

Trade at the Extensive Margin and Civil Wars in Africa

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- PRELIMINARY AND INCOMPLETE -

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ABSTRACT

The aim of this paper is to explore if the end of a civil war is accompanied by increases in international trade at the extensive margin in Africa. We test this hypothesis using bilateral trade data disaggregated in 5,000 products for 47 African countries exporting to 191 potential markets around the world, in a sample period of 1995 to 2009. After controlling for unobserved heterogeneity at the country-pair/product level, we find evidence that the probability of exporting a new product to a new destination is an increasing function of the years at peace. We also find spillovers to neighboring countries, given by an increase in the probability of exporting a new product with the number of years that the destination country has ended a civil war. The results could have important policy implications, in terms of pacification as determinant of export diversification and regional integration.

Key Words: Extensive margin, peace dividend, regional integration, civil war

JEL: D74, F15, F51

1. Introduction

Africa's export composition stagnated over the years immediately after independence. But over the last two decades, there has been a non-negligible progress towards diversification in the export basket composition as well as increase in the number of destination markets for African exports (Figure 1). In other words, an expansion of African exports on the extensive margin and a reduction in the "Zero trade flows" in Africa's trade matrix (Figure 2).

One of the major changes in the region during the same period is the resolution or reduction in the intensity of civil wars. While during the 1990s one fourth of African countries were actively involved in civil conflicts, just 10% were in 2005 (Figure 3). The aim of this paper is to explore if both facts are related, i.e., the end of internal armed conflict is accompanied by an increase in the trade at the extensive margin.

There is vast literature on the economic effects of war and peace. An established fact is that the end of long internal conflicts is associated to an increase in GDP growth (Collier, 1999, Knight et al. 1996). The shift from military expenditures to productive investments implies a push for the post-war economy, a phenomenon known as the "peace dividend". Other factors influencing economic recovery are capital repatriation, return of mobile factors of production and certainty on stability of the markets. Less attention has been paid to the effects of conflict resolution on international trade, although previous studies provide evidence of the adverse effects of civil war on trade volumes (Martin, et al, 2008a, Bayer and Rupert, 2004). Nonetheless, to the best of our knowledge, this is the first paper studying the relationship between civil wars and trade at the extensive margin.

It is relatively easy to find case studies that provide *prima facie* support to this hypothesis. In Figure 4 we show the case of two East African countries with relatively similar population size that had suffered from severe internal conflicts (both with international spillovers): Rwanda and Somalia. The former had a long lasting civil war related to ethnic clashes that climaxed into genocide in 1994 and then extended to fights between the government and rebel militias until 2002 (UCDP/PRIODataset). The latter started a civil war in 1982, unresolved until today. When both countries were having internal conflicts at the same time, the number of exported varieties was similar, around 200 products each. Nevertheless, after the Rwandan conflict ended, the varieties exported multiplied by three, while those of Somalia only increased marginally in the same period.

If post conflict economic recovery is manifested through increased participation of the recovering country in international trade, it might also have positive spillovers for neighboring economies in terms of providing new business opportunities. Let us take the case of Uganda and neighbor countries ending civil wars (Table 1). The average number of varieties exported to and imported from Rwanda has more than doubled in the period after the war. In the case of Burundi, with a civil war of similar characteristics like Rwanda that considerably decreased in intensity since 2003, the number of exported products increased by

a factor of six. Even more impressive is the case of Sudan. After the signing of the Comprehensive Peace Agreement in 2005, that ended a devastating South-North conflict, the number of varieties exported by Uganda has increased almost eightfold.

Going beyond anecdotal evidence, our aim is to test if this relationship holds in a detailed bilateral trade dataset with approximately 5,000 article/product categories for 47 African countries and 191 potential destination markets in the period of 1995-2009. In particular, we test two hypotheses: (i) the likelihood of starting to export a new product to a new market in the world increases in a country that ends a civil war; and (ii) the likelihood of starting to export a product to a new destination in Africa increases when the potential trade partner ends a civil war. Using different estimation specifications and samples (to deal with problems of data quality), we find support for both hypothesis. Nevertheless, the results are not always robust to different estimation of the standard errors and therefore not always statistically significant.

The rest of the paper is organized as follows: the next section reviews relevant literature and the following section describes our data. Section 4 describes the empirical strategy and presents the main results, while the last section briefly concludes.

2. Related literature

Our study relates to the extensive literature on the connection between economic conditions and civil war.¹ We are particularly interested in the effect of the end of a conflict. A first line of relevant literature relates to the “peace dividend”: the shift from military expenditures to productive investments implies a push for the post-war economy. While previous studies tested the relationship of country’s military expenditures and its growth rate before, the first rigorous test of the “peace dividend” hypothesis is provided by Knight, Loayza and Villanueva (1996). They extend the standard growth model to exploit cross-section and time series to estimate the effects of the growth-retarding effects of military spending. Their model simulation results suggest a substantial long-term peace dividend in form of higher capacity output per capita attributed to current and cuts in military spending. Collier (1999) develops a model of economic effects of war and the post-war period that is tested on data for civil wars since 1960, finding that after long civil wars the economy recovers rapidly, whereas after short wars economies continued to decline. Collier (1999) also notes that there is a shift in composition of economic activity distinguishing between war-vulnerable and war-safe activities. Using evidence from Uganda; he finds the compositional effects of war to be substantial.

As for the effects of military conflicts on international trade, Bayer and Rupert (2004) estimates that total bilateral trade is reduced by a third in the presence of a civil war. Martin, Mayer and Thoenig (2008a) show that trade destruction (intensive margin) due to civil wars is very large and persistent and increases with the severity of the conflict. But the causality runs

¹ See Blattman and Miguel (2010) for an comprehensive literature review.

also in the opposite direction. Martin, Mayer and Thoenig (2008a) show that trade can have two effects on the risk of civil conflicts a deterrent effect if gains from trade are put at risk during a civil war and an insurance effect if international trade works as a substitute for internal trade during a civil war. When it comes to interstate wars, Martin, Mayer and Thoenig (2008b) show that countries that trade more between them have less probability of a conflict, but multilateral trade openness increases the probability of war. Also related is the literature about the effect of commodity prices on the onset of wars, where contradictory results have been found: Besley and Persson (2008) find that the incidence of civil wars rises with export prices but Brückner and Ciccone (2010) have opposite results and Bazzi and Blattman (2011) show that both results are weak.

In recent years, an increasing attention has been paid to the importance of the extensive margin of trade. Hummels and Klenow (2005) show that the extensive margin is more important than the intensive margin to explain export growth, particularly in bigger and richer countries. Evenett and Venables (2002) and Amurgo-Pacheco and Pierola (2008) find that the extensive margin plays an important role as a source of export growth for developing countries, especially in terms of geographic diversification. These results have been contested by Besedes and Prusa (2011), among others, based in the fact that new trade relations have very low rate of survival in developing countries. Low survival is indeed a salient characteristic of African exports, as shown by Cadot et al. (2011). Our paper contributes to this literature by expanding the determinants of new trade relations. Previous studies have shown that gravity-like determinants are also important the extensive margin (Felbermayr and Kohler, 2006), also that changes in tariffs have just moderate effects (Debaere and Mostashari, 2010) and trade preferences matter (Bensassi et al, 2011).

