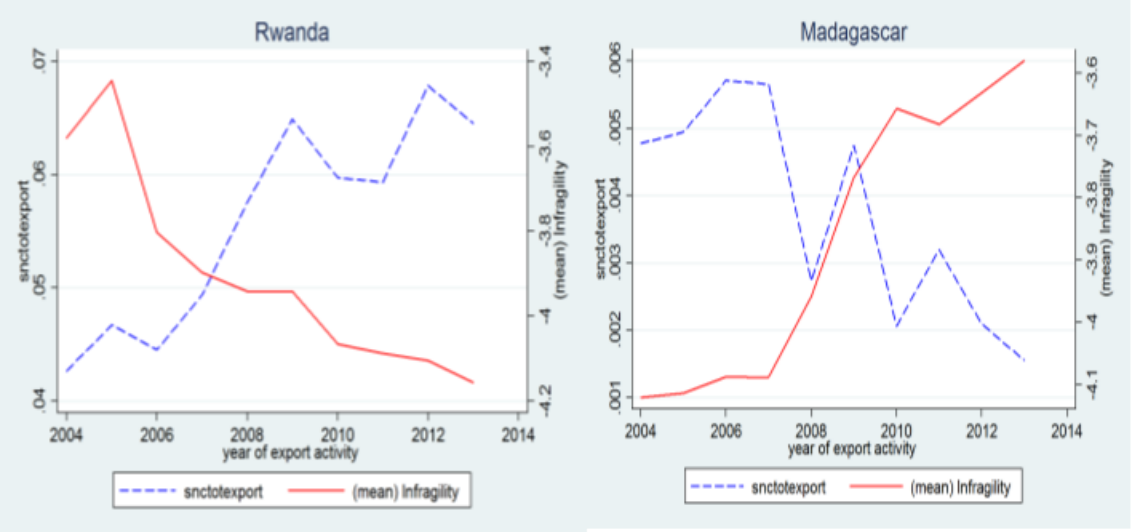
Figure 2: Kenya's average exports and mean destination fragility over time



Notes: Left-hand y-axis is the mean ln (export value) i.e. Kenya's average export value across all destinations countries in Africa and over time. On the right-hand side is the mean ln (fragility) which is the average fragility in the destination country over time.

It can be observed that in years when average destination fragility drops, the average exports across countries increased. Similarly, in years when the average fragility rose, the average exports across countries dropped. Thus, there is a negative relationship between average exports and average destination country fragility over time. We also plotted the share of exports from Kenya to Rwanda and Madagascar that have experienced opposite shock in their fragility index. The share is calculated as the ratio of exports to Rwanda (or Madagascar) relative to Kenya's exports to the African continent. Figure 3, shows the time series plot of the share of Kenya's exports to Rwanda and Madagascar.

Figure 3: Share of Kenya's total exports to Rwanda and Madagascar, 2004-2013



Notes: Left-hand y-axis is the share of exports to Rwanda and Madagascar in Kenya's total exports to Africa. On the right-hand side is the mean fragility (in logs) for the respective countries.

In Rwanda, the fragility index has dropped while in Madagascar, the index has increased over time. The share of Kenya's exports to Rwanda has increased over-time as the destination country's fragility has dropped. In Madagascar, the share of Kenya's exports to that destination country has decreased as its fragility increases over time. The negative relationship between destination fragility and exports is clear in the two examples.

In summary, the data suggests that looking over time, there is a negative effect of fragility on Kenya's exports to African countries. This effect can be identified more precisely along the time dimension. In the next section, we present the empirical strategy and presents the econometric results.

4.0 Empirical Strategy and Results

4.1 Empirical strategy

Our empirical strategy follows Kamal and Sundaram (2016) and assumes that exporter i exports to destination j at time t if:

$$\sum_{\tau=0}^{+\infty} \frac{\pi_{ijt+\tau}}{1+r^{t+\tau}} - f_{ijt} > 0 \qquad (1.)$$

where $\sum_{\tau=0}^{+\infty} \frac{\pi_{ijt+\tau}}{1+r^{t+\tau}}$ is the present discounted value of future profits from exporting to destination j and r is the discount rate (Kamal & Sundaram, 2016). f_{ijt} is the fixed cost of entering destination j and is specific to the firm-destination pair and time period t when the firm exports to destination j. To simplify, we assume that there is no uncertainty over future profits and rewrite (1) as:

$$\frac{\pi_{ijt+\tau}}{r} - f_{ijt} > 0 \qquad (2.)$$

Profit $\pi_{ijt+\tau}$ is a function of exporter and destination country characteristics.

Incorporating additional costs to export to fragile states

In this framework, we assume that fragility effects operate by increasing the annual costs of serving a given market. We argue that if an export destination market is fragile, there are additional costs associated with serving this market. Risks may include delays in delivery, hardened border control, hijacking, lost sales proceeds, and abdication of contracts, among others. Potential exporters are expected to factor these risks in their decision to export to fragile markets. We can decompose the annual cost of serving a given destination j into four parts:

$$f_{ijt} = g(Z_{jt-1}) + X_{it-1} + X_{jt-1} + \varepsilon_{ijt} \qquad (3.)$$

where the cost is increasing in destination fragility $g(Z_{jt-1})$ and decreasing in exporter specific characteristics X_{it-1}(i.e. firm size). It is also dependent on destination j characteristics (X_{jt-1}) and an idiosyncratic error term (ε_{ijt}).

