Weapons and War: The Effect of Arms Transfers on Internal Conflict

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March 9, 2021

Abstract

Despite the fact that weapons are necessary for conflicts, it remains unclear if any country could make a difference by reducing their export. I use historical links between arms exporters and importers, and shocks to conflict engagement of the exporters, to instrument the volume of arms exports. The 2SLS estimates reveals that arms imports increase the likelihood of new internal conflicts, their number, and the number of battle-related deaths. Additionally, it shows that if European weapons manufacturers declared a moratorium on arms exports to Africa for a single year, this would reduce the number of refugees by half a million.

Abstract Keywords: Instrumental Variables (IV) Estimation, Internal Conflict, Migration, Rebellion, Arms imports

JEL classification: C26, D74, F22, H56, O10, O19

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Haitham and Qassim said they also planned to return to Syria and continue fighting. "[My unit had] a weapons shortage," Qassim said. "I am waiting for a call telling me they have more weapons, then I will return." two 16-year-old Syrian rebels, as reported by Human Rights Watch (2012)[1]

In Angola, the independist groups were stopped in a similar way in 2002 due to weapon shortage. Such anecdotal pieces of evidence illustrate the necessity of weapons to sustain war effort. Even if arms are a crucial ingredient for warfare, it is far from sure if any given country could make a big difference by stopping to export weapons. An argument put forward frequently is that simply another producer would deliver weaponry and rather than causing violence, arms sales are simply the consequence of warfare. Establishing a causal relationship is crucial –among others for enforcing treaties– and this is exactly what the current paper focuses on.

Specifically, using worldwide data for the period of 1992 to 2011, this paper provides, to the best of my knowledge, the first quantification of the effects of arms exports from a global set of suppliers on conflicts in the recipient country while also addressing endogeneity issues. A major barrier to quantify the effect of arms imports on conflict indicators is reverse causality that would bias OLS estimates. Indeed, a conflict outbreak increases the demand for arms creating upward bias[2]. On the other hand, violence in the destination country might also reduce supply creating downward bias.[3]

To overcome endogeneity issues, an instrumental variable is introduced. Anecdotal evidence suggests war in a supplier country puts pressure on their supply of arms and ammunition as production is redirected from the market[4]. The negative sign of the IV in the first stage representing this shortage involves important considerations. First, suppliers are constrained with respect to the quantity produced. Second, when major suppliers experience a shortage, other arms dealers cannot substitute completely.[5] This result invalidates a common argument of arms suppliers that if they do not send weapons, others will.

The instrument is a weighted average representing the proportion of usual suppliers of the recipient country involved in wars on another continent. More precisely the instrument belongs to the shift-share or Bartik instrument category. The weighted average is an interaction between

[1] Syria: Opposition Using Children in Conflict, last accessed 30.06.18: `https://www.hrw.org/news/2012/11/29/syria-opposition-using-children-conflict`

[2] *"US forced to import bullets from Israel as troops use 250,000 for every rebel killed"*. Independent.co.uk (2005). Last access 30.05.18: http://www.independent.co.uk/news/world/americas/us-forced-to-import-bullets-from-israel-as-troops-use-250000-for-every-rebel-killed-314944.html

[3] *"Merkel: No German arms exports to Saudi until killing cleared up"* Reuters (2018). Last access 25.10.18: https://www.reuters.com/article/us-saudi-khashoggi-germany-merkel/merkel-no-german-arms-exports-to-saudi-until-killing-cleared-up-idUSKCN1MW2LT

[4] "Ammo shortage squeezes police forces: Demand skyrockets partially due to wars". NBC (2007). Last accessed 30.05.18. http://www.nbcnews.com/id/20322566/ns/us_news-security/t/ammo-shortage-squeezes-police-forces/

[5] If the first best choice for a product is not available, clients have to turn to the second-best. As it's a second choice, they might differ with price or quality. Hence, the second-best might offer contract conditions less appealing, leading to a reduced quantity. For example, if Russia AK-type bullets are not available, the USA is also producing 7.62x39mm bullets but at a higher price on average.

a continent-year supply shock—represented by a set of dummies indicating whether each supplier is fighting at least one war on a continent different than that of the recipient country (time-series variation, the "shift")—and the weights, which are the percentage of weapons imported from each supplier for the whole sample (cross-sectional variation, the "share"). The time series component is controlled by the continent-year fixed effect, while the cross-sectional component is controlled by the country fixed effect.