3. Data

3.1 Data description

We use bilateral trade data at HS 6 digit level of disaggregation from the BACI/CEPII dataset, based on data from UN/COMTRADE for 47 African countries² exporting up to 5,000 products to 191 potential destination markets for the period 1995-2009. Data in the BACI database have better quality than these directly from COMTRADE, given the former is mirrored using the most reliable available partner.³ This improvement in data quality is crucial to our work, given the problems with data measurement that generally abound in trade data from African countries. As it can be seen in Figure 1, the average African country at the beginning of our sample was exporting 400 products to 30 destinations, while at the end of the sample the average rose to 500 products and 40 destinations, a first evidence of an increase in trade at the extensive margin.

² Namibia, Botswana, Lesotho, Swaziland, Seychelles and São Tomé and Príncipe are not included in the sample. In the case of the first four countries, trade data was not available for all the years in our sample. In the case of the latter two countries, data availability for the control variables was incomplete.

³ The technical details of BACI data construction can be found in Gaulier and Zignago (2010).

The dataset on civil wars in Africa is obtained from UCDP/PRIO Armed Conflict Dataset (Version 4-2011). This dataset gives the dates of the starting and ending of all civil wars since 1960 by month. These data also allowed us to classify the civil wars as severe and non-severe according to the number of casualties recorded during the war. Severe civil wars included those whose casualties numbered more than 1,000 people in a single year, while in non-severe civil wars casualties ranged from 25-1,000 people. Table 2 shows the 27 African countries that were involved in some kind of civil war in our period of study, with an average of 11 countries per year. The years in which more nations had a conflict were 1997 and 1998, 15 countries, and the most peaceful year was 2005, with 6 countries in civil war (Figure 3). As an additional control in the empirical analysis, we will include armed conflict between countries, also from the UCDP/PRIO database.⁴

Our dataset also includes various economic controls like GDP of both the exporter and importer, the GDP per capita for both partners and the rate of GDP growth for all countries in the sample. We also include the total trade GDP ratio of the bilateral partners as a measure of trade openness (exports+imports over GDP). These variables are obtained from the World Development Indicators (WDI, 2011).⁵ In addition to the above controls we include some political variables. We obtained data on Free Trade Agreements between countries from Baldwin and Jaimovich (2010) and updated their data with WTO RTA database for years 2008 and 2009. Country level political regime information comes from Polity IV database.

3.2 Data issues

Two factors may undermine the quality of our dataset regarding the bilateral trade flows and the kind of empirical analysis we undertake in this study. First, unreported or underreporting of trade data by customs officials is likely to be endemic in Africa countries largely because of institutional capacity issues by both the customs officials, and the exporters themselves. Second, erratic reporting would also affect our analysis in the sense that the classification of a merchandise might change arbitrarily and then appear as a new product in our analysis. We endeavor therefore to take into account these two factors in our analysis.

A first step to improve data quality is the use of the BACI database, that allow us to get the report from the most reliable trade partner, partially solving the problem of weak quality institutions of African custom services. The fact that BACI data is mirrored is particularly useful in helping us to alleviate measurement errors correlated to our main explanatory variable. It is very likely that trade report quality will be worse when a country is at civil war, but, on the other hand, the conflict should not affect the quality of the data provided by the trade partner.⁶

As a further step, we will impose thresholds in our definition of a new product-destination export, both for the number of years the new product is exported and the number of years since it was first exported. Specifically, we will define two thresholds:

⁴ We will consider armed conflict between countries both “Interstate armed conflict” and “Internationalized internal armed conflict” from UCDP/PRIO Armed Conflict Dataset (Version 4-2011).

⁵ GDP Data for Somalia was obtained from the Penn World tables.

⁶ This will still be an issue in internationalized civil wars.

- Y_o : The first year of a new product-destination is exported at least Y_o after the beginning of sample.
- Y_x : The new product-destination is exported at least for Y_x years. These years might not be consecutives.

Table 3 shows examples of country-pair product sub-samples that meet the minimum requirement for the least demanding thresholds ($Y_o=1$, $Y_x=1$) and the most demanding thresholds ($Y_o=5$, $Y_x=5$) that we will use in our empirical specification.

While the use of these thresholds to filter the data will not completely solve the problem of estimating the probability of exports with low rates of survival, at least it helps in terms of interpreting the results as true new exported product instead of simple measurement error.

4. Empirical analysis

4.1 Model specification

The empirical strategy aims to provide evidence related to our two hypotheses:

H1: The likelihood of starting to export a new product increases in a country that ends a civil war.

H2: The likelihood of starting to export a product to a new destination in the region increases when the potential trade partner ends a civil war.

For H1, we estimate the increase in the probability of exporting a new product x associated with the pacification of the origin country i to any new destination j , we will start with estimating the following equation:

$$\Pr(Exp_{xij,t \in Y_x} = 1 / Exp_{xij,Y_0} = 0) = G(\beta_0 + \beta_1 Peace_{i,t} + \beta_2 War_{i,t} + \beta_3 z_{i,t} + \beta_4 z_{j,t} + \beta_5 z_{ij,t} + \beta_6 \tau_t) \quad (1)$$

Where $G(*)$ is the logistic cumulative distribution function. $Exp_{xij,t \in Y_x}$ takes value 1 if a product (at the HS6 level) that was not previously exported from i to j in the range period Y_o starts being exported in year t , and is exported for at least Y_x years (the thresholds Y_o and Y_x are defined in section 3.2). The peace dividend at the extensive margin for country that ends civil war, will be tested with parameter β_1 , given that the variable $Peace_{i,t}$ indicates years since the end of the civil war. This variable has two specifications: a single variable numbering the years since the end of the civil war and a set of dummies for each year after the

war.⁷ For the former, a square value that captures a potential non-linearity of the effect will also be included. If H1 is true, we expect β_1 to be positive and statistically significant.

In a similar fashion than the peace variable, $War_{i,t}$ in equation 1 is the number of years since the beginning of a civil war (if any during the period), following both the continuous measure and the vector of dummies. We do not have a clear prediction related to β_2 . While it is reasonable to expect that the probability of exporting a new product will be diminished in a country that faces civil war, it might also be the case that some sectors of the economy remain unaffected or even stimulated by the extra military expenditures and then can actually increase exports at the extensive margin. In the case that civil war has negative effects in trade at the extensive margin, it must be expected β_2 to be negative.

The rest of the variables in equation 1 are time-variant controls at different levels. County level variables, for both exporter and destination market, includes log of GDP, GDP growth, political regime and openness to trade. Country pair characteristics include the existence of an FTA and the existence of an armed conflict between the two countries. We also include a time trend, τ_t . Time invariant characteristics are not included, given that the empirical strategy explained below direct deals with them (and this explains why typical gravity variables like geographical distance or common language are not included).