4.2 Estimation Equation and Results

The probability that firm i exports to a destination j, conditional on annual specific costs arising from destination country fragility, firm attributes and destination market characteristics is given as:

$$pr(Exp_{ijt} > 0) = pr\left(\frac{\pi_{ijt+\tau}}{r} - f_{ijt} > 0\right) \quad (4.)$$

$$pr(Exp_{ijt} > 0) = pr\left[\varepsilon_{ijt} < f\left(g(Z_{jt-1}), X_{it-1}, X_{jt-1}, \frac{\pi_{ijt+\tau}}{r}\right)\right] \quad (5.)$$

Where equation (5) is obtained after substituting (3) into (4).

This probability is an increasing function of firm size and a decreasing function of the level of destination fragility. The average effect of fragility and size can be estimated using a binary choice model as:

$$Pr[Exp_{ijt} = 1|\mathbf{X}] = \beta_0 + \beta_1(lnfragility_{jt-1}) + \beta_2(\ln Size_{ijt-1}) + \beta_3(lnfragility_{jt-1})(\ln Size_{ijt-1}) + (\boldsymbol{X_{jt-1}'\beta}) + \boldsymbol{\delta_t} + \boldsymbol{\delta_{ij}} + \varepsilon_{ijt} \quad (6.)$$

where Exp_{ijt} is a dummy variable equal to 1, if an exporter i exports to destination j in period t and zero otherwise. The explanatory variable $lnfragility_{jt-1}$ captures the term $g(Z_{jt-1})$ while $\ln Size_{ijt-1}$ represents exporter specific characteristics (X_{it-1}). X_{jt-1} is a vector of destination country gravity variables such as market size (real GDP), days to import, documents to import and the real exchange rate [3]. $\boldsymbol{\delta_t}$ and $\boldsymbol{\delta_{ij}}$ are the year and firm-destination country fixed effects. We expect $\beta_1$to be negative capturing the negative effect of destination fragility on export participation. β_2 is expected to be positive in line with the role of firm size (or productivity) in export participation while β_3 is expected to be positive if large firms are less adversely affected by fragility relative to small firms.

Our empirical strategy includes firm-destination country fixed effects, such that the effect of destination country fragility on export status is identified entirely along the time dimension within each firm-destination combination. This specification allows us to examine within each firm-destination over time, how a change in destination fragility affects export participation within a firm to that destination country. We estimate equation (6) over the

[3] A rise represents a depreciation of the Kenya shilling against a foreign currency.

sample period 2004-2013 using a linear probability model (LPM) as in Kamal and Sundaram (2016) and Fernandes and Tang (2015). Table 5 presents the results.

Table 5: Fragility, firm's size and export status to a given destination country

Dependent variable:	Firm's export status to country j (exp_ijt>0)	
	(1)	(2)
L.Log(fragility)	-0.0179***	-0.0194***
	(0.0040)	(0.0040)
L.Log(size)	0.0175***	0.0200***
	(0.0003)	(0.0010)
(L.Log(fragility))(L.Log(size))		0.0008***
		(0.0003)
L.Log (gdp_cons)	0.0491***	0.0494***
	(0.0152)	(0.0152)
L.Log(real exchange rate)	0.0037	0.0038
	(0.0099)	(0.0099)
L.Log(days_import)	-0.0121	-0.0116
	(0.0078)	(0.0078)
L.Log(doc_import)	-0.0131	-0.0147*
	(0.0081)	(0.0081)
Observations	203,278	203,278
Number of groups	22,673	22,673
R-squared	0.2789	0.2789
Year dummy	YES	YES
Firm-Destination FE	YES	YES
F-Statistics/LR Chi2(13)	346.2	323.4

Notes: The dependent variable is a dummy equal to 1, if an exporter exports to destination j in time t. The main explanatory variable is destination fragility and size. All continuous variables are in logs and lagged by one-time period (t-1). All results obtained from LPM with firm-destination country fixed effects. Asterisk denotes level of significance (***p<0.01, **p<0.05, and *p<0.1). Robust standard errors in brackets.

Column (1) results show that the sign on destination fragility is negative and significant at 1% level suggesting that an increase in destination fragility by 10% is, on average, associated with a reduction in the probability that a firm serves that destination by 0.2%, holding everything else constant. To illustrate the magnitude of the effect, let us assume that a destination country moves from the 25th percentile in fragility of (-3.98) to the 90th percentile (-1.75) on a log scale while all other variables are held constant at the mean. Our results show that the probability of a Kenyan firm exporting to the 25th percentile fragility country is 0.2569 but it is 0.2171 for the 90th percentile, such that a deterioration in the fragility rank is, on average, associated with a 15.49% (=(0.2171/0.2569)-1*100) decrease in the probability that a firm exports to that market.