Potential violation of the exclusion restriction could arise if conflict on another continent drove violence for usual clients of supplier j more intensely than for unusual clients through other pathways than arms import not captured by the control variables. For a concrete example, the US deploying forces in Afghanistan following 9/11 is assumed to affect differently the conflicts in Burundi where 18% of arms import are from the US and the one in Chad with none of the arms import from the US only through the difference in arms supply. To assess the validity of this assumption I run several robustness checks in Section 3.3. The model is augmented to control for development aid, control for overall trade relationships between countries (involved in conflicts), exclude supplier countries who intervened in the past in the recipient country, and exclude major countries subject to Islamist terrorism (as they link conflicts between continents). The results are robust to these tests.

Using this strategy, arms transfers are shown to increase the number of internal conflicts in the destination country, the onset of internal conflicts, the number of battle-related deaths, and the number of refugees escaping from the country. The model predicts that if the European suppliers stopped exporting arms to Africa for a year, the number of refugees would fall by approximately 500,000 per year. Additonally, consider the implication on violence if the top five suppliers of arms in Africa would completely stop exports for a year. During the sample period 56% of arms in Africa originated from five countries, the US (18.1%), Italy (12.2%), France (9.3%), Spain (9.0%) and China (7.4%). If those countries stop their arms export, the model predicts a decrease in number of internal conflicts by 0.03[6], a decrease of the onset of internal conflict by 0.8%, a decrease of the number of battle-related deaths of 15.5%, and a reduction of the number of refugees fleeing the country of 11,990.[7]

The suggested channel supporting those results is that arms transfers reflect an increase in weapons availability among the population, thus facilitating insurrection. Following the contest success function literature, higher "military capacity" increases the probability of an armed group winning an internal conflict leading to an increase in fighting effort[8]. Missing precise information on whether the recipient in the destination country is government or civilian, this mechanism is also based on the observation that the wide majority of Small Arms and Light Weapons are held

[6]Interpretation of the coefficient: On the 54 countries in Africa it would reduce the number of conflict by 1.5

[7]See Section 3.1 for more details on the computations.

[8]The model in Grossman (1991) shows that increases in the technology of war, leads to a higher expected return of time invested in an insurrection. Consequently, a higher quality of armament will leads the population to invest more time in fighting.

by civilians. A recent study Karp (2018) by the Small Arms Survey estimates 84.6% of the 1 billion firearms worldwide were held by civilians in 2017. Moreover, in Section 3.5, the instrument is shown not to predict military expenditure, reinforcing the assumption that international small arms transfers reflect mostly civilian purchase. Finally, looking at the type of violent events and the victims reveals that weapons imports increase mostly one-sided violence against unorganized civilians as well as non-state violence between armed groups, increasing relatively more civilian deaths compared to fighter deaths.

The second main contribution of this paper is to suggest an approach to account for the specific correlation structure between errors in the Shift-share setup. The growth of these instruments is evident as 290 articles contain the terms Shift-share or Bartik instrument in 2019 compared to 44 five years earlier.[9] A literature highlighting the potential bias of those instrument has emerged (Adao, Kolesar and Morales (2019), Borusyak, Hull and Jaravel (2018), Goldsmith-Pinkham, Sorkin and Swift (2018), and Jaeger, Ruist and Stuhler (2018)). A novel way to correct the errors with a Shift-Share instrument with the arbitrary clustering method is introduced in this paper. The problems described in Adao, Kolesar and Morales (2019) is that errors might be correlated between countries with a similar set of weights caused by similar values of unobservables. The approach has two steps. First, a dissimilarity index between the distributions of weights of the Shift-Share for each pair of countries is computed and yields a distance matrix. Second, this dissimilarity matrix allows for a specific correlation structure between the errors in the variance-covariance matrix in the arbitrary clustering method from Colella et al. (2019).