In order to test H2, we will expand equation 1 in the following way:

$$\Pr(Exp_{xij,t \in Y_x} = 1 / Exp_{xij,Y_0} = 0) = \quad (2)$$

$$G(\beta_0 + \beta_1 Peace_{i,t} + \beta_2 War_{i,t} + \beta_3 Peace_{j,t} + \beta_4 War_{j,t} + \beta_5 z_{i,t} + \beta_6 z_{j,t} + \beta_7 z_{ij,t} + \beta_8 \tau_t)$$

where the additional variable $Peace_{j,t}$ indicates years since the destination market has finished the last civil war and $War_{j,t}$ the years since the civil war started (if any during the period). If H2 is true, we expect β_3 to be positive and significant. As for β_4 , we do not have a clear prediction, since war in the partner can diminish their imports of new products given the negatives effects of the conflict in the economy but, in the other hand, can make the government (or other armed groups) to start demanding war-related supplies from abroad. For the estimation of equation 2 we limit the sample just to African trade partners. We have two reasons for this. First, it is likely that most of the relevant trade exchanges with post-civil war countries of African countries will be within the continent, and since H2 relates to regional integration in Africa, these are actually the exchanges that matter to us. Second, it is not easy to have a meaningful measure of years at peace for countries outside Africa.⁸

Given our variables of interest, $Peace_{i,t}$ and $Peace_{j,t}$, are at the country level, the specifications of equations 1 and 2 are attractive in the sense that allow us to directly estimate changes in the probability associated to these variables. Nonetheless, if we consider the exports-imports matrix as a network of reciprocate interactions, this specification is not well

⁷ For countries with no civil war, we take the number of years since 1960, a year close enough to the date when most of the African countries became independent. For those that gained independence later, we consider years since independence.

⁸ The assumption of taking 1960 as the starting year of peace for countries without a civil war is meaningless outside Africa.

identified, given that symmetry is not preserved (Fafchamps and Gubert, 2007). To preserve symmetry, it is required that the effect of (z_{it}, z_{jt}) on $\Pr(\text{Exp}_{xijt})$ is the same as the effect of (z_{jt}, z_{it}) on $\Pr(\text{Import}_{xijt})$. In order to satisfy this requirement, we will additionally estimate the following model:

$$\begin{aligned} \Pr(\text{Exp}_{xijt \in Y_x} = 1 / \text{Exp}_{xij, Y_0} = 0) = & \\ G(\delta_0 + \delta_1(\text{Peace}_{i,t} + \text{Peace}_{j,t}) + \delta_2(\text{Peace}_{i,t} - \text{Peace}_{j,t}) + & \\ \delta_3(z_{i,t} + z_{j,t}) + \delta_4(z_{i,t} - z_{j,t}) + \delta_5 z_{ij,t} + \delta_6 \tau_t) & \end{aligned} \quad (3)$$

where symmetry is preserved by using the sum and differences of all the country level variables, including $\text{Peace}_{i,t}$ and $\text{Peace}_{j,t}$. The interpretation of the coefficients of interest is less directly related to H1 and H2 in this case. If δ_1 is positive, the probability that i will export a new product to j is higher the more years both countries have been peaceful. In that sense, δ_1 relates to H2. In the case of δ_2 , a positive value is to be interpreted as evidence of increase in the probability to export a new product when i has been without a civil war more years than j , an indirect test for H1.

4.2 Econometric issues

Estimating panel data models with limited dependent variable has complications. Forcing fixed-effects by including a set of dummy variables raises the problem of incidental parameters, namely inconsistency in the estimation of fixed effects is ‘transmitted’ to inconsistency in the estimation of the parameters. In order to control for unobservable heterogeneity at country-pair-product level, we will estimate equations 1 and 2 using the specification proposed by Chamberlain (1980), where the conditional likelihood function will take the following form:

$$L = \prod_{ij=1}^N \Pr \left(\frac{X_{ij,1}, \dots, X_{ij,T}}{\sum_{t=1}^T X_{ij,t}} \right). \quad (4)$$

If the conditional probability is different than one, the logit function does not involve the fixed effects parameters and conventional maximum likelihood estimation can be performed. In this case, *conditional logit* will provide unbiased estimates of the parameters, but only for the sub-sample of dyads that switch status during the observed period, this implies that products either never exported or always exported from i to j during the period of analysis will be excluded from the sample of analysis.

Given the different dimensions of our data, it is extremely unlikely that the assumption of independent errors will hold. In most of the studies described in section 2, it is assumed that errors are grouped at the country-pair level, and this structure of cluster is used to adjust inference. Nevertheless, given the network-like structure of trade data, the structure of error’s correlation is indeed more complicated. Taking $u_{xij,t}$ as the standard errors from our estimating

equation, we will have that $E[u_{xij,t}, u_{xik,t}] \neq 0$ and $E[u_{xij,t}, u_{xkj,t}] \neq 0$ for all countries k . Similarly, $E[u_{xij,t}, u_{xjk,t}] \neq 0$ and $E[u_{xij,t}, u_{xki,t}] \neq 0$. We follow Fafchamps and Gubert (2007) and Cameron et al. (2011) in implementing adjusted standard errors by two-way clustering at the country level, that correct for non-independent errors as well as potential heteroscedasticity.⁹

4.3 Main results

In Table 4 we show the estimation of equation 1 for the full sample and taking $Peace_{i,t}$ and $War_{i,t}$ as years since the end of a civil war and years since the beginning of a conflict, respectively. We have include standard errors estimated both clustering at dyadic level and two-way country level. As described in section 3.2, we show estimations for different levels of the thresholds Y_0 and Y_x . β_1 , the parameter associated to $Peace_{i,t}$ (label as Peace1 in the table) is positive in all the thresholds, providing preliminary evidence of an increase of the probability to export a new product the more years a country has been without a conflict. The square value of $Peace_{i,t}$ is negative, then there are diminishing returns of additional years of peace. In terms of the inference, this result is always statistically significant when errors are cluster at dyad level. When two-way cluster errors are used, the result is significant at conventional levels for all the thresholds except $Y_x=5$.

As for the other variables in Table 4, it can be seen that β_2 , the parameter for $War_{i,t}$, switches between negative and positive values and is never significant for the most demanding inference strategy. As for the other controls, the only variables that are significant after using two-way cluster errors are the policy index for the partner (pol2), GDP growth in the partner (gdp2) and bilateral FTA, all of them having a positive effect in new exports.