The previous size of the firm in the export market is an important factor in explaining the probability of exporting to a given destination country consistent with the findings in the literature that show large firms are more likely to be multi-destination exporters (Fernandes & Tang, 2015; Bernard, Redding & Schott, 2011; Bernard, Redding & Schott, 2009; Chaney, 2008). A 10% increase in the size of a firm is, on average, associated with 0.175% increase in the probability that it will export to a given destination market.

Market size (gdp_cons), real exchange rate, number of days to import (days_import) and documents to import in the destination country (doc_import), have the expected signs but only real GDP is statistically significant. An increase in the destination market's real GDP by 10% is associated with an increase in the probability that a firm serves that market with exports by 0.5%, holding all other factors constant. An increase in the market size is expected to attract more firms in serving that destination, just as predicted by the gravity model of trade. An increase in days to import and the number of documents required to import in a destination country tend to reduce the probability of exporting while a depreciation in the real exchange rate tends to increase the probability of exporting. However, these results are not statistically significant.

To assess whether size mediates the effect of fragility, column (2) adds an interaction term between destination fragility and size. The coefficient on interaction term is positive and significant. This suggests that larger firms are less adversely affected by fragility than smaller firms. To see how the fragility effect on probability of exporting to a given country changes as the size of a firm increases, let us assume that a firm's size moves from the 10th to the 90th percentiles (in log scale, this is a movement from 7.764 to 15.922). The average effect of a 10% increase in fragility on the probability to export is -0.132% for a firm size at the 10th percentile while it is -0.067% for a firm size at the 90th percentile[4]. This shows that the effect of fragility decreases with the size of the firm which is in line with the key predictions of models of firm heterogeneity and trade regarding the important role of firm size (or productivity) in overcoming costs of entry in export markets (Chaney, 2008; Bernard, Redding & Schott, 2003; Melitz, 2003).

[4]The partial derivative of the probability to export with respect to fragility is $\frac{\partial pr}{\partial fragility} = -0.0194 + 0.0008 * \ln(size)$. Size is taken at the 10th percentile and 90th percentile for the sample of firms used in the estimation.

4.3 Channels through which fragility affects export participation

This section looks at each indicator that went into the creation of the composite fragility index through the PCA method. We unpacked the role of each included WGI indicator in our PCA and split fragility into two components, namely political risk and business risk. This is to allow for differentiated effects and determines the channels through which fragility affects firm level export participation. We re-run equation (6) where the composite fragility index and each of the six indicators from the WGI are used as explanatory variables in a separate regression. The results are shown in Table 6.

Table 6: Firm's export status to a given destination and other proxies for fragility

Dependent variable:	Firm export status to j (exp_ijt>0)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L.Log(fragility)	-0.0194***						
	(0.0040)						
(L.Log(fragility))(L.Log(size))	0.0008***						
	(0.0003)						
L.Log(voice & account_vac)		0.0039					
		(0.0102)					
(L.Log(voice & account_vac)) (L.Log(size))		0.0022***					
		(0.0005)					
L.Log(regulatory quality_rq)			-0.0674***				
			(0.0101)				
(L.Log(regulatory quality_rq)) (L.Log(size))			0.0014*				
			(0.0008)				
L.Log(rule of law_rol)				-0.0059			
				(0.0064)			
(L.Log(rule of law_rol)) (L.Log(size))				0.0018***			
				(0.0005)			
L.Log(political stability_pse)					-0.0149***		
					(0.0023)		
(L.Log(political stability_pse)) (L.Log(size))					0.0001		
					(0.0003)		
L.Log(government effect_ge)						-0.0124***	
						(0.0044)	
(L.Log(government effect_ge)) (L.Log(size))						-0.0002	
						(0.0004)	
L.Log(control of corruption_coc)							-0.0257***
							(0.0050)
(L.Log(control of corruption_coc)) (L.Log(size))							0.0009**
							(0.0005)
L.Log(size)	0.0200***	0.0256***	0.0231***	0.0239***	0.0180***	0.0168***	0.0206***
	(0.0010)	(0.0019)	(0.0029)	(0.0017)	(0.0010)	(0.0014)	(0.0016)
The coefficients on all proxies of fragility at common size of the firm							
At the 10th percentile(7.764)	-0.0132	0.0209	-0.0565	0.0081	-0.0141	-0.0139	-0.0187
At the 90th percentile (15.922)	-0.0067	0.0389	-0.0451	0.0227	-0.0133	-0.0156	-0.0114
Observations	203,278	203,278	203,278	203,278	203,278	203,278	203,278
R-squared	0.2789	0.2789	0.2790	0.2789	0.2790	0.2789	0.2789
Other controls	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Firm-Country FE	YES	YES	YES	YES	YES	YES	YES
F-Statistics	323.4	322.4	325.1	322.2	324.8	322.2	323.4

Notes: The dependent variable is the probability that a firm export to destination j in time t. Results are from separate LPM regressions with time and firm-country fixed effects. Other controls include GDP, days to import, documents to import, and the real exchange rate. Asterisk denotes level of significance (*** p<0.01, ** p<0.05, * p<0.1). Robust standard errors are in brackets.