With regards to the existing literature, one major contribution of the present paper is to estimate the causal effect of arms import on internal conflict for a global set of suppliers. To my knowledge, the only work aiming at quantifying this effect while tackling endogeneity issues on a global scale is Benson and Ramsay (2018). Benson and Ramsay (2018) study the effect on the number of battle-related deaths while instrumenting arms import with a weighted average of conflict termination with the weights based on geographical distance or trade network distance. Given that larger weights are attributed to the end of a conflict as it is closer, transnational economic or strategic factors uncontrolled in Benson and Ramsay (2018), cast doubt on the validity of the exclusion restriction[10]. On the other hand, using the network distance might link more strongly countries that are not direct neighbours but the geographic link being not clear it poses difficulty to assess the exogeneity of the instrument. Moreover, the current work extends the results found in Benson and Ramsay (2018) by exploring a wider range of outcomes (number of conflicts, onset, incidence, refugee flows, type of internal conflicts, and victims).

Other research papers are restricted to the United States of America. Dube, Dube and García-

[9]Source: Google Scholar search results, excluding patents and citations.

[10]Gleditsch (2007) show that transnational ethnic/political/economic ties matter in conflict onset. Examples of transnational factors include conflict-induced refugees flow which might spread conflict by *inter alia* facilitating the displacement of arms **??**).

Ponce (2013) show that the end of assault weapons ban in some border US states with Mexico favoured weapons availability and lead to an increase in homicides on the other side of the border. Magesan and Swee (2018) show that government purchase of US weapons reduces political repression but increases the onset of civil war using a Shift-Share instrument based on the frequency of purchase as share and inflation in the US as shift.

The second major contribution of the present paper is to provide an approach to account for the potential correlation between errors unaddressed by standard clustering methods with a Shift-share instrument. This paper contributes to the literature on the statistical properties of the Shift-share approach in Adao, Kolesar and Morales (2019), Borusyak, Hull and Jaravel (2018), Goldsmith-Pinkham, Sorkin and Swift (2018), and Jaeger, Ruist and Stuhler (2018). Furthermore, it also shows the usefulness of arbitrary clustering in the context of the Bartik instrument in Colella et al. (2019).

This present paper also contributes to other strands of the literature. First, it fills a gap in the long economic literature trend explaining conflict with "greed" by adding small arms import to the list of facilitating factors. Several seminal papers mention arms availability as a factor favouring insurgency including Fearon and Laitin (2003) or making rebellion more viable as in Collier and Hoeffler (2004) and Collier, Hoeffler and Rohner (2009) without identifying causality the relationships. This present paper is also linked to the international interconnection of conflict as in Durante and Zhuravskaya (2018) who show that Israel times particularly sensitive attacks when news in the US is predicted to be focused on some other topics. The paper also extends recent analysis on the participation of arms producers in the black market as in DellaVigna and La Ferrara (2010) by showing that even legal transfers are troublesome.

Second, this work enriches the understanding of micro-based models theorizing rebels and government interaction by measuring the effect of arms. Gates (2002) show how geography, ideology, and ethnicity influence the success of the rebels using a principal-agent model in a rent-seeking contest. Besley and Persson (2011) model the consequences of the inability to commit by the two sides where the conflict situation arises with both sides investing in violence. Several seminal papers including Hirshleifer (1988), Grossman (1991), and Skaperdas (1992) theorize conflicts with models based on a Contest-Success-Function where the probability of winning relies on relative military capacity.

Third, the present paper is consistent with the recent literature on relative power between armed groups. Rebel forces usually start weak with violence intensifying as their power grows. Fighting reduces the uncertainty of relative forces, finally reaching a sufficient power to negotiate peace or ceasefire as described in Bapat (2005), and Hultquist (2013).

Fourth, the present paper underscores the direct link between arms import and refugee outflow. Assessing this result, developed countries as the major arms suppliers might have a direct responsibility in the conflict-induced migration flow. It also reinforces the previous finding of Hatton

(2016) that a key driver of migration outflow is conflict in the origin country or threats for personal integrity as in Davenport, Moore and Poe (2003).

Finally, the present results confirm the suspected relationship between arms transfers and violence revealed by the positive correlation often found in the political science literature and reported by NGOs. Serious violations of International Humanitarian Law or War crimes[11] are facilitated by the availability of arms as noted in Herby (1999). A report from ICRC (2013) mentions that in most places where they take action ICRC faces issues caused by weak arms transfers control. Arms proliferation cost goes far beyond direct deaths or injuries as it is identified as hindering peace, stability, and human rights causing population displacement. Healing the psychological and physical wounds can take very long as noted by Ayuba and Okafor (2014), Marshall and Gurr (2003), Craft and Smaldone (2002), Muggah and Berman (2001), and Sislin and Pearson (2001).

