Refugees and "Missing" Arms Trade

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Abstract: Millions of people are killed or wounded by small arms each year. The aim of this study is to enhance our understanding of "missing" arms trade across countries. We proceed in two steps. First, we measure the extent of missing arms trade on the basis of official trade statistics. We construct a measure of the gap in arms trade based on the discrepancy between the value of arms exports reported by the exporting country and the value of arms imports recorded by the importing country. Second, we uncover the link between refugee movements and missing arms trade. Refugee flows, by reducing the ability of the receiving country to patrol its borders and its customs, are found to be correlated with arms smuggling across the border into the importing country. A series of robustness checks confirm the above findings.

JEL codes: F14, K42, O15.

Keywords: international trade, refugees, arms.

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1. Introduction

Millions of people are killed or wounded by small arms each year. According to a report by the UK's Department of International Development (2003), small arms and light weapons act as a "multiplier of violence": the availability of arms escalates civil wars, puts at risk people's lives and instigates violence. The aim of this study is to enhance our understanding of missing arms trade across countries. We proceed in two steps: first, we measure the extent of missing arms trade on the basis of official trade statistics. We construct a measure of the gap in arms trade based on the discrepancy between the value of arms exports reported by the exporting country and the value of arms imports recorded by the importing country. Second, we show that missing arms trade is related to the degree of strain experienced by customs and borders on the importer side.

In order to measure missing arms trade, we adopt a measure introduced by Fisman and Wei (2004) and applied by Javorcik and Narciso (2008) to measure tariff evasion. Using product level trade data between Hong Kong and China in 1998, Fisman and Wei show that the extent of missing trade is positively related to the tariff rate, thus suggesting a positive relationship between tariff evasion and tariff rates. Javorcik and Narciso (2008) extend Fisman and Wei's findings, by demonstrating that the responsiveness of the trade gap to the tariff rate is higher for differentiated products, *i.e.* those products whose value is more difficult to assess. Yang (2008a) provides evidence that pre-shipment inspections of imports can increase import duty collection, although partial pre-shipment inspection programs may induce importers to seek alternative duty-avoidance methods (Yang, 2008b). In a recent paper Fisman and Wei (2009) analyze the smuggling of antiques and cultural products and provide evidence of the existence of a correlation between the level of corruption of the exporting country and the level of art smuggling. This relation is greater for countries that are well endowed in export restricted cultural properties.

This paper tries to answer the following question: what happens if we consider a product which is valuable and potentially dangerous like small arms and light weapons? We expect that the extent of missing trade in arms will depend on factors other than the tariff rate, for example, on the level of strain experience at the border. We provide evidence that refugee flows, by reducing the ability of the receiving country to patrol its borders and its customs, may ultimately lead to an increase in missing trade in arms across the border into the importing country.

Illegal arms trade is still an unexplored field, due to the difficulty of measuring the extent of it. In a recent paper, DellaVigna and La Ferrara (2010) analyze illegal arms trade

by focusing on eight countries under UN embargoes. The authors propose a method of detecting illegal arms trade which relies on stock prices fluctuations around 18 events that increase or decrease the extent of conflict hostilities. If the arms producing company is trading illegally, then its stock price should reflect the increase or decrease in the demand for illegal arms. The authors do not find any evidence overall, apart from those companies based in countries with a lower governance level.

This paper also contributes to the emerging literature on refugees and civil wars. Salehyan and Gleditsch (2006) argue that refugee movements increase the likelihood of a civil conflict in the host country. The authors suggest that refugee flows might expand rebels' networks and are likely to be responsible for the spread of arms in the receiving country. Along similar lines, Buhaug and Gleditsch (2008) analyze the spatial pattern of civil war and investigate the extent of contagion effects across countries. The authors show that civil war contagion is likely to take place in situations where there exist ethnic links with groups in a neighboring country. Refugee movements have also been found to be one of the most relevant factors in the spread of malaria. Montalvo and Reynal-Querol (2007) provide evidence of a positive relationship between refugees coming from tropical countries and the incidence of malaria in refugee receiving countries. The authors conclude that preventing civil wars and therefore limiting forced population movements will help reducing malaria transmission as well.

We adopt a similar measure as in Fisman and Wei (2004) in order to assess the extent of missing arms trade. We create a bilateral dataset reporting the value of small arms exports and the value of small arms imports for all available country pairs. We use official arms trade figures to build a measure of missing trade in arms for each country pair, by year. The trade gap in arms trade is measured as the difference between the value of arms exports from country *i* to country *j*, as reported by country *i*, minus the value of imports from country *i* to country *j* as reported by country *j*. As we are interested in analyzing the route followed by refugees, we consider the exporting country to be the country from which refugees originate from, and the importing country to be the refugees' host country. The findings support our prior: the presence of refugees indirectly decreases the ability of the receiving country to patrol and control its own customs. This ultimately leads to an increase in arms illegally smuggled into the importing country. These results are robust also to controlling for the governance and democracy levels of both the importing and exporting country.

We conduct a series of robustness checks. A stable long term refugee population may have different implications than a sudden inflow. Therefore we focus on the impact of a change in the number of refugees on missing arms trade: refugee flows are found to have a positive and statistically significant impact on changes in the arms trade gap. Next, we analyze the role of borders, by focusing on landlocked countries and on the length of the border between each country pair, the rationale being that longer borders are more difficult to patrol. We provide evidence that the impact of refugee movements on arms trade gap is greater the longer the border and in landlocked countries. The robustness checks confirm our results and rule out other possible concurrent driving factors, like embargoes, tariff evasion and exchange rate fluctuations, which might affect missing trade. Finally, we test our results using plants as a placebo good. We conclude that, given the nature of small arms and light weapons, greater attention should be paid to customs functioning in periods of distress.