As for the specification of equation 1 taking $Peace_{i,t}$ as a series of dummies after each year of the end of a conflict (the excluded dummy is years at war), we present the results in a graphical form in figure 5, where we have chosen the specification for $Y_0=3$ and $Y_x=3$. Taking advantage of the characteristics of the logistic function, we present the results as percentage changes in the odd of new exports after each year of war. It can be seen that after 1 to 6 years of a conflict there is an increase in the probability to export, decreasing to levels close to zero afterwards. The effect of each additional year is individually significant when the confidence interval is built using standard errors clustered at dyadic level, but not when two-way clusters at country level are considered. Joint significance is always accepted for the different thresholds. While this specification provide some support for the idea that the first years after the war are exceptional in terms of new exports at the extensive margin, the evidence is not always robust.

Table 5 displays results for the estimation of equation 2, when just the African sample is considered. The magnitude and significance of β_1 are similar to those described in Table 4, and again β_2 is rarely significant. As for β_3 , the coefficient associated to $Peace_{j,t}$, is always positive and generally significant in both inference strategies, except for threshold $Y_x=5$. This result provides preliminary evidence in favor of H2. In the case of β_4 , the coefficient for $War_{j,t}$, is always negative, but never statistically significant.

⁹ We have implemented a STATA code for two-way clustering errors in conditional logit estimation, *clomit2*, available upon request.

For the specification using dummies for each year after the war for $Peace_{j,t}$, we do not find significance for the individual parameters, but, for most specifications, we do find joint significance (results are not reported).

In Table 6 we present the estimation of the parameters in equation 3, where symmetry of explanatory variables is preserved. The results are in line with those of tables 4 and 5. δ_1 , the parameter for $(Peace_{i,t} + Peace_{j,t})$ is always positive and significant when $Y_x \neq 5$, then the probability that i will export a new product to j is higher the more years both countries have been peaceful. Also δ_2 , the parameter for $(Peace_{i,t} - Peace_{j,t})$, is positive and significant when $Y_x \neq 5$, evidence of increase in the probability to export a new product when i has been without a civil war more years than j .

Finally, Tables 7 and 8 present the results of the estimations of equation 1 and 2 using the definition of severe wars (with yearly casualties over 1,000 people) for $Peace_{i,t}$ and $Peace_{j,t}$. In this case, both β_1 and β_3 are never significant, evidence that very destructive wars can have long-term negative consequences in terms of permanently affecting the capacity to export new products.

5. Conclusions

We use bilateral trade data disaggregated in 5,000 products for 47 African countries exporting to 191 potential markets around the world, in a sample period of 1995 to 2009, to test the relationship between an increase in the export at the extensive margin (a new product to a new destination) with the end of a civil war. After controlling for unobserved heterogeneity at the country-pair/product level using conditional logit estimation, we find evidence that the probability of exporting a new product to a new destination is an increasing function of the years at peace. We also find evidence that the first years after the conflict are particularly intense in terms of new exports, but this result is not robust in all specifications.

A second hypothesis that we aimed to test relates to spillover of the peace effect to neighboring countries. We find indeed that the probability of exporting a new product is an increasing function of the years that the destination country has ended a civil war, but not necessarily that this will happen immediately after the end of a conflict.

The results have important policy implications, in terms of pacification as one important determinant of export diversification in African countries and also a relevant mechanism of regional integration.

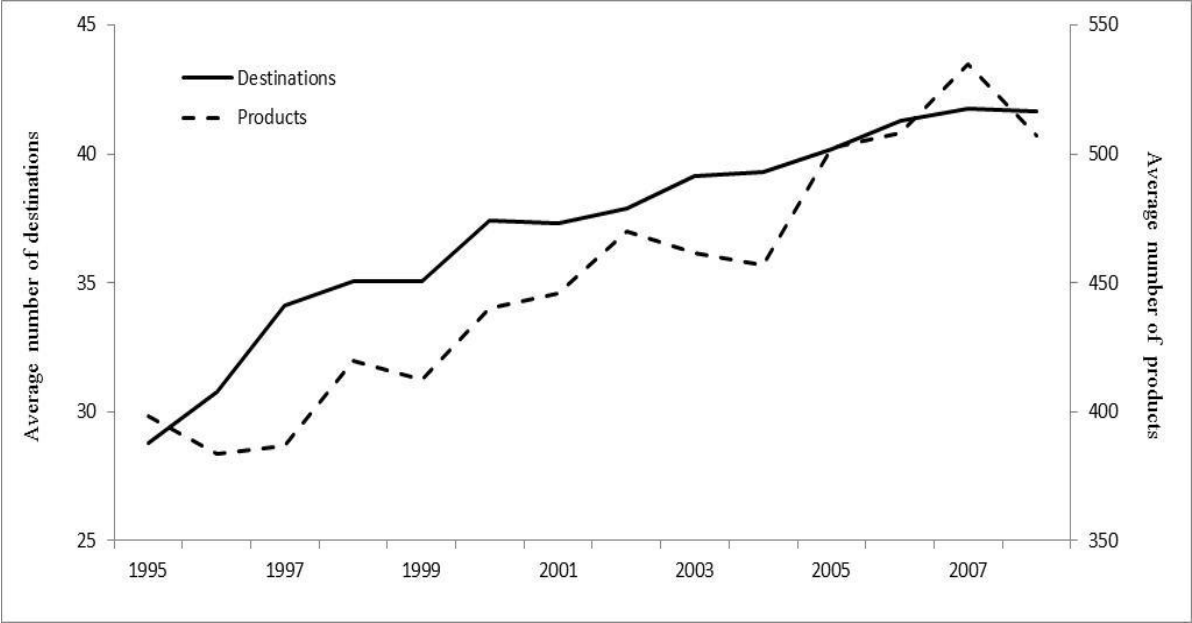
In future stages of this work, we aim to implement a series of extra analysis, including a battery of tests of the estimation specification of the main equations and the definition of our variables of interest. We also attempt to explore the use of non-parametric estimation techniques, as well as performing a series of robustness checks and provide better understanding of the results, in terms of the type of new varieties exported, the kind of conflicts that affect more exports at extensive margin and timing of post-conflict recovery.