The paper is structured as follows. Section II describes the Data. Section III explains the Empirical Strategy and Section IV the Results. Finally, Section V concludes.

1 Data

My dataset is a country-year panel from 1992 to 2011. The dataset starts in 1992 as Small Arms and Light Weapons became a major issue at the end of the Cold War as explained in Appendix A and ends in 2011 due to data availability.

1.1 Dependent variable: Conflict

The purpose of this paper is to measure the impact of small arms and light weapons transfers on the violence in the recipient country. Conflict is measured using several outcome variables including the number of internal conflicts, the incidence of internal conflicts, the onset of internal conflicts, and the number of battle-related deaths. Conflict is known as a driver for refugees leading to the estimation of the direct effect of the violence on refugees flows captured as the number of refugees from country i (Hatton (2016), and Davenport, Moore and Poe (2003)).

The first set of outcome variables is the number of ongoing internal conflicts, onset, and incidence from the UCDP/PRIO Armed Conflict Dataset as in Gleditsch et al. (2002), and Pettersson and Wallensteen (2015). A less conventional outcome variable is the number of internal conflicts and internationalized internal conflicts. More weapons might help a new rebel group fight over the same territory or trigger additional conflict in the same country. The armed conflict definition in this dataset is the following: *"a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths."* (Harbom, Havard and Havard (2009)). As we can see

[11] 'Serious violations of International Humanitarian Law' or 'War crime' are actions that cause grave violations of Human Rights as kidnapping, raping, killing civilians, recruiting children for battle or torturing

in Appendix B, the vast majority of internal conflict in the sample took place in Africa and Asia. Additionally, the intensity of the violence is captured with the number of battle-related deaths from UCDP/PRIO Armed Conflict Dataset.

This paper studies the direct effect of arms import on refugees flows from the recipient country based on the UNHCR Population statistics database. Refugees are defined as *"[...] individuals recognised 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 recognised in accordance with the UNHCR Statute; individuals granted complementary forms of protection; or those enjoying temporary protection. Since 2007, the refugee population also includes people in a refugee-like situation."*.

Finally, also using UCDP/PRIO data, the effect of arms on the duration of conflict and resolution including continuation, ceasefire or peace-agreement, rebel win, government win or rebel in low activity are estimated.

1.2 Explanatory variable: Small Arms and Light Weapons transfers

For measuring Small Arms and Light Weapons transfers, the most reliable and detailed source of data is the Norwegian Initiative on Small Arms Transfers NISAT in Marsh (2014). NISAT data contains country-year pairs of authorized transfers valued in USD. We can see in Appendix C that on average North America, Europe and Asia are the largest receivers of transfers. In the econometric framework, arms inflows are measured using the natural logarithm of arms transfers value since the distribution is highly skewed right (Skewness 15.73) and as the estimated model is linear.[12]

It is worth mentioning that this research is focused on the authorized market and thus do not include black market data for two reasons. First, this paper focuses on the effects of legal transfers. For policy recommendation, assessing this effect might reinforce or discard the legal framework such as the Arms Trade Treaty aiming to control arms transfers. On the other hand, the black market is illegal and prohibition of those transfers is already established. As some transfer might be unreported as described in the NISAT user manual and the blackmarket is unobserved, those arms data suffer from measurement errors. The data represents a lower boundary of transfers. As there is no evidence that the measurement errors correlate with the unobserved latent variable, we are in the presence of Classical errors-in-variables leading to an attenuation bias of the baseline estimates as described in Wooldridge (2010).

[12]There is no transfer with a value of one US$ as the smallest value in my dataset for a transfer is 17 USD and the first percentile of the non-zero values of transfers is 1,054 USD. Finally, the median of 1.7 million USD is of such order of magnitude the slight modification would not influence the results.

1.3 Instrumental Variable: Weighted average of arms suppliers war involvement

The instrumental variable belongs to the Bartik or Shift-Share family of instruments. It is an interaction between a time-varying shock (the shift) and a cross-sectional sensitivity to the shock (the share). The instrument represents the percentage of usual arms supplier of country i involved in a conflict in year t on another continent different from the recipient country.

The shock is captured as a set of binary variables taking the value one if a supplier country is involved in a conflict using the UCDP/PRIO Armed Conflict Dataset. The share is a set of weights measuring the percentages of arms received from each supplier over the whole sample period using NISAT data. See Section 2.2 for in-depth explanation of the instrumental variable and identification strategy.