This study is structured as follows. Section 2 presents the data. Section 3 explores the relationship between refugee movements and "missing" arms trade. The robustness checks are presented in Section 4. Finally, Section 5 concludes.

2. Data

There exist two main sources of data on arms transfers: national official exports reports and official trade statistics. However, according to the Small Arms Survey (2004) "*National export reports, which are published mainly for reasons of transparency, are at time less transparent on arms trade than international customs data, which were not designed as an arms trade transparency device*". [1] About 30% of UN members lack any regulation on arms exports, while approximately 10% of UN members provide official reports on small arms exports and exports licenses, although the presentation of the data vary very significantly. Most countries require the parties involved in arms transactions to apply for an import/export license and in some cases to apply for a use and end-user (government or private) license. This information should be recorded by national authorities. Licenses, however, do not always act as a reliable source of information. Often the quantity indicated on the license is different from the quantity actually exported, and there might not be any record on whether the delivery has actually taken place. Besides, some countries allow for open licenses, which do not report any information regarding the quantity, the actual delivery and the end-user (Holtom, 2008).

[1] Small Arms Survey (2004), page 101.

Our main data source for arms flows is the World Bank's World Integrated Trade Solution (WITS) database. WITS reports bilateral trade flows data on the basis of UNCTAD's COMTRADE. Customs data present some shortcomings as well: countries may not report the destination of their arms exports or they report the value, but not the quantity of small arms imported or exported. However, according to the Small Arms Survey (2002) the great advantage of using customs data relies on the comparability across countries. We collect data on bilateral exports and imports of small arms, category 93 according to the 6-digit Harmonized System (1988/92), for all countries and all years available.[2] Trade data are expressed in thousands of current US dollars. UNCTAD collects the data from local authorities either in current US dollars or in local currency. Where trade values are expressed in local currency, a monthly exchange rate is applied to convert values into US dollars. We use the official arms trade figures to construct a measure of missing arms trade for each available country pair, by year.[3]

Our measure of missing arms trade is measured as the difference between the value of small arm *a* exported from country *i* to country *j*, as reported by country *i*, minus the value of small arm *a* imported from country *i* to country *j* as reported by country *j*. In some cases imports and exports are not matched, *i.e.* the exporting country might report exports of a certain arm category, while the importing country does not report any value for that specific category. In this case we input zero import value for the missing category, thus assuming that complete smuggling takes place. Similarly, in case of a missing value of exports for a certain category and in presence of import value, we impose zero for the missing export category. As we are interested in analyzing the route followed by refugees, we consider the exporting country to be the country refugees originate from, and the importing country to be the refugees' host country. The missing arms trade measure is defined as follows:

$$Trade\ Gap\ in\ Arms\ Trade_{aijt} = \ln\left(Exports_{aijt} + 1\right) - \ln\left(Imports_{aijt} + 1\right)$$

In the absence of arms smuggling, the difference between the value of exports, as reported by the exporter, and the value of imports, as reported by the importer, should be negative. In fact, import values include the cost of freight and insurance, while export figures are free on board (Javorcik and Narciso, 2008). As shown in the middle panel of Table 1, the mean discrepancy over the sample is indeed negative, *i.e.* the value of arms exports reported by the exporter is smaller than the value of arms imports recorded by the importer.

Some concerns might arise regarding the reliability of export values: countries from which refugees migrate from are likely to be involved in a conflict. This might affect the

[2] See Data Appendix for details.
[3] Note that military aid does not pass through customs (Small Arms Survey, 2002).

extent to which exports are recorded. We tackle this issue in three ways. First, we control for the quality of democracy in both the sending and the receiving country, by using the Gastil index which measures political rights and civil liberties. Second, we control whether the sending or the receiving country are under UN or EU embargo. Finally, we argue that we would expect a country in turmoil, as the sending country is likely to be, to declare a *lower* value of exports, which would ultimately lead to a lower arms trade gap.

According to Small Arms Survey (2003), about 98 countries in the world have the capacity of producing small arms and light weapons, or ammunitions. The majority of arms producers are located in Europe, the US, followed by Asia, South America, Middle East, and Sub Saharan Africa. The top arms exporters in our sample are Germany, US, Japan, United Kingdom, Saudi Arabia, the latter being mainly involved in transfers due to servicing and repairs. The top arms importers are US, Italy, France, and Germany.