Column (1) contains results for our preferred measure, which is the composite index obtained through the PCA method. The coefficient on fragility is negative and significant (-0.0194), suggesting that a 10% increase in this variable is, on average, associated with a 0.19% reduction in the probability that a firm export to that destination. Column (2) shows results for voice and accountability and surprisingly, this is positive (0.0039) but insignificant. Column (3) presents the coefficient on regulatory quality, which is negative and significant (-0.0674) indicating a larger effect of this indicator on probability to export to a given destination. Column (4) shows that the effect of rule of law is negative and insignificant with a coefficient equal to -0.0059. The effect of political stability and absence of violence/terrorism (column 5) shows a negative and significant coefficient equal to -0.0149, while column (6) presents the coefficient on government effectiveness (-0.0124) which is negative and significant. Finally, column (7) shows the effect of control of corruption indicator (-0.0257), which is negative and significant.

The coefficients on each of the proxy indicators is conditional on firm size. To allow comparison across all of them, we plugged in the respective coefficient on each proxy for the 10^{th} and 90^{th} percentiles size firm. We see that at the 10^{th} percentile size firm, the coefficient on the composite index (fragility_all) is -0.0132 which is close to the coefficient on political stability and absence of terrorism (-0.0141), government effectiveness (-0.0139) and control of corruption (-0.0187) but much smaller relative to the coefficient on regulatory quality equal to (-0.0565). The sign on voice and accountability and rule of law goes the opposite direction but both variables are not statistically significant. The results remain similar at the 90^{th} percentile size firm. Overall, they suggest that the negative effect (-0.0194) attached to the composite fragility index in our results, is mainly driven by five indicators: regulatory quality; political stability and absence of terrorism; government effectiveness and control of corruption.

Next, we created two additional indicators of destination country fragility from the WGI using PCA. The first one included voice and accountability, political stability and rule of law as inputs into the PCA method to generate an average political risk index (fragility_pol). We are of the view that this political risk indictor captures "periods when states lack the capacity, accountability or legitimacy to mediate relations" (World Bank, 2011:18). The second index includes regulatory quality, government effectiveness and control of corruption. This index is viewed as closely reflecting business environment risks in the destination country

(fragility_buss). We compare these two channels for possible insights into the negative effect of aggregate fragility on export participation. We would like to assess how the political risk and business risk indices perform once we include them in the same regression. Table 7 shows the result.

Table 7: Effect of fragility based on all three indices computed using PCA

Dependent variable:	Firm export status to j (exp_ijt>0)			
	Composite fragility	Political risk	Business risk	2&3
	(1)	(2)	(3)	(4)
L.Log(fragility_all)	-0.0194***			
	(0.0040)			
(L.Log(fragility_all))(L.Log(size))	0.0008***			
	(0.0003)			
L.Log(fragility_pol)		-0.0084**		-0.0072*
		(0.0037)		(0.0039)
(L.Log(fragility_pol))(L.Log(size))		0.0011***		0.0035***
		(0.0003)		(0.0006)
L.Log(fragility_buss)			-0.0350***	-0.0262***
			(0.0052)	(0.0055)
(L.Log(fragility_buss))(L.Log(size))			0.0005	-0.0032***
			(0.0004)	(0.0008)
L.Log(size)	0.0200***	0.0213***	0.0191***	0.0179***
	(0.0010)	(0.0011)	(0.0014)	(0.0014)
Observations	203,278	203,278	203,278	203,278
Number of groups	22673	22673	22673	22673
R-squared	0.2789	0.2789	0.2790	0.2792
Other controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm-Country FE	YES	YES	YES	YES

Notes: The dependent variable is the probability that a firm export to destination j. The proxy for destination country fragility: fragility _all (a composite index of all WGI); fragility_pol (political risk) and fragility_buss (business risk). All explanatory variables are in logs and are lagged by one period. Other controls include GDP, days to import, documents to import, and the real exchange rate. Results are obtained using LPM with firm-destination country FE. Asterisk denotes level of significance (*** p<0.01, ** p<0.05, * p<0.1).

We can observe that all measures of fragility in the destination market have a negative and significant relationship with the probability that a firm will export to a given country. The coefficient on the composite index (fragility_all) is -0.0194, while the coefficient on political risk (fragility_pol) is -0.0084 and that on business risk (fragility_buss) is -0.0350. This indicates that business risk has the strongest effect on the probability that a firm will export to a given country, followed by the composite index. The negative effect of political risk is very small, although significant at 5% level. These results suggest that the composite fragility index is largely capturing business environment risks rather than political risks.