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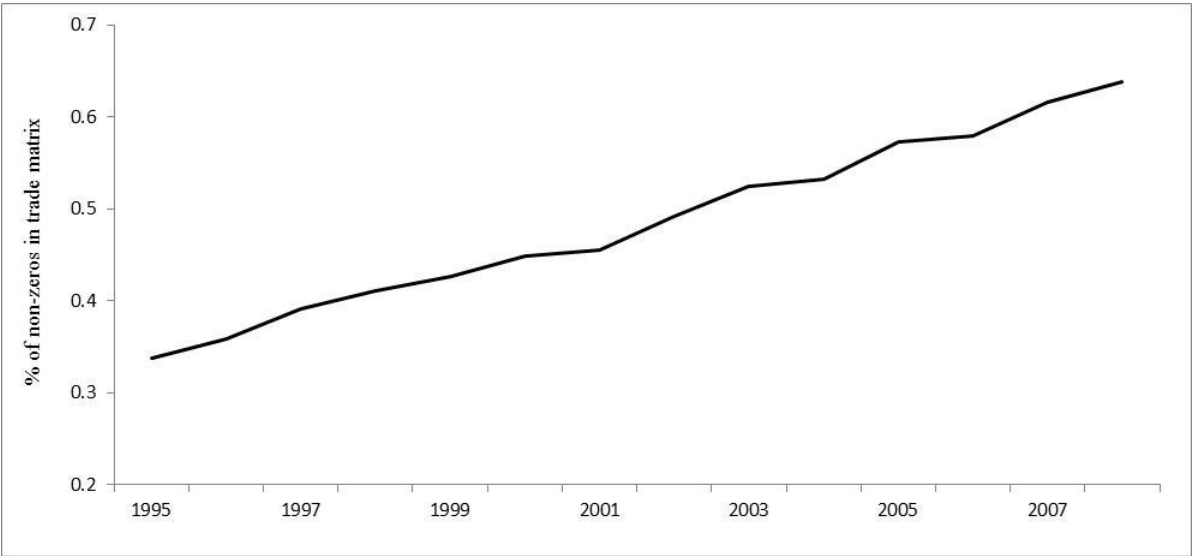
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Figure 1: Evolution of number of destinations and products for Africa’s exports



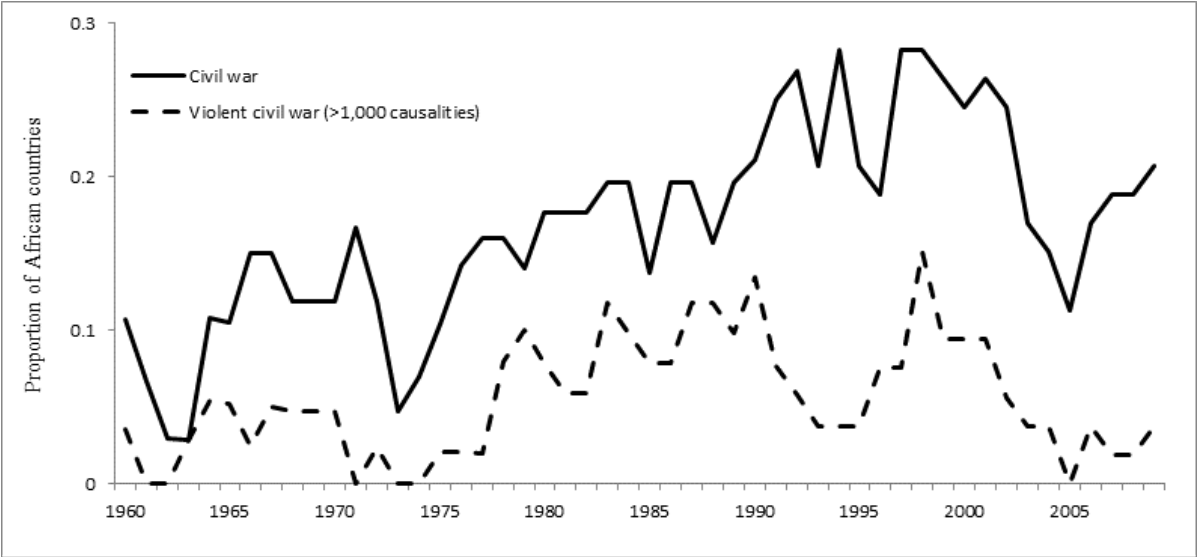
Note: For each, the variable is simple average for the 47 African exporters in our sample.
 Source: Authors’ calculation based on BACI database.

Figure 2: Non-zeros in Africa’s export matrix



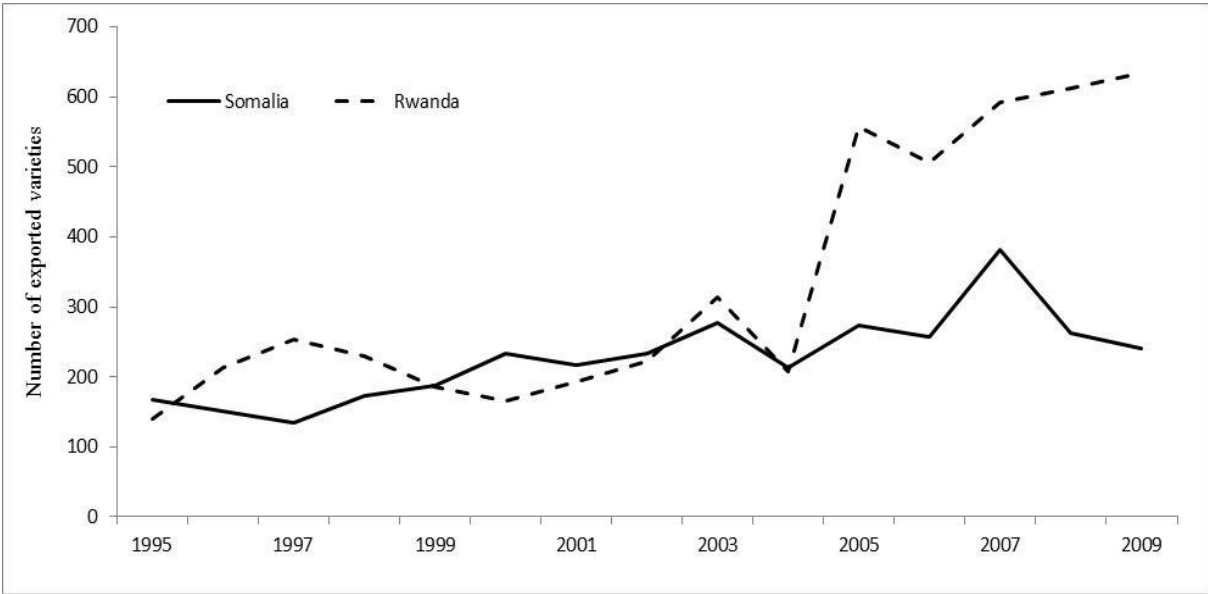
Note: The vertical axis is the proportion of non-zeros in the export matrix of Africa. Each cell in the matrix is at the exporter-destination-product level. Our dataset covers 47 exporters, 191 potential markets and 5015 potential products, therefore 46,935,385 cells.
 Source: Authors’ calculation based on BACI database.