Table 1: Summary statistics

Variable	*Mean*	*Min*	*Max*
Refugees	13,252	1	591,754
Refugees from Neighboring countries	4,259	0	350,104
Arms Trade Gap (value)	-0.751	-11.578	11.423
Arms Exports ('000$)	447.990	0	151,336
Arms Imports ('000$)	560.511	0	144,601
Sending countries (N=148)			
GDP per capita (2000US$)	7,719	80	38,551
Population (000s)	64,382	71.212	1,296,157
Gastil Index	3.17	1	7
Corruption Perception Index	4.95	0.69	10
Receiving countries (N=121)			
GDP per capita (2000US$)	9,127	118	38,551
Population (000s)	44,834.53	273.7	1,288,401
Gastil Index	2.88	1	7
Corruption Perception Index	5.12	0.4	10

Our data source for refugee data is the UN Refugee agency (UNHCR). UNHCR collects data from host countries on the number of refugees, by country of origin. According to UNHCR "*refugees include persons recognized under the 1951 Convention relating to the Status of Refugees, its 1967 Protocol, the 1969 OAU Convention Governing the Specific Aspects of Refugee Problems in Africa, those recognized in accordance with the UNHCR Statute, persons granted complementary forms of protection and persons granted temporary*

protection".[4] We create a bilateral dataset reporting the number of refugees yearly present in each country, by country of origin, for all available country pairs. The data set contains many missing observations and particular attention has been paid on how to treat the missing data. A missing observation can indeed be interpreted as a true missing or as a zero, *i.e.* no refugee originating from a specific country. We drop the missing observations in our analysis, however we also perform two robustness checks: first, we replicate the empirical analysis by replacing missing observations with zeros; second, we aggregate over time and we conduct our empirical analysis using five-year averages instead of yearly data.[5]

Our final data set covers the period 1988 to 2004 and it includes 121 receiving countries and 148 sending countries. The summary statistics for refugees are reported in upper panel of Table 1. The mean number of refugees in refugee receiving countries and territories is 13,505, of which about 4,341 come from neighboring countries. United States, Germany, Serbia and Montenegro, India, Malaysia, and Sweden appear to be the largest refugee receivers in our sample. However, when we focus on the largest refugee receivers from neighboring countries, the main receivers are Bosnia Herzegovina, Togo, India, Russia, Gabon, Kazakhstan, Kenya, Papua New Guinea, Croatia, Georgia, and Greece. Refugees mainly originate from Bosnia Herzegovina, Croatia, Serbia and Montenegro, China, Turkey, and Sri Lanka. The top senders to neighboring countries are: Bosnia Herzegovina, China, Turkey, Serbia and Montenegro, Azerbaijan, Togo, and Sudan.

Finally, the lower panel of Table 1 presents the summary statistics of the control variables, *i.e.* real GDP per capita at constant 2000 US$ and population from the World Development Indicators; the Gastil index of democracy compiled by Freedom House; the governance level, measured by the Corruption Perception Index (CPI). Sending countries tend to have a lower GDP per capita, a lower level of democracy and a higher level of corruption than receiving countries.

3. Refugees and missing arms trade

The presence of refugees may put pressure at the border and in customs, therefore reducing the ability of the receiving country to police and patrol its borders and its customs, thus indirectly leading to an increase in the illegal arms smuggling into the receiving country. In this section and in the following one we provide evidence that missing trade in arms is higher the larger the presence of refugees. To this end, we focus on the impact of

[4] UNCHR Statistical Yearbook (2006), page 2.
[5] Results are available from the author upon request.

refugees originating from *neighboring* countries, rather than the total number of refugees present in a country. Table 2 reports the result of a simple exercise. We split the data on arms between countries with refugees coming from neighboring countries and states without refugees from neighboring countries. Both the mean and the median of arms trade gap are larger for those countries receiving refugees from neighboring countries and the difference is statistically different from zero.

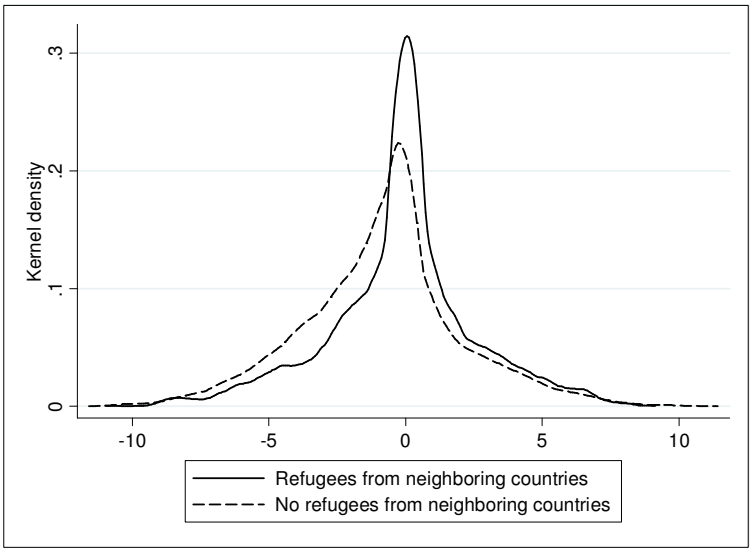
Table 2: Arms trade gap and refugees from neighboring countries

No Refugees from Neighboring countries (1)	Refugees from Neighboring countries (2)	Difference (2)-(1)
Mean Arms Trade Gap		
-0.8384 [16,325 obs.]	-.1477 [2,355 obs.]	0.6907***
Median Arms Trade Gap		
-0.6710 [16,325 obs.]	0.0015 [2,355 obs.]	0.5573***

*** p<0.01.

Figure 1 presents the kernel density of arms trade gap for the two samples. The dash line represents the kernel density of arms trade gap for those countries without refugees from neighboring states, while the solid line represents the kernel density for countries with refugees from neighboring nations. Missing arms trade appears to be larger for countries hosting refugees from neighboring nations.