In column (4) we include both political and business fragility in the same regression. Both indicators remain negative but the magnitude of the effect is large on the business fragility. The coefficient on business fragility is equal to -0.0262 and significant at 1% level, while the coefficient on political fragility is 0.0072 and significant at 10% level. The interaction term between size and fragility_buss is negative and significant suggesting that the effect of size diminishes at very high level of state fragility as predicted by Crozet et al. (2007). The results show that an increase in both political and business fragility have a significant effect on the probability of a firm exporting to a given country in Africa. However, the magnitude of the effect is larger for business risks relative to political risks. This finding is interesting and calls for differentiated policy interventions to enhance the probability of exporting from Kenya to the African market.

4.3 Robustness to alternative measurement of fragility

There is a concern that our results may be driven by the WGI by Kaufmann et al. (2011) used as proxy for destination country fragility. To test the robustness of our results to alternative measurements of fragility, we follow Crozet et al. (2007) and use the International Country Risk Guide (ICRG)[5] as proxy for fragility (PRS Group, 2011). Table 8 shows the results.

[5] There is a positive and significant correlation equal to 0.8415 between the ICRG political stability index and our fragility measure.

Table 8: Robustness to alternative measurement of fragility using ICRG Index

Dependent variable:	Firm's export status to j (exp_ijt>0)	
	(1)	(2)
L.Log(fragility_ICRG)	-0.1014***	-0.1022***
	(0.0292)	(0.0292)
L.Log(size)	0.0142***	0.0176***
	(0.0003)	(0.0030)
(L.Log(fragility_ICRG))(L.Log(size))		0.0009
		(0.0008)
L.Log (gdp_cons)	0.0638***	0.0640***
	(0.0214)	(0.0214)
L.Log(real exchange rate)	-0.0254*	-0.0252*
	(0.0147)	(0.0148)
L.Log(days_import)	0.0368***	0.0369***
	(0.0110)	(0.0110)
L.Log(doc_import)	-0.0556***	-0.0561***
	(0.0121)	(0.0121)
Observations	138,051	138,051
Number of groups	17305	17305
R-squared	0.2686	0.2686
Year FE	YES	YES
Firm-Destination FE	YES	YES

Notes: The dependent variable is the probability that a firm export to destination j. The proxy for destination country fragility is the ICRG obtained from the PRS Group website. Other controls include GDP, real exchange rate, days to import, documents to import and the proxy measure for firm network. All explanatory variables enter with a one period lag. Asterisk denotes level of significance (*** p<0.01, ** p<0.05, * p<0.1).

The ICRG indices provide a total score on political stability across countries and the availability of this variable matches the sample period of 2004-2013. However, the data is only available for 32 countries in Africa, which means we lose some observations. The index measures political stability along dimensions such as socioeconomic conditions, democracy, ethnic tensions and military conflicts and determinants of business climate. It ranges from 0 (very unstable) to 100 (most stable), which means to measure fragility we must use an inverse of the index. An increase in the score translates to a decrease in fragility in a destination country.

Column (1) results show that fragility negatively affects the probability of a Kenyan firm exporting to a given destination country in Africa. A 10% increase in fragility is associated with a 1.0% reduction in the probability of exporting, holding everything else constant. This result is qualitatively similar to that obtained in Table 5 column (1) although the magnitude of the effect is now stronger. Column (2) includes size and its interaction with fragility as controls. The results show a negative and significant coefficient on fragility. Size also has a

positive and significant effect but the interaction term is not significant. This result is also qualitatively similar with our findings in Table 5 column (2). Overall, the sign on the coefficients on the destination country fragility remains negative and statistically significant. Size has positive effects on the probability of exporting. This suggests that our baseline results are robust to alternative measurement of destination country fragility.

4.4 Destination Country Fragility and Home Country Export Margins

Destination fragility and total exports

The analysis so far has focused on how fragility affects firm entry/exit into destination markets. To analyse how fragility affects aggregate exports, we follow Bernard et al. (2009) and decompose the value of exports between Kenya and a given destination country in Africa in period t into the unique number of exporters, the number of exported products, the density[6] term that measures the number of firm-product observations for which trade to a given country is positive and the average export value per firm.

$$X_{HF} = N_{HF} V_{HF} D_{HF} \bar{x}_{HF} \qquad (7.)$$

where X_{HF} is the bilateral exports between Kenya and a foreign country, N_{HF} is the number of exporters, V_{HF} is the number of exported products, D_{HF} is the density term and $\bar{x}_{HF}$ is the average export value per firm. The average export value per firm captures the change in the bilateral trade through the intensive margin, while firms, products and density terms capture the changes in bilateral trade through the extensive margin. We argue that an increase in destination country fragility reduces the bilateral export value with that destination[7]. This reduction in export flow is an outcome of the reduced number of exporters and the number of exported products to a fragile destination country. To estimate this empirically, we estimate the following regression.

$$\boldsymbol{Exp}_{\boldsymbol{jt}} = \gamma_0 + \boldsymbol{\gamma} fragility_{jt-1} + \left(\boldsymbol{X'}_{\boldsymbol{jt-1}} \boldsymbol{\beta}\right) + \boldsymbol{\delta_t} + \boldsymbol{\delta_j} + \vartheta_{jt} \qquad (8.)$$

[6] Since firms generally are active in a small subset of the overall number of products exported by Kenya, we need an additional term in the decomposition to account for the density of trade (i.e. the fraction of all possible firm-product combinations for Kenya for which trade is positive).