1.4 Control variables: Democracy index, GDP, arms exports, and past conflicts

The regime type of the recipient country is expected to interact with the level of internal violence and with the propensity to receive weapons. Violent repression by the government is usually less common in democracy meaning that arms availability might affect democracies, anocracies, or autocracies differently as in Henderson (1991), Poe and Tate (1994), Rummel (1995), Krain (2000), and Hegre et al. (2001). Including the PolityIV scale allows measuring the effect of weapons transfer on violence keeping the democracy level fixed. The PolityIV index is a widely used regime scale going from -10 (complete autocracy) to 10 (perfect democracy) based on criteria such as Competitiveness of Executive Recruitment, Constraint on Chief Executive, or Competitiveness of Political Participation (Marshall, Jaggers and Gurr (2002), and Eckstein and Gurr (1975)). PolityIV data are reported only for countries with more than half a million population excluding smaller countries from the sample.

The GDP Purchasing Power in constant USD comes from the World Devlopement Indicators (Bank (2020)). For reasons similar to those for arms imports, the log is applied to the data. Higher GDP might influence the violence level in the country but at the same time influence the number of arms imported.

Finally, two other potential sources of weapons are included as controls. The effect of arms import might differ if arms are already available. The first control is the arms exports using the NISAT dataset. Missing the information on local production, larger exports proxy for local production or large stock. The second control is an indicator variable for past conflict, taking the value one if there was a conflict on the territory during the last 15 years. Conflicts tend to leave a massive amount of weapons in the country and are widely accepted by international observers as a reserve of weapons.

Table 1: **Summary Statistics (World)**

Yearly:	Mean	Standard Deviation	Min	Max
# of internal conflicts	36.25	5.74	29.00	49.00
Incidence of internal conflicts	26.85	4.07	21.00	35.00
Onset of internal conflicts	2.10	1.45	0.00	5.00
Battle related deaths in 10k	6.82	11.55	1.43	54.79
# of refugees in 10k	821.27	313.70	499.56	1378.32
SALW imports in billions	2.56	0.99	1.62	4.36
PolityIV	3.08	0.65	2.01	4.01

Table 2: **Summary Statistics (Africa)**

Yearly:	Mean	Standard Deviation	Min	Max
# of internal conflicts	12.80	2.55	7.00	17.00
Incidence of internal conflicts	11.60	2.54	6.00	15.00
Onset of internal conflicts	0.90	0.85	0.00	3.00
Battle related deaths in 10k	4.93	11.27	0.54	52.06
# of refugees in 10k	377.47	123.13	231.81	676.82
SALW imports in billions of USD	0.10	0.05	0.02	0.20
PolityIV	0.37	1.15	-1.84	2.12

2 Empirical Strategy

2.1 Baseline specification

Here is the baseline specification to measure the effect of arms inflow on conflict.

$$Conflict_{it} = \beta_0 + \beta_1 ln(Arms^*_{it} + 1) + \boldsymbol{X'_{it}}\lambda + FE_i + FE_{ct} + \epsilon_{it} \tag{1}$$

where $Conflict_{it}$ is one of the outcomes described in Section 1.1, $ln(Arms^*_{it} + 1)$ is the natural logarithm of the value of weapons import in USD corrected for inflation. $pmbX_{it}$ is a vector of controls containing the Polity IV scale, the log of GDP, an indicator variable if there was at least one conflict during the last fifteen years and the log of arms exports. FE_i is the country fixed effect. FE_{ct} is a continent year fixed effect. Finally, ϵ_{it} is an error term clustered on country level (See Appendix D for arbitrary clustering method).

2.2 Identification strategy

To address the endogeneity issue, I am using an Instrumental Variable. The IV is based on a Supply Shifter. The shock shift the supply affecting the equilibrium quantity but does not directly shift demand.

Anecdotal evidence suggests that war involvement by a supplier country generates supply shortage with stock and production directed towards self-need: *"Russia conflict could cause ammo shortages in the U.S."* AL.com (18.03.2014)[13] *"US forced to import bullets from Israel as troops use 250,000 for every rebel killed"* Independent.co.uk (24.09.2005)[14].