Figure 3: Proportion of African countries with active civil war (1960-2009)



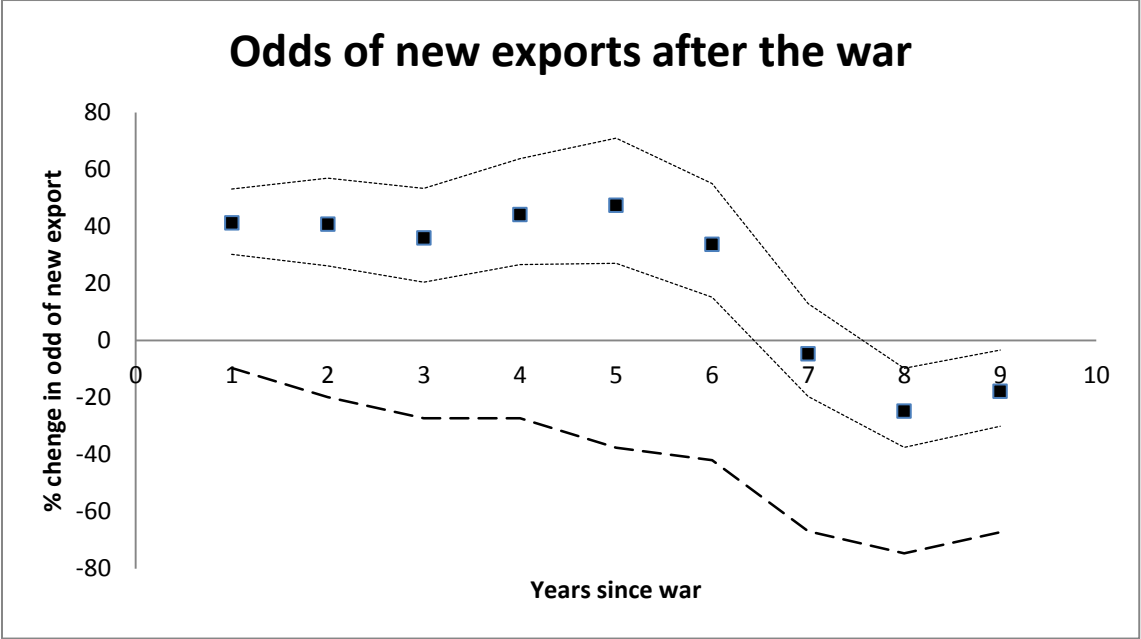
Source: Authors' calculation based on UCDP/PRIO Armed Conflict Dataset.

Figure 4: Number of products exported by Rwanda and Somalia (1995-2009)



Source: Authors' calculation based on BACI database.

Figure 5: Percentage change in the odds of new exports for each year after the war.



Note: 90% confidence interval, dotted line for standard errors clustered at dyad level and dashed line for two-way cluster standard errors at country level (just lower bound shown for the former).

Table 1: Uganda's exports and imports at the extensive margin

year	Uganda's exports			Uganda's imports		
	Burundi	Rwanda	Sudan	Burundi	Rwanda	Sudan
1995	25	288	68	22	33	4
1996	17	301	22	16	51	3
1997	40	329	56	7	63	1
1998	40	327	59	3	77	10
1999	62	272	58	6	21	10
2000	60	144	76	4	20	7
2001	65	280	58	3	34	5
2002	78	362	53	5	36	7
2003	84	453	32	5	48	3
2004	202	198	89	8	14	8
2005	238	646	215	13	83	5
2006	287	731	392	15	63	5
2007	342	847	512	28	133	8
2008	412	981	668	30	136	24
2009	324	1340	36	8	147	1

Source: BACI database.

Table 2: African countries with civil war (1995-2009)

Country	Number of years at civil war	Country	Number of years at civil war
Algeria	15	Guinea	2
Angola	13	Guinea-Bissau	2
Burundi	13	Lesotho	1
Cameroon	1	Liberia	4
Central African Republic	4	Mali	3
Chad	11	Niger	5
Comoros	1	Nigeria	3
Congo	4	Rwanda	7
Cote d'Ivoire	3	Senegal	6
DRC	11	Sierra Leone	6
Djibouti	2	Somalia	8
Egypt	4	Sudan	15
Eritrea	6	Uganda	15
Ethiopia	14		

Source: Authors' calculation based on UCDP/PRIO Armed Conflict Dataset.

Table 3: Example of country-pair product data for the different thresholds

THRESHOLD 1,1					THRESHOLD 5,5				
year	product	iso1	iso2	export	year	product	iso1	iso2	export
1996	10119	AGO	ZMB	0	1995	130231	MAR	ROM	0
1997	10119	AGO	ZMB	1	1996	130231	MAR	ROM	0
1998	10119	AGO	ZMB	0	1997	130231	MAR	ROM	0
1999	10119	AGO	ZMB	0	1998	130231	MAR	ROM	0
2000	10119	AGO	ZMB	0	1999	130231	MAR	ROM	0
2001	10119	AGO	ZMB	0	2000	130231	MAR	ROM	0
2002	10119	AGO	ZMB	0	2001	130231	MAR	ROM	1
2003	10119	AGO	ZMB	0	2002	130231	MAR	ROM	1
2004	10119	AGO	ZMB	0	2003	130231	MAR	ROM	1
2005	10119	AGO	ZMB	0	2004	130231	MAR	ROM	1
2006	10119	AGO	ZMB	0	2005	130231	MAR	ROM	0
2007	10119	AGO	ZMB	0	2006	130231	MAR	ROM	1
					2007	130231	MAR	ROM	0

Note: First panel is data for $Y_0=1$ and $Y_x=1$, second panel for $Y_0=5$ and $Y_x=5$.