[7] See Crozet et al.(2007) for a formal derivation.

The dependent variable $\boldsymbol{Exp}_{jt}$ is a vector of the number of exporters, the number of products, the density term and the average export value per firm between Kenya and a given African market j in period t. The main explanatory variables are destination country fragility and a vector $\boldsymbol{X}'$ containing gravity variables such as market size, real exchange rate, days to import, and documents to import. We expect $\boldsymbol{\gamma}$ to be negative and significant for the number of exporters and the number of products but positive with respect to density term. The relationship between fragility and the average export value per firm is positive reflecting pure selection effect.

We estimate equation (8) using the Pseudo Poisson Maximum Likelihood (PPML) proposed by Silva and Tenreyro (2006). This method is able to account for the zero trade flows that are frequent in the trade matrix. In addition, the PPML provides a consistent estimate of non-linear gravity model and is consistent with the recent theoretical gravity model that requires inclusion of fixed effects by exporter and by importer (Anderson and Van Wincoop, 2003). However, in our case since the only exporter is Kenya, we consider destination country fixed effect (i.e. importers from Africa).

The PPML is an exponential model, which means we can interpret the effect of explanatory variables in a straight forward way, just as in OLS (Silva & Tenreyro, 2006). Firstly, all the dependent variables are in levels rather than in logs, which means we retain the zeros in the estimation. Secondly, coefficients of explanatory variables that are in logs are interpreted as simple elasticities. Table 9 presents the regression results.

Table 9: Kenya's export trade margins and destination fragility

Dependent variables:	Firms	Products	Density	Av.value	Tot.value
	PPML	PPML	PPML	PPML	PPML
	(1)	(2)	(3)	(4)	(5)
L.Log(fragility)	-0.2328**	-0.2679	0.3114*	0.8625***	-0.0265
	(0.1004)	(0.1704)	(0.1877)	(0.3100)	(0.1133)
L.Log(gdp_cons)	-0.1220	-0.3548	-0.0268	-0.7614	0.1069
	(0.1955)	(0.3301)	(0.6992)	(0.4788)	(0.4905)
L.Log(days_import)	-0.1391*	0.0066	-0.0360	-0.4146	-0.2266*
	(0.0764)	(0.1039)	(0.3184)	(0.2831)	(0.1325)
L.Log(doc_import)	0.1363	0.1057	-0.6679	0.4959	0.1319
	(0.1194)	(0.1488)	(0.5127)	(0.3341)	(0.1540)
L.Log(real exchange rate)	0.1040	-0.5471**	-0.6741	0.0605	0.6175***
	(0.1727)	(0.2617)	(0.4508)	(0.5772)	(0.1526)
Constant	12.82***	9.001***	-10.33**	16.54***	28.65***
	(2.0951)	(3.3033)	(5.2012)	(4.7406)	(3.6781)
Observations	388	388	388	388	388
R-squared	0.9951	0.9870	0.6359	0.9301	0.9964
Other gravity controls	YES	YES	YES	YES	YES
Year dummy	YES	YES	YES	YES	YES
Destination-country dummy	YES	YES	YES	YES	YES

Notes: The dependent variables are the number of firms, the number of exporters, the density term, the average export value (Av.value) per firm and Kenya' total export value (Tot.value) to a given African country. The explanatory variables are the destination country fragility and other gravity controls and are in logs and lagged by one period. We control for the year and destination country fixed effects. Asterisk denotes level of significance (***p<0.01, **p<0.05, and *p<0.1) and the standard errors are clustered on destination-country level.

The results in column (1) show that the effect of destination fragility on the number of exporters is negative and significant at the 5% level. This suggests that a 10% increase in destination fragility is, on average, associated with a 2.3% decrease in the number of exporters to that destination-country. This result is qualitatively similar but smaller compared to that found by Crozet et al. (2007) for France. In their study they estimate a tobit regression of the log of the number of French firms exporting to a given country per year (over 1986-1992) on the destination country's insecurity index. They found that a 10% increase in the destination country's insecurity index reduced the number of exporting firms to that destination by 4.8%. Amongst all the time varying gravity controls, only the number of days (days_import) it takes to import in a destination country is significant at 10% level, suggesting that an increase in this variable reduces the number of exporters from Kenya to that destination.

Column (2) results are obtained from a regression of the number of exported products to a given destination country against fragility and other controls. The results reveal a negative but insignificant effect of destination fragility on the number of products exported. Exporters

therefore do not appear to adjust the range of products they export to a destination in response to changes in fragility. In column (3) we regress the density variable against destination fragility. According to Bernard et al. (2009:488) the density variable measures the number of firm-product observations for which trade to a given destination is positive. It ranges from a minimum of

$(\frac{1}{firms};\frac{1}{products})$ to unity as the number of observations approaches the multiple of firms to products.