The value of arms that we observe is the equilibrium value resulting from the intersection of supply and demand. The vector of controls $\boldsymbol{X_{it}}$, fixed effect and errors are defined as in equation (1).

Demand:

$$ln(Arms_{it}^{D}+1) = \alpha_0 + \alpha_1 Price_{it} + \alpha_2 Conflict_{it} + \boldsymbol{X'_{it}} A + FE_i + FE_{ct} + \xi_{it} \tag{2}$$

Supply:

$$ln(Arms_{it}^{S}+1) = \beta_0 + \beta_1 Price_{it} + \beta_2 Conflict_{it} + \beta_3 SupplierWarInvolvement_{it} + \boldsymbol{X'_{it}} B + FE_i + FE_{ct} + \nu_{it} \tag{3}$$

Solving for equilibrium quantity, we obtain:

Equilibrium:

$$ln(Arms_{it}^{*}+1) = \gamma_0 + \gamma_1 Conflict_{it} + \gamma_2 SupplierWarInvolvement_{it} + \boldsymbol{X'_{it}} \Gamma + FE_i + FE_{ct} + \zeta_{it} \tag{4}$$

Thus, in equation (1) we have one endogenous variable $ln(Arms_{it}^{*}+1)$ that can be instrumented with the exogenous supply shifter *"SupplierWarInvolvement"*.

The instrument is the proportion of usual suppliers involved in an interstate war on another continent:

$$SupplierWarInvolvement_{it} = \sum_{j=1}^{n} w_{ij} * x_{jt,-c} \tag{5}$$

A Shift-Share instrument is built as an interaction between a set of shocks and a set of share capturing the extent to which observation i is affected by the each shock. The first component of the instrument, the shift, is a set of indicator variables $x_{jt,-c}$ that takes the value 1 if a supplier j is involved in a war during the year t. A direct worry arises if the war involvement by the supplier

[13] Last access 30.05.18: `http://www.al.com/sports/index.ssf/2014/03/russia_conflict_could_cuase_am.html`

[14] Last access 30.05.18: http://www.independent.co.uk/news/world/americas/us-forced-to-import-bullets-from-israel-as-troops-use-250000-for-every-rebel-killed-314944.html

country takes place in the recipient country or its region[15] as that would violate the exclusion restriction by directly influencing violence in the country i. To prevent this issue, I am using wars outside the continent of the recipient country represented by the subscript $-c$ in equation 5. This main effect is controlled by the continent-year fixed effect. Furthermore, note that $x_{jt,-c}$ is an indicator variable. Indeed, the number of conflicts in the UCDP dataset might reflect a number of different issues in a country. For example, in India in 2010 there are six different conflicts recorded but it certainly does not reflect that war involvement by India is six times larger than US conflict against Al-Qaeda in Afghanistan. The hypothesis made here is that the pressure on supply depends on the difference between peacetime and war, but not on the number of wars. Furthermore, given that the shock must be large enough to influence arms supply, this indicator variable includes only interstate conflict, internationalized internal conflict, and extra systemic armed conflict[16].

Second, this time-varying supply shock is interacted with sensitivity to the shock similar to the approach of Nunn and Qian (2014). A usual client from supplier j is more likely to be affected by the shortage generated by conflict involvement $x_{jt,-c}$ than a country that never imported weapons from country j. Thus, the weight w_{ij} in the weighted average is the proportion of arms imported by country i from supplier j on the whole sample. The weights are country-specific with the main effect controlled by the country fixed effect to avoid endogeneity.

Finally, the instrument is a weighted average built with the interaction of the two sets of variables described above, representing the percentage of usual suppliers involved in wars on a continent other than that of the recipient country (see equation 5).