Figure 1: Arms trade gap and refugees from neighboring countries



Next, we estimate the model of arms trade gap as a function of the number of refugees.[6] The basic specification is as follows:

$$Arms\ Trade\ Gap_{aijt} = \beta_1 REF_{ijt} + \beta_2 N_{ij} + \beta_3 REF_{ijt} * N_{ij} + +\gamma_1 \boldsymbol{X}_{it} + \gamma_2 \boldsymbol{X}_{jt} + \delta_i + \vartheta_j + \lambda_t + \varepsilon_{aijt} \qquad (1)$$

where REF_{ijt} is the natural logarithm of the number of refugees (plus 1) from country i to country j at time t; N_{ij} is the contiguity dummy variable taking value 1 if the two countries are adjacent, and 0 otherwise; $\boldsymbol{X}_{it}$ represents the set of controls for the sending country i at time t, while $\boldsymbol{X}_{jt}$ is the set of controls for the receiving country j at time t. Among the controls, we consider the democracy level, measured by the Gastil index; the governance level, measured by the Corruption Perception Index (CPI); the natural logarithm of the real GDP per capita at constant 2000 US$; and the natural logarithm of population. Finally, δ_i represents exporter fixed effects, ϑ_j represents importer fixed effects and λ_t is the set of time dummies. We differentiate the impact of refugees on missing arms trade. Countries with better institutional set-ups and better quality of democracy are more likely to host refugees. Therefore we expect these countries to report their arm imports in a more accurate way, *i.e.* we envisage a smaller arms trade gap. On the other hand, refugees from neighboring countries are more likely to negatively affect policing of the border, thus leading to more arms smuggling and a larger arms trade gap.

The results, reported in Table 3, are consistent with our prior. Column 1 presents the basic specification which includes the number of refugees, the number of refugees interacted with the contiguity dummy variable, the contiguity dummy variable, real GDP per capita for both the sending and the receiving country, countries' size as measured by population, exporter and importer fixed effects and time dummies. Forced population movements from neighboring countries have a positive and statistically significant impact, while the number of refugees is found to affect missing arms trade in a negative and statistically significant way. The marginal effect for refugees from neighboring countries is reported in the lower part of the table and is statistically significant at the 1% level. These findings support our prior: the presence of refugees originating from a neighboring country may reduce the ability of the host country to police its borders, thus leading to an increase of arms smuggled inside the country. A 1% increase in the number of refugees from adjacent countries leads to an increase of 7.9% in arms smuggling.

[6] Due to the presence of large outliers, the top and bottom 1% observations are dropped from the sample.

The measure of missing arms trade crucially depends on the quality of the institutions, both on the exporter and importer side. Therefore, in column 2 and 3 we include two measures of governance. Column 2 presents the results of the specification which includes the level of corruption. Corruption is measured according to the Corruption Perception Index (CPI) produced by Transparency International. The CPI index is constructed on a "poll of polls", based on business surveys and interviews to experts. Higher values of the CPI are associated with less corrupted countries. The index is time-varying and it is available starting from 1996. Refugees from neighboring countries have still a positive and statistically significant impact on missing arms trade. The corruption measure does not have a statistically significant impact on arms trade gap for either the sending or the receiving country.

Next, we control for the democracy level in the importing and exporting country (column 3). Our measure of democracy is the Gastil Index of Civil Liberties and Political Rights compiled by Freedom House. The Gastil index takes values between 1 and 7, where lower values are associated with better democracies. Again, the number of refugees from neighboring countries has a positive and statistically significant impact on the level of the trade gap in arms flows.

Table 3: Arms trade gap and refugees

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Arms Trade Gap					
REF*Contiguity dummy	0.133***	0.106***	0.126***	0.145***	0.122***	0.138***
	[0.026]	[0.029]	[0.026]	[0.028]	[0.031]	[0.028]
REF	-0.053***	-0.058***	-0.052***	-0.060***	-0.058***	-0.058***
	[0.013]	[0.015]	[0.013]	[0.015]	[0.018]	[0.016]
CPI – Receiving country		0.035			0.053	
		[0.071]			[0.073]	
CPI – Sending country		0.086			0.076	
		[0.053]			[0.054]	
Gastil Index - Receiving country			-0.075			-0.171
			[0.104]			[0.108]
Gastil Index - Sending country			0.047			0.046
			[0.046]			[0.046]
Marginal effect	0.079	0.049	0.074	0.084	0.064	0.080
F-value	10.67	3.11	9.26	10.56	4.37	9.36
P-value	0.001	0.078	0.002	0.001	0.037	0.002
Sample	All	All	All	Reduced	Reduced	Reduced
Observations	18132	14988	17829	17157	14077	16885
Adjusted R-squared	0.216	0.208	0.214	0.217	0.210	0.215

Each specification includes: Log(Real GDP pc) - receiving country, Log(Real GDP pc) - sending country, Log(population) - receiving country, Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects.
Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Some countries in our sample receive no refugees at all. In order to focus on the actual impact of refugees on arms smuggling into the receiving country, we replicate the same specification above for a reduced sample, which includes only the refugees-receiving countries. The results, reported in columns 3 to 5 of Table 3, hold also for the reduced sample. Again, the marginal effects of refugee presence from neighboring countries are positive and statistically significant as shown in the lower panel of Table 3.