Since firms are generally 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. A large value (i.e. near unity) for the term implies very few firms and products from Kenya to a given destination. For example, if only one firm exports one product to Sao Tome and Principe, then the density will take a value of 1. However, if two firms export two products to that country, this will amount to a density value equal to one half. As such, the density term is expected to be positively correlated with destination fragility. Indeed, the results show a positive and significant relationship between density of trade and destination fragility. An increase in destination fragility by 10% is, on average, associated with a 3.1% increase in the density term, implying a reduction in the firm-products observations to a given destination.

Column (4) shows that fragility has a positive and significant effect on the average export value per firm to a given destination country in Africa. An increase in destination fragility by 10% is, on average, associated with an 8.6% increase in the mean export value per firm to that destination country. This result is driven by pure selection effect as fragility causes exit of exporters that are less efficient relative to the average productivity exporters. As firms exit, the sample of exporters changes and so does the average value. Our results differ from those found by Crozet et al. (2007) for France, where an increase in the destination insecurity index had no significant effect on the mean exports (intensive margin) per firm. They explain this fact to be driven by the fact that insecurity in the destination country caused exit of both small and unlucky large exporters.

Finally, in column (5), we examine the effect of destination fragility on Kenya's total export values to a given destination country in Africa. This specification is similar to most gravity equations in the literature considering the overall effect of destination fragility on bilateral

exports (Glick & Taylor, 2010; Martin, Mayer & Thoenig, 2008; Mansfield & Bronson, 1997; Pollins, 1989). The results reveal a negative but insignificant coefficient on destination fragility. This result is not surprising, since we already know that new entrants and exiting firms are, on average, very small in their share of export market (Eaton et al., 2007). Fragility affects mainly the entry and exit decisions for the small firms (the extensive margin) resulting in a change in the sample of firms that actively participate in exports. These changes in the sample of firms implies the average export value per firm to that destination country necessarily increases due to selection effect but the effect on Kenya's total export value is not significant.

5.0 Conclusion

This study analyses the effect of fragility in destination markets on firm export behaviour and the role of firm size in mediating adverse outcome. The analysis is conducted using firm transaction data on Kenyan exports to Africa over the period 2004 to 2013. The empirical strategy controls for endogeneity of destination choice by the firm through firm-destination country fixed effects. The results reveal that fragility negatively affects a firm's decision of being active in a destination market, reducing Kenya's bilateral trade through the number of firms willing to export to fragile states in Africa. We also find that larger firms are less likely to exit in response to destination shocks in fragility. These results are robust to alternative measurement of destination fragility and to controlling for as many as possible standard time varying gravity variables. We related the results to findings in the recent trade theory that emphasize firm heterogeneity and trade costs in international markets.

The decomposition of aggregate destination fragility into parts reveal that the effect of business fragility (regulatory quality, government effectiveness, and control of corruption) dominates political fragility (voice and accountability, rule of law, and political stability), although both effects are negative and significant. These results are related to the literature examining the importance of trade facilitation and successful performance of firms in international trade and may call for differentiated policies to address business risks and political risks associated with exporting within the African continent.

References

Anderson, J.E. & Marcouiller, D. 2002. Insecurity and the pattern of trade: An empirical investigation. *Review of Economics and Statistics.* 84(2):342-352.

Arkolakis, C. 2016. A unified theory of firm selection and growth. *The Quarterly Journal of Economics.* 131(1):89-155.

Arkolakis, C. & Muendler, M. 2010. *The Extensive Margin of Exporting Products: A Firm-level Analysis.* Cambridge: NBER Working Paper Series (No. w16641).

Baldwin, R. & Krugman, P. 1989. Persistent trade effects of large exchange rate shocks. *The Quarterly Journal of Economics.* 104(4):635-654.

Bernard, A.B. & Jensen, J.B. 1999. Exceptional exporter performance: cause, effect, or both? *Journal of International Economics.* 47(1):1-25.

Bernard, A.B., Redding, S.J. & Schott, P.K. 2011. Multiproduct firms and trade liberalization. *The Quarterly Journal of Economics.* 126(3):1271-1318.

Bernard, A.B., Redding, S. & Schott, P.K. 2003. *Product choice and product switching.* Cambridge, Mass: National Bureau of Economic Research.

Bernard, A., Redding, S. & Schott, P. 2009. *Multi-Product Firms and Trade Liberalization.* Cambridge: NBER Working Paper Series (No. w12782).

Blomberg, S.B. & Hess, G.D. 2006. How much does violence tax trade? *The Review of Economics and Statistics.* 88(4):599-612.

Carrere, C. 2004. African Regional Agreements: Impact on Trade with or without Currency Unions. *Journal of African Economies.* 13(2):199-239.

Chaney, T. 2008. Distorted gravity: the intensive and extensive margins of international trade. *The American Economic Review.* 98(4):1707-1721.

Chauvet, L. & Collier, P. 2008. What are the preconditions for turnarounds in failing states? *Conflict Management and Peace Science.* 25(4):332-348.

Clark, X., Dollar, D. & Micco, A. 2004. Port efficiency, maritime transport costs, and bilateral trade. *Journal of Development Economics.* 75(2):417-450.