Table 4: Effect of years of peace on probability to export a new product (full sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
war1	0.048 (0.011) [0.031]	0.046 (0.014) [0.045]	0.045 (0.015) [0.052]	0.024 (0.015)	-0.016 (0.020) [0.111]	-0.044 (0.023) [0.124]	0.007 (0.018)	-0.045 (0.025) [0.148]	-0.091 (0.030) [0.166]
war1^2	-0.002 (0.001) [0.001]	-0.002 (0.001) [0.002]	-0.002 (0.001) [0.002]	-0.001 (0.001)	-0.000 (0.001) [0.005]	0.001 (0.001) [0.006]	-0.002 (0.001)	-0.000 (0.001) [0.006]	0.001 (0.002) [0.007]
Peace1	0.047 (0.006) [0.012]	0.05 (0.008) [0.017]	0.062 (0.010) [0.023]	0.048 (0.006) [0.017]	0.04 (0.009) [0.024]	0.045 (0.012) [0.032]	0.032 (0.007) [0.023]	0.017 (0.011) [0.030]	0.017 (0.014) [0.038]
Peace1^2	-0.001 (0.000) [0.000]	-0.001 (0.000) [0.000]	-0.001 (0.000) [0.001]	-0.001 (0.000)	-0.001 (0.000) [0.001]	-0.001 (0.000) [0.001]	-0.001 (0.000)	-0.001 (0.000) [0.001]	-0.001 (0.000) [0.001]
gdp1	0.104 (0.035) [0.140]	0.163 (0.081) [0.254]	-0.028 (0.120) [0.362]	-0.027 (0.032)	-0.24 (0.097) [0.377]	-1.007 (0.266) [1.162]	-0.136 (0.043)	-0.525 (0.202) [0.612]	-1.239 (0.399) [1.366]
gdp2	0.274 (0.159) [0.189]	0.325 (0.240) [0.273]	0.292 (0.254) [0.298]	0.193 (0.106)	0.194 (0.141) [0.180]	0.074 (0.140) [0.194]	0.097 (0.068)	0.031 (0.086) [0.139]	-0.186 (0.107) [0.160]
pol1	-0.000 (0.005) [0.011]	0.003 (0.007) [0.012]	0.004 (0.008) [0.015]	0.023 (0.005)	0.032 (0.007) [0.021]	0.032 (0.009) [0.024]	0.056 (0.007)	0.061 (0.010) [0.036]	0.059 (0.013) [0.044]
pol2	0.012 (0.006) [0.009]	0.017 (0.009) [0.009]	0.021 (0.011) [0.009]	0.031 (0.007)	0.036 (0.011) [0.013]	0.04 (0.014) [0.015]	0.048 (0.008)	0.052 (0.012) [0.018]	0.067 (0.015) [0.021]
gdpg1	0.007 (0.002) [0.005]	0.006 (0.003) [0.008]	0.003 (0.004) [0.011]	-0.002 (0.002)	0.002 (0.004) [0.013]	0.001 (0.004) [0.017]	0.008 (0.003)	0.02 (0.004) [0.020]	0.02 (0.005) [0.028]
gdpg2	0.013 (0.003) [0.005]	0.018 (0.004) [0.007]	0.02 (0.006) [0.009]	0.011 (0.003)	0.018 (0.004) [0.007]	0.02 (0.005) [0.009]	0.021 (0.003)	0.029 (0.005) [0.009]	0.034 (0.006) [0.012]
tgdp1	-0.004 (0.001) [0.003]	-0.005 (0.001) [0.004]	-0.008 (0.002) [0.005]	-0.004 (0.001)	-0.005 (0.001) [0.004]	-0.007 (0.002) [0.005]	-0.002 (0.001)	0.001 (0.002) [0.005]	0.004 (0.002) [0.005]
tgdp2	0.001 (0.001) [0.002]	0.001 (0.002) [0.002]	0.000 (0.002) [0.003]	0.003 (0.001)	0.004 (0.002) [0.003]	0.005 (0.003) [0.003]	0.004 (0.001)	0.005 (0.002) [0.003]	0.007 (0.003) [0.004]
FTA	0.241 (0.038) [0.047]	0.395 (0.051) [0.081]	0.533 (0.064) [0.118]	0.436 (0.042)	0.705 (0.057) [0.074]	0.989 (0.077) [0.133]	0.569 (0.045)	0.952 (0.066) [0.052]	1.492 (0.100) [0.092]
intwar	0.304 (0.252) [0.299]	0.297 (0.260) [0.334]	0.178 (0.219) [0.284]	0.209 (0.322)	-0.044 (0.259) [0.299]	-0.214 (0.194) [0.189]	-0.361 (0.258)	-0.517 (0.178) [0.220]	-0.262 (0.238) [0.269]
Yo	1	1	1	3	3	3	5	5	5
Yx	1	3	5	1	3	5	1	3	5
Observations	11,439,685	3,504,420	1,849,951	9,349,331	2,229,543	958,807	7,558,835	1,465,419	520,551
Pseudo R2	0.0566	0.0901	0.121	0.114	0.194	0.272	0.183	0.307	0.434

Standard errors clustered at dyad level in parentheses

Two-way standard errors clustered at country level in square brackets

Table 5: Effect of years of peace on probability to export a new product (only African countries)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
war1	0.034 (0.022) [0.044]	0.038 (0.031) [0.063]	0.051 (0.035) [0.075]	0.041 (0.028) [0.086]	0.008 (0.041) [0.127]	-0.012 (0.050) [0.143]	0.035 (0.032) [0.110]	-0.002 (0.048) [0.157]	-0.067 (0.058) [0.175]
war1^2	0.000 (0.002) [0.002]	-0.000 (0.002) [0.003]	-0.002 (0.003) [0.003]	-0.000 (0.002) [0.003]	0.001 (0.003) [0.005]	0.001 (0.004) [0.007]	-0.001 (0.002) [0.004]	-0.001 (0.003) [0.007]	0.002 (0.004) [0.008]
Peace1	0.063 (0.012) [0.019]	0.066 (0.016) [0.023]	0.08 (0.019) [0.031]	0.062 (0.012) [0.020]	0.054 (0.018) [0.026]	0.059 (0.022) [0.034]	0.042 (0.014) [0.029]	0.028 (0.022) [0.036]	0.029 (0.026) [0.041]
Peace1^2	-0.001 (0.000) [0.000]	-0.001 (0.000) [0.001]	-0.001 (0.000) [0.001]	-0.001 (0.000) [0.001]	-0.001 (0.000) [0.001]	-0.001 (0.001) [0.001]	-0.001 (0.000) [0.001]	-0.001 (0.001) [0.001]	-0.001 (0.001) [0.001]
war2	-0.027 (0.019) [0.015]	-0.030 (0.025) [0.014]	-0.020 (0.030) [.]	-0.014 (0.021) [0.020]	-0.012 (0.029) [0.021]	0.008 (0.041) [0.029]	-0.012 (0.025) [0.029]	-0.017 (0.035) [0.034]	0.006 (0.052) [0.048]
war2^2	0.002 (0.001) [0.001]	0.001 (0.001) [0.001]	0.001 (0.001) [0.001]	0.001 (0.001) [0.001]	0.001 (0.001) [0.001]	0.001 (0.002) [0.001]	0.001 (0.001) [0.001]	0.001 (0.002) [0.001]	0.001 (0.003) [0.002]
endwar2	0.02 (0.009) [0.011]	0.027 (0.012) [0.012]	0.032 (0.015) [0.013]	0.017 (0.008) [0.014]	0.025 (0.010) [0.016]	0.032 (0.013) [0.018]	0.010 (0.009) [0.023]	0.018 (0.011) [0.023]	0.020 (0.014) [0.024]
endwar2^2	0 (0.000) [0.000]	-0.001 (0.000) [0.000]	-0.001 (0.000) [0.000]	0 (0.000) [0.000]	-0.001 (0.000) [0.000]	-0.001 (0.000) [0.001]	0 (0.000) [0.000]	-0.001 (0.000) [0.000]	-0.000 (0.000) [0.001]
Yo	1	1	1	3	3	3	5	5	5
Yx	1	3	5	1	3	5	1	3	5
Observations	4,431,030	1,411,356	748,939	3,649,000	903,452	386,123	2,934,504	585,814	202,315
Pseudo R2	0.0664	0.103	0.136	0.125	0.204	0.282	0.194	0.313	0.437

Standard errors clustered at dyad level in parentheses

Two-way standard errors clustered at country level in square brackets

Table 6: Effect of years of peace on probability to export a new product preserving symmetry (only African countries)