4. Robustness checks

In this section, we discuss a series of robustness checks. First, we consider a specification in first differences. Then we focus on the role of borders. If the presence of refugees does affect the ability of a country to patrol its borders, we would expect the length of the border or whether the country is landlocked to affect the extent of missing arms trade. We also test for other possible concurrent driving factors, like embargoes, tariff evasion and exchange rate fluctuations, which might affect missing arms trade. Finally, we examine whether the same results hold for a placebo good. All of these robustness checks confirm that refugee movements are positively related to arms smuggling into the refugee receiving country.

4.1 First differences

The first robustness check consists of estimating the model in first differences. We analyze the impact of a *change* in our measure of arms trade gap as a function of the *change* in the number of refugees coming from neighboring countries. We expect that a stable long term refugee population may have different implications than a sudden inflow, therefore an increase in refugee flows from neighboring countries should lead to a positive change in the arms trade gap. Column 1 of Table 4 reports the results of the basic specification in first differences. Refugee flows from neighboring countries do appear to have a statistically significant impact on the change in the arms trade gap, while no effect is found for refugees flows originating from non-neighboring countries. The same results hold when we control for the change in the democracy index for both the sending and receiving country. Excluding those countries that do not face any change in the number of refugees over time does not affect the results (columns 3 and 4).

Table 4: Arms trade gap and refugees. Specification in first differences

VARIABLES	(1)	(2)	(3)	(4)
	Δ *Arms Trade Gap*			
Δ REF*Contiguity dummy	0.399**	0.411**	0.492***	0.505***
	[0.169]	[0.169]	[0.182]	[0.182]
Δ REF	-0.054	-0.064	-0.077	-0.087
	[0.083]	[0.084]	[0.088]	[0.088]
Δ Gastil Index - Receiving country		-0.041		-0.049
		[0.087]		[0.098]
Δ Gastil Index - Sending country		0.220		0.222
		[0.150]		[0.232]
Marginal Effect	0.344	0.346	0.414	0.417
F-value	5.54	5.61	7.21	7.32
P-value	0.019	0.018	0.007	0.007
Sample	All	All	Reduced	Reduced
Observations	8813	8693	6284	6207
Adjusted R-squared	0.002	0.002	0.008	0.007

Each specification includes: Δ Log(Real GDP pc) - receiving country, Δ Log(Real GDP pc) - sending country, Δ Log(population) - receiving country, Δ Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects.
Robust standard errors are listed in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

4.2 The role of borders

In order to analyze what happens at the border, we need more disaggregate information on customs, immigration and detailed information on arms transportation. Unfortunately detailed customs information is not available for the large set of countries in our sample. By focusing on refugees from neighboring countries, we are implicitly assuming that refugees reach the destination country by land. Cases of refugees reaching the destination country by boat, as in the case of Malta, Italy and Yemen, are therefore ruled out. A similar issue arises for the way arms are transported. It is important to remark that the arms into consideration are small arms and light weapons, which, given the size, are more easily smuggled. In order to understand whether the presence of refugees is really interfering with customs controls, we proceed in two steps. First, we focus on landlocked countries, therefore allowing for the possibility that arms are transported by lorry or by airplane and excluding shipment by boat. Second, we control for the length of the border between each country pair. Columns 1 and 2 of Table 5 show the results for the specification

which controls for landlocked refugee receiving countries. The impact of refugees on missing arms trade is larger when the receiving country is landlocked. This result holds also when we control for the democracy index of both the receiving and the sending country (column 2).

Table 5: Arms trade gap, refugees and the role of borders

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	*Arms Trade Gap*				Δ *Arms Trade Gap*			
REF	-0.041***	-0.039***	-0.052***	-0.051***				
	[0.013]	[0.013]	[0.013]	[0.013]				
REF*	0.065***	0.056**						
Landlocked	[0.025]	[0.026]						
Gastil Index		-0.063		-0.074				
Receiving country		[0.103]		[0.104]				
Gastil Index		0.055		0.046				
Sending country		[0.046]		[0.046]				
REF*Length			0.017***	0.016***				
of border			[0.004]	[0.004]				
Δ REF					-0.046	-0.051	-0.042	-0.052
					[0.082]	[0.082]	[0.083]	[0.083]
Δ REF*					0.334*	0.319*		
Landlocked					[0.193]	[0.194]		
Δ Gastil Index						0.228		0.220
Receiving country						[0.151]		[0.150]
Δ Gastil Index						-0.036		-0.040
Sending country						[0.086]		[0.087]
Δ REF*Length							0.045**	0.046**
of border							[0.022]	[0.022]
Observations	18132	17829	18132	17829	8813	8693	8813	8693
Adjusted R-squared	0.215	0.213	0.216	0.214	0.002	0.002	0.002	0.002

Specifications in columns 1 and 2 include: Log(Real GDP pc) - receiving country, Log(Real GDP pc) - sending country, Log(population) - receiving country, Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects. Specifications in columns 3 and 4 include: Δ Log(Real GDP pc) - receiving country, Δ Log(Real GDP pc) - sending country, Δ Log(population) - receiving country, Δ Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects.
Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Columns 3 and 4 report the results of the specification which includes an interaction term between the number of refugees and the length of the border measured in kilometres for

each country pair.[7] We expect that the longer the border, the more difficult policing, the greater the impact of refugees on arms smuggling. The results support our prior (column 3). A similar effect is found when we control for the level of democracy (column 4). The estimated coefficient of the interaction between border length and refugees is positive and statistically significant at the 1% level.