Clerides, S.K., Lach, S. & Tybout, J.R. 1998. Is learning by exporting important? Micro-dynamic evidence from Colombia, Mexico, and Morocco. *The Quarterly Journal of Economics.* 113(3):903-947.

Collier, P. & Hoeffler, A. 2004. Greed and grievance in civil war. *Oxford Economic Papers.* 56(4):563-595.

Crozet, M., Koenig, P. & Rebeyrol, V. 2007. Exporting to risky markets: a firm-level analysis. *MimeoUniversity of Reims.* 01(2007-01):1-31.

Das, S., Roberts, M.J. & Tybout, J.R. 2007. Market entry costs, producer heterogeneity, and export dynamics. *Econometrica.* 75(3):837-873.

Dennis, A. & Shepherd, B. 2011. Trade facilitation and export diversification. *The World Economy.* 34(1):101-122.

Dixit, A. 1989. Entry and exit decisions under uncertainty. *Journal of Political Economy.* 97(3):620-638.

Eaton, J., Eslava Mejía, M., Kugler, M. & Tybout, J.R. 2007. *Export dynamics in Colombia.* Cambridge, Mass: National Bureau of Economic Research.

Fearon, J.D. & Laitin, D.D. 2003. Ethnicity, insurgency, and civil war. *American Political Science Review.* 97(01):75-90.

Feenstra, R.C. & Ma, H. 2014. Trade facilitation and the extensive margin of exports. *The Japanese Economic Review.* 65(2):158-177.

Fernandes, A.M., Freund, C. & Pierola, M.D. 2016. Exporter behavior, country size and stage of development: Evidence from the exporter dynamics database. *Journal of Development Economics.* 119(1):121-137.

Fernandes, A.P. & Tang, H. 2015. Scale, scope, and trade dynamics of export processing plants. *Economics Letters.* 133:68-72.

Glick, R. & Taylor, A.M. 2010. Collateral damage: Trade disruption and the economic impact of war. *The Review of Economics and Statistics.* 92(1):102-127.

Greenaway, D. & Kneller, R. 2007. Firm heterogeneity, exporting and foreign direct investment. *The Economic Journal.* 117(517):F161.

Iwanow, T. & Kirkpatrick, C. 2007. Trade facilitation, regulatory quality and export performance. *Journal of International Development.* 19(6):735-753.

Kamal, F. & Sundaram, A. 2016. Buyer–seller relationships in international trade: Do your neighbors matter? *Journal of International Economics.* 102:128-140.

Kee, H., Nicita, A. & Olarreaga, M. 2009. Estimating trade restrictiveness indices. *The Economic Journal.* 119(534):172-199.

Mansfield, E.D. & Bronson, R. 1997. Alliances, preferential trading arrangements, and international trade. *American Political Science Review.* 91(01):94-107.

Mansfield, E.D. & Pevehouse, J.C. 2000. Trade blocs, trade flows, and international conflict. *International Organization.* 54(04):775-808.

Martin, P., Mayer, T. & Thoenig, M. 2008. Make trade not war? *The Review of Economic Studies.* 75(3):865-900.

Melitz, M.J. 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica.* 71(6):1695-1725.

Morrow, J.D., Siverson, R.M. & Tabares, T.E. 1998. The political determinants of international trade: the major powers, 1907–1990. *American Political Science Review.* 92(03):649-661.

Murdoch, J.C. & Sandler, T. 2004. Civil Wars and Economic Growth: Spatial Dispersion. *American Journal of Political Science.* 48(1):138-151. Available: http://www.ingentaconnect.com/content/bpl/ajps/2004/00000048/00000001/art00010.

Penubarti, M. & Ward, M.D. 2000. Commerce and democracy. *Center for Statistics and the Social Sciences Working Paper.* 2(6):1-36.

Pollins, B.M. 1989. Conflict, cooperation, and commerce: The effect of international political interactions on bilateral trade flows. *American Journal of Political Science.* 33(3):737-761.

Qureshi, M.S. 2013. Trade and thy neighbor's war. *Journal of Development Economics.* 105(1):178-195.

Roberts, M.J. & Tybout, J.R. 1997. The decision to export in Colombia: an empirical model of entry with sunk costs. *The American Economic Review.* 87(4):545-564.

Sambanis, N. 2001. Do ethnic and nonethnic civil wars have the same causes? A theoretical and empirical inquiry (Part 1). *Journal of Conflict Resolution.* 45(3):259-282.

Silva, J.S. & Tenreyro, S. 2006. The log of gravity. *The Review of Economics and Statistics.* 88(4):641-658.

Wold, S., Esbensen, K. & Geladi, P. 1987. Principal component analysis. *Chemometrics and Intelligent Laboratory Systems.* 2(1-3):37-52.

World Bank. 2011. *World development report 2011: conflict, security, and development.* Washington, DC: World Bank.

Yeats, A.J. 1998. What can be expected from african regional trade arrangements?: Some empirical evidence. *SSRN Working Papers.* 7(1):1-30.