VARIABLES	(1) select	(2) select	(3) select	(4) select	(5) select	(6) select	(7) select	(8) select	(9) select
sum_gdp	0.121 [0.097]	0.220 [0.198]	0.096 [0.313]	0.038 [0.089]	-0.021 [0.225]	-0.555 [0.745]	-0.038 [0.076]	-0.185 [0.239]	-0.880 [0.961]
dif_gdp	0.069 [0.102]	0.183 [0.215]	0.117 [0.345]	0.038 [0.083]	0.060 [0.192]	-0.329 [0.692]	0.008 [0.072]	-0.050 [0.210]	-0.563 [0.929]
sum_pol	-0.000 [0.006]	0.004 [0.004]	0.005 [0.004]	0.027 [0.007]	0.038 [0.010]	0.038 [0.013]	0.069 [0.015]	0.079 [0.018]	0.083 [0.025]
dif_pol	-0.000 [0.008]	0.000 [0.008]	-0.000 [0.010]	0.007 [0.011]	0.011 [0.013]	0.010 [0.014]	0.019 [0.018]	0.023 [0.020]	0.020 [0.025]
sum_gdpg	-0.001 [0.005]	-0.006 [0.007]	-0.012 [0.009]	-0.009 [0.007]	-0.009 [0.011]	-0.011 [0.015]	0.001 [0.009]	0.008 [0.015]	0.010 [0.021]
dif_gdpg	-0.001 [0.005]	-0.001 [0.007]	-0.002 [0.008]	-0.004 [0.007]	-0.002 [0.011]	-0.000 [0.015]	-0.002 [0.010]	0.006 [0.017]	0.008 [0.024]
sum_tgdp	-0.002 [0.002]	-0.003 [0.003]	-0.004 [0.004]	-0.001 [0.002]	-0.001 [0.003]	-0.000 [0.003]	0.000 [0.003]	0.003 [0.004]	0.008 [0.004]
dif_tgdp	-0.002 [0.002]	-0.002 [0.003]	-0.002 [0.004]	-0.003 [0.003]	-0.003 [0.003]	-0.004 [0.004]	-0.003 [0.004]	-0.002 [0.004]	-0.001 [0.004]
FTA	0.302 [0.080]	0.518 [0.087]	0.708 [0.118]	0.486 [0.087]	0.803 [0.100]	1.118 [0.139]	0.633 [0.078]	1.016 [0.084]	1.542 [0.147]
intwar	0.261 [0.314]	0.196 [0.337]	0.009 [0.295]	0.147 [0.388]	-0.192 [0.322]	-0.486 [0.263]	-0.384 [0.308]	-0.61 [0.274]	-0.525 [0.391]
sum_war	0.018 [0.017]	0.010 [0.019]	0.001 [0.019]	0.016 [0.019]	0.009 [0.026]	0.001 [0.032]	0.012 [0.021]	-0.002 [0.028]	-0.010 [0.036]
dif_war	0.009 [0.016]	0.010 [0.020]	0.007 [0.022]	0.005 [0.021]	-0.004 [0.028]	-0.017 [0.033]	-0.001 [0.022]	-0.018 [0.028]	-0.038 [0.035]
sum_peace	0.012 [0.002]	0.011 [0.003]	0.01 [0.003]	0.009 [0.002]	0.007 [0.003]	0.006 [0.004]	0.001 [0.007]	-0.002 [0.007]	-0.004 [0.008]
dif_peace	0.008 [0.003]	0.01 [0.004]	0.011 [0.005]	0.007 [0.004]	0.007 [0.004]	0.006 [0.005]	0.004 [0.008]	0.002 [0.008]	-0.005 [0.008]
Yo	1	1	1	3	3	3	5	5	5
Yx	1	3	5	1	3	5	1	3	5
Observations	4,431,030	1,411,356	748,939	3,649,000	903,452	386,123	2,934,504	585,814	202,315

Two-way standard errors clustered at country level in square brackets

Table 7: Effect of years of peace after severe wars on probability to export a new product (full sample)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
war1	0.202	0.177	0.199	0.206	0.086	0.045	0.065	-0.050	-0.154
	[0.085]	[0.121]	[0.124]	[0.128]	[0.151]	[0.156]	[0.201]	[0.224]	[0.219]
war1^2	-0.019	-0.013	-0.013	-0.015	0.001	0.008	0.003	0.017	0.030
	[0.009]	[0.012]	[0.012]	[0.014]	[0.015]	[0.015]	[0.021]	[0.022]	[0.022]
peace1	0.023	0.010	0.012	0.015	-0.010	-0.015	0.019	-0.021	-0.044
	[0.016]	[0.021]	[0.024]	[0.025]	[0.030]	[0.035]	[0.029]	[0.038]	[0.047]
peace1^2	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.001]	[0.000]	[0.001]	[0.001]
Yo	1	1	1	3	3	3	5	5	5
Yx	1	3	5	1	3	5	1	3	5
Observation	11,439,685	3,504,420	1,849,951	9,349,331	2,229,543	958,807	7,558,835	1,465,419	520,551
Pseudo R2	0.0566	0.0901	0.121	0.114	0.194	0.272	0.183	0.307	0.434

Two-way standard errors clustered at country level in square brackets

Table 8: Effect of years of peace after severe wars on probability to export a new product (only African countries)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
war1	0.209	0.149	0.258	0.237	0.064	0.156	0.143	0.086	0.106
	[0.078]	[0.086]	[0.083]	[0.119]	[0.149]	[0.183]	[0.161]	[0.195]	[0.219]
war1^2	-0.024	-0.016	-0.026	-0.023	-0.004	-0.012	-0.010	-0.004	-0.005
	[0.008]	[0.008]	[0.007]	[0.011]	[0.014]	[0.018]	[0.015]	[0.020]	[0.023]
peace1	0.06	0.052	0.066	0.05	0.035	0.036	0.043	0.012	-0.001
	[0.021]	[0.024]	[0.027]	[0.024]	[0.027]	[0.035]	[0.027]	[0.035]	[0.047]
peace1^2	-0.001	-0.001	-0.002	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]	[0.000]	[0.001]	[0.001]
war2	-0.046	-0.047	-0.023	-0.045	-0.021	0.035	-0.139	-0.144	-0.134
	[0.050]	[0.060]	[0.072]	[0.074]	[0.083]	[0.103]	[0.116]	[0.129]	[0.181]
war2^2	-0.001	-0.000	-0.001	0.002	-0.001	-0.005	0.014	0.014	0.016
	[0.005]	[0.005]	[0.007]	[0.007]	[0.007]	[0.008]	[0.012]	[0.012]	[0.017]
peace2	0.005	0.006	0.005	-0.011	-0.012	-0.012	-0.014	-0.021	-0.037
	[0.014]	[0.016]	[0.019]	[0.022]	[0.022]	[0.021]	[0.030]	[0.034]	[0.039]
peace2^2	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Yo	1	1	1	3	3	3	5	5	5
Yx	1	3	5	1	3	5	1	3	5
Observations	4,431,030	1,411,356	748,939	3,649,000	903,452	386,123	2,934,504	585,814	202,315
Pseudo R2	0.0566	0.0901	0.121	0.114	0.194	0.272	0.183	0.307	0.434

Two-way standard errors clustered at country level in square brackets