In line with the robustness check reported in Section 4.1, columns 5 to 8 present the results for the role of borders in the first differences specification. The estimation results confirm our findings: the impact of an increase in forced population movement on the change in the arms trade gap is larger for landlocked countries and for countries sharing longer borders.

4.3 Three scenarios

The evidence so far points in the direction of a relationship between refugee flows and missing trade in arms. The aim of this section is to answer the following question: why does the presence of refugees lead to a larger trade gap in small arms? We could think of three possible scenarios. In the first scenario refugees demand arms with the intention to return to their country of origin to conquer it back. According to the second scenario, which is the one we have put forward in the previous sections, refugee flows make the borders porous and therefore facilitate arms smuggling. Finally, in the third scenario the presence of refugees creates informal networks and hence facilitates arms smuggling. The aim of this section is to test which of the three different scenarios is supported by the data.

Table 6 reports the estimation results of the first test. If the first scenario holds, *i.e.* refugees demand arms to take back their country, we should observe that what matters is the overall presence of refugees, rather than the number of refugees from the arms exporting country. Therefore, the main regressor in columns 1 and 2 is the natural logarithm of the *total* number of refugees in the importing country (plus 1), independently of the refugees' country of origin. The estimated coefficient of the variable *Total Refugees* is not statistically significant either in the basic specification (column 1) or in the one which includes the Gastil Index among the controls (column 2). Similar results hold when we consider the specification in first differences, presented in columns 3 and 4. We do not find any evidence supporting the first scenario: the change in the total number of refugees present in a country does not have a statistically significant impact on the change in the arms trade gap.

[7] Source: CIA Factbook.

Table 6: Arms trade gap and total number of refugees

VARIABLES	(1)	(2)	(3)	(4)
	Arms Trade Gap		Δ *Arms Trade Gap*	
Total Refugees	0.012	0.008		
	[0.016]	[0.016]		
Gastil Index Receiving country		-0.037		
		[0.104]		
Gastil Index Sending country		0.052		
		[0.046]		
Δ Total Refugees			-0.005	-0.004
			[0.008]	[0.008]
Δ Gastil Index Sending country				-0.087
				[0.095]
Δ Gastil Index Receiving country				0.176
				[0.145]
Observations	18132	17829	11129	10958
Adjusted R-squared	0.215	0.212	0.012	0.012

Specifications in columns 1 and 2 include: Log(Real GDP pc) - receiving country, Log(Real GDP pc) - sending country, Log(population) - receiving country, Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects. Specifications in columns 3 and 4 include: Δ Log(Real GDP pc) - receiving country, Δ Log(Real GDP pc) - sending country, Δ Log(population) - receiving country, Δ Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects.
Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 7 presents the results of the tests for the second and third scenario. According to the second scenario the presence of refugees makes the borders porous during the influx time. However, we would expect borders to get sealed by the host country at a later stage and we would foresee a decrease in the impact of the refugees on missing arms trade. On the other hand, if the third scenario holds, *i.e.* refugees create informal networks and facilitate arms smuggling, such effect should not decrease over time.

Table 7: Arms trade gap and lagged refugee flows

VARIABLES	(1)	(2)	(3)	(4)
	Arms Trade Gap		Δ *Arms Trade Gap*	
Lagged REF*Contiguity dummy	0.080**	0.074**		
	[0.032]	[0.032]		
Lagged REF	-0.059***	-0.057***		
	[0.015]	[0.015]		
Gastil Index Receiving country		-0.045		
		[0.124]		
Gastil Index Sending country		0.063		
		[0.051]		
Lagged Δ REF* Contiguity Dummy			0.069	0.056
			[0.090]	[0.091]
Lagged Δ REF			-0.045	-0.047
			[0.034]	[0.034]
Δ Gastil Index Receiving country				-0.001
				[0.176]
Δ Gastil Index Sending country				0.019
				[0.106]
Marginal Effect	0.021	0.016	0.024	0.009
F-value	0.50	0.29	0.08	0.01
P-value	0.481	0.589	0.779	0.919
Observations	14468	14227	7545	7423
Adjusted R-squared	0.222	0.220	0.017	0.015

Specifications in columns 1 and 2 include: Log(Real GDP pc) - receiving country, Log(Real GDP pc) - sending country, Log(population) - receiving country, Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects. Specifications in columns 3 and 4 include: Δ Log(Real GDP pc) - receiving country, Δ Log(Real GDP pc) - sending country, Δ Log(population) - receiving country, Δ Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects.

Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Columns 1 and 2 of Table 7 report the specification in levels, which is similar to the one in equation 1, apart from the two lagged variables: number of refugees, *Lagged REF*, and the lagged number of refugees from neighboring countries, *Lagged REF*Contiguity dummy*. The estimated coefficients are smaller than the ones with the results presented in Table 3. The number of refugees from the arms exporting country has a negative relationship with the missing trade in arms. However, we cannot reject the hypothesis that the sum of the coefficients on *Lagged REF* and *Lagged REF*Contiguity dummy* is zero. Columns 3 and 4 of Table 7 report the results for the specification in first differences. We consider the lagged

change in the number of refugees instead of the current change in the number of refugees, as in Table 4. None of the estimated coefficients is statistically significant. The effect of refugee influx on missing trade in arms appears to be contemporaneous. This result is in line with the second scenario: the presence of refugees puts pressure at the border and makes it more difficult for the host country to patrol its customs at the time the refugee influx takes place. Such effect disappears over time, as shown in Table 7.