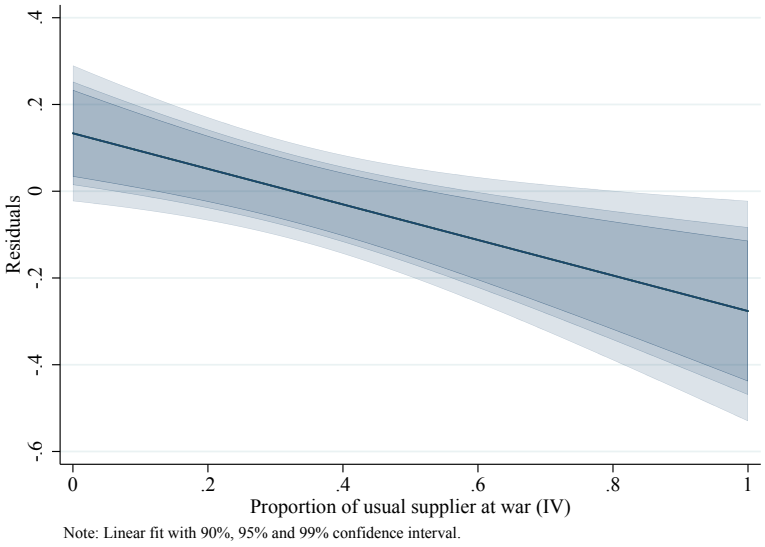
A valid instrumental variable requires two properties: relevance and exogeneity. First, the IV has to be relevant. In the present context of this paper, the arms supplier use of military force implying a shortage of supply must be correlated significantly with the quantity of weapons inflow to their usual consumers. Figure 1 shows the negative correlation between the proportion of usual suppliers at war on another continent (IV) and the log of arms imports for the world. The y-axis represents the residuals of the regression of the log of arms on controls and fixed effects while the x-axis represents the value of the instrumental variable. The relevance is assessed statistically using with the first stage F-stat. The rule of thumb is that this statistic must be above the threshold of 10 (See Section 3).

An instrument must also be exogenous meaning that it affects the outcome only through the instrumented variable. As an example, Spain provided 14% of the weapons to Angola in the sample period. This supplier joined forces with Operation Enduring Freedom in the global war against terrorism launched by George W. Bush. Starting in May 2002, 1200 Spanish troops were involved in the operation, followed by *"three C-130 Hercules planes and 70 soldiers to an airborne*

[15] Violence propagate through transnational ethnic/political/economic effect (Gleditsch (2007), Salehyan and Gleditsch (2006)).

[16] UCDP/PRIO Armed Conflict Dataset Codebook definition: *" Extrasystemic armed conflict occurs between a state and a non-state group outside its territory."*

Figure 1: Linear trend with confidence intervals of the "corrected" log of arms imports and proportion of usual suppliers at war on another continent (IV)



detachment" (Patterns of Global Terrorism 2002, p.48). This action results in an increase of the instrument the same year for Angola of 0.14 representing 14% more of the suppliers are now involved in conflicts on another continent, in this case Spain in the war against Al-Qaeda. The same year weapons import fall by 88% from 1,438,186USD to 167,422USD. Furthermore, two rebel groups the FLEC-Renovada (FLEC-R) and FLEC-FAC (Armed Forces of Cabinda) entered a period of low activity with less than 25 battle-related deaths. The participation of Spain in Operation Enduring Freedom is a source of the fall of arms import in Angola which might explain that *"[...] until late 2002, the armed conflict in Cabinda was a low-intensity guerrilla war, as FLEC never had the manpower or weaponry of a conventional army"* documented in Human Rights Watch[17]. There seems to be no branch of Al-Qaeda in Angola and no connection with the FLEC fighting for the independence of the Cabinda Region[18].

The exclusion restriction requires that conflict on another continent from the recipient country by a supplier j is influencing relatively more usual clients compared to non-usual clients of supplier j only through arms transfer. In the context of the example above, that war of Spain against

[17]Angola: Between War and Peace in Cabinda, p.5; Watch (2004))

[18]In the list of all individuals or organizations sanctioned by the United Nations Security Council for their links to Al-Qaeda and ISIL, there is only one mention to an organization listed in 2017 who is responsible for exporting workers from North Korea as construction workers and has been reported to conduct business with Angola among others (Security Council Committee pursuant to resolutions 1267 (1999) 1989 (2011) and 2253 (2015) concerning ISIL (Da'esh) Al-Qaida and associated individuals groups undertakings and entities).

Al-Qaeda does not influencing violence in Angola by FLEC-R and FLEC-FAC more than other African countries not importing arms from Spain (for example Burundi) through other channels . Note that the direct effect of the conflict in Afghanistan on Africa is captured by the continent-year fixed effect. Furthermore, ties with Spain carried in the weight of my instrument is captured by the country fixed effect. Several factors that might question the validity of the exclusion restriction are tested in Section 3.3 including development aid, direct military intervention in the recipient country, other imports from arms suppliers, and international Islamist terrorist action.