4.4 Embargoes

Countries under embargo should be excluded from arms trade. We consider both UN and EU embargoes and we build a dummy variable, *embargo*, which takes value 1 if either the UN or the EU has imposed an embargo on the specific country. Seven countries in our sample report arms imports, notwithstanding the embargo: Bosnia Herzegovina, Serbia and Montenegro, Croatia, Nigeria, Rwanda, Sudan, China. The countries that officially reported arms exports to the embargoed countries are: Albania, Bosnia Herzegovina, Croatia, India, Iran, Macedonia, Pakistan, Russia, Saudi Arabia, Togo, Turkey, Uganda, Serbia, and South Africa. Similarly, the countries under embargo that report arms exports are: China, Angola, Bosnia Herzegovina, China, Croatia, Indonesia, Macedonia, Nigeria, Rwanda, Sudan, Sierra Leone, Slovenia, Serbia, South Africa, Congo (Zaire), and Zimbabwe. The list of countries that receive arms from embargoed countries is much diversified.

Table 8 presents the results. The main findings hold when we control for embargoes: an increase in the number of refugees is related to an increase in the arms trade gap, both when we focus on the specification in levels and in first differences. The estimated coefficient on the embargo dummy variable for the sending country is positive and statistically significant. We interpret this result as showing that the importing partner is either another embargoed country, or a non-embargoed country which conceals its arms imports from an embargoed country.

Table 8: Arms trade gap, refugees and embargoes

VARIABLES	(1)	(2)	(3)	(4)
	Arms Trade Gap		Δ *Arms Trade Gap*	
REF*Contiguity Dummy	0.133***	0.127***		
	[0.026]	[0.026]		
REF	-0.052***	-0.052***		
	[0.013]	[0.013]		
Gastil Index Receiving country		-0.074		
		[0.105]		
Gastil Index Sending country		0.021		
		[0.050]		
Embargo – Receiving country	-0.877**	-0.522	0.335	0.476
	[0.349]	[0.354]	[1.137]	[1.002]
Embargo – Sending country	0.595***	0.304*	0.437*	-0.016
	[0.154]	[0.177]	[0.254]	[0.252]
Δ REF*Contiguity Dummy			0.398**	0.415**
			[0.170]	[0.169]
Δ REF			-0.051	-0.064
			[0.084]	[0.084]
Δ Gastil Index Receiving country				0.221
				[0.151]
Δ Gastil Index Sending country				-0.042
				[0.089]
Marginal Effect	0.080	0.075	0.347	0.350
F-value	10.83	9.53	5.58	5.71
P-value	0.001	0.002	0.018	0.017
Observations	18132	17829	8813	8693
Adjusted R-squared	0.216	0.214	0.002	0.001

Specifications in columns 1 and 2 include: Log(Real GDP pc) - receiving country, Log(Real GDP pc) - sending country, Log(population) - receiving country, Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects. Specifications in columns 3 and 4 include: Δ Log(Real GDP pc) - receiving country, Δ Log(Real GDP pc) - sending country, Δ Log(population) - receiving country, Δ Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects.
Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

4.5 Is it about exchange rates?

The value of exports and imports is reported in US dollar. One possibility is that the effect on missing arms trade is due to exchange rates fluctuations, which might be correlated

to refugee flows. We control for this possibility by inserting in the specification importer-year and exporter-year fixed effects, which capture exchange rate fluctuations over time. The results hold, but are not reported.

4.6 The role of tariffs

Fisman and Wei (2004) and Javorcik and Narciso (2008) provide evidence of the relationship between the trade gap and the tariff rate. To this end, we include the tariff rate on arms in the specification outlined in equation 1. Our prior is that arms are valuable in themselves, therefore we do not expect the tariff rate to affect small arms trade gap. The estimation results are presented in Table 9. The coefficient on *Tariff* is never statistically significant either in the specification in levels or in the one in first differences. The effect of refugees on arms trade gap is still positive and statistically significant at the 5% level, also in the specification in first differences. A change in the number of refugees coming from neighboring country is related to a positive change in the arms trade gap of the refugee receiving country.

Table 9: Arms trade gap, refugees and tariffs

VARIABLES	(1)	(2)	(3)	(4)
	Arms Trade Gap		Δ *Arms Trade Gap*	
Tariff	0.013	0.014		
	[0.011]	[0.011]		
REF*Contiguity	0.183***	0.186***		
Dummy	[0.053]	[0.053]		
REF	-0.049**	-0.051**		
	[0.023]	[0.023]		
Gastil Index		-0.488***		
Receiving country		[0.183]		
Gastil Index		0.016		
Sending country		[0.080]		
Δ Tariff			-0.011	-0.012
			[0.012]	[0.012]
Δ REF *Contiguity			0.404**	0.405**
Dummy			[0.199]	[0.199]
Δ REF			-0.086	-0.088
			[0.114]	[0.115]
Δ Gastil Index				0.126
Receiving country				[0.239]
Δ Gastil Index				0.015
Sending country				[0.133]
Marginal Effect	0.134	0.135	0.317	0.317
F-value	7.12	7.23	3.85	3.85
P-value	0.008	0.007	0.050	0.050
Observations	7024	6952	3609	3584
Adjusted R-squared	0.194	0.195	0.004	0.004

Specifications in columns 1 and 2 include: Log(Real GDP pc) - receiving country, Log(Real GDP pc) - sending country, Log(population) - receiving country, Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects. Specifications in columns 3 and 4 include: Δ Log(Real GDP pc) - receiving country, Δ Log(Real GDP pc) - sending country, Δ Log(population) - receiving country, Δ Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects.
Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

4.7 A placebo product

If arms smuggling is more likely when there is pressure at the border, as in the case of refugee flows, what happens if we consider an alternative product? Should we expect to

observe an increase in smuggling of other products as well? The answer depends on the product type. Arms have a value in itself, therefore we expect missing trade in arms to be greater the more porous borders are. To this end we compare our results with those of a product which has very different features than arms. We introduce as placebo product the product category 06 of the HS1988/92: live trees and other plants, bulbs, roots and cut flowers. We replicate the specification outlined in equation 1, with plant trade gap as the new dependent variable. Columns 1 and 2 of Table 9 present the results for the specification in levels for this product. The number of refugees coming from neighboring countries has a positive effect on the trade gap in flowers and plants and the marginal effect is statistically significant at the 1% level. Next, we control for the tariff level. We expect the incentive of smuggling or underreporting the value of imports to be higher the higher the tariff rate. The impact of the tariff level is in line with previous findings in the tariff evasion literature: a 1% increase in the tariff rate leads to a 0.3% increase in the flower trade gap. The impact of the number of refugees from neighboring countries remains statistically significant at 1%. In the next two columns, we consider the specification in first differences, which capture the change rather than impact in levels. The results on refugees do not appear robust: the estimated coefficient on refugee flows is not statistically significant and we cannot reject the hypothesis that refugee flows have no impact on the change in flowers and plants smuggling. Column 4 presents the specification which includes the tariff rate. A change in the tariff rate positively affects the change in the plants missing trade. Again, the impact of refugee flows on plants missing trade is not statistically significant.

What can we conclude from these results? The type of product matters. Unlike arms, plants are not valuable, therefore we expect tariff evasion, rather than pure smuggling, to have a greater role for this type of products.

Table 10: Plants trade gap, refugees and tariffs

VARIABLES	(1)	(2)	(3)	(4)
	Plants Trade Gap		Δ *Plants Trade Gap*	
REF*Contiguity Dummy	0.182***	0.182***		
	[0.038]	[0.038]		
REF	0.006	0.005		
	[0.018]	[0.018]		
Tariff		0.003*		
		[0.002]		
Δ REF			-0.069	-0.069
			[0.053]	[0.053]
Δ REF *Contiguity Dummy			-0.048	-0.052
			[0.117]	[0.117]
Δ Tariff				0.004*
				[0.002]
Marginal Effect	0.188	0.187	-0.117	-0.121
F-value	24.10	23.78	1.27	1.35
P-value	0.000	0.000	0.259	0.246
Observations	5532	5532	2879	2879
Adjusted R-squared	0.213	0.214	0.001	0.001

Specifications in columns 1 and 2 include: Log(Real GDP pc) - receiving country, Log(Real GDP pc) - sending country, Log(population) - receiving country, Log(population) - sending country, contiguity dummy, importer fixed effects, exporter fixed effects, year fixed affects. Specifications in columns 3 and 4 include: Δ Log(Real GDP pc) - receiving country, Δ Log(Real GDP pc) - sending country, Δ Log(population) - receiving country, Δ Log(population) - sending country, contiguity dummy, year fixed affects. Due to the smaller sample size exporter and importer fixed effects are excluded from columns 3 and 4. Inclusion of importer and exporter fixed effects deteriorates the adjusted R-squared without affecting the results.
Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

5. Conclusions

The aim of this study is to enhance our understanding of arms smuggling across countries. We use the official arms trade figures to build a measure of "missing" arms trade for each available country pair, by year. The trade gap in arms trade is measured as the difference between the value of arms exports from country *i* to country *j*, as reported by country *i*, minus the value of imports from country *i* to country *j* as reported by country *j*. We show that missing trade in arms is related to the degree of strain experienced by customs and borders on the importer side. The findings support our prior: the presence of refugees indirectly decreases the ability of the receiving country to patrol and control its own customs. This ultimately leads to an increase in arms illegally smuggled into the importing

country. These results are robust also when we control for the governance and democracy levels of the importer and exporter country. A series of robustness checks support our findings rule out other possible concurrent driving factors. We conclude that, given the nature of arms, greater attention should be paid to customs functioning in periods of distress.

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Data Appendix

Arms: 6-digit 1988/92 HS. The arms categories included are: 930100 Military weapons, other than revolvers, pistols; 930200 Revolvers and pistols, other than those of heading No 93.01; 930310 Muzzle-loading firearms; 930320 Shotguns including combination shotgun-rifles sportive; 930330 Rifles, sporting, hunting or target-shooting; 930390 Firearms and similar devices operated by the firing; 930400 Other arms, excluding those of heading No 93.07; 930510 Parts and accessories of revolvers or pistols; 930521 Shotgun barrels of Heading No 93.03; 930529 Parts and accessories of shotguns or rifles; 930590 Parts and accessories of heading No 93.01; 930610 Cartridges for riveting or similar tools; 930621 Cartridges, shotgun; 930629 Air gun pellets and parts of shotgun cartridges; 930630 Cartridges and parts thereof; 930690 Munitions of war and parts hereof and other ammunition; 930700 Swords, cutlasses, bayonets, lances and similar arms and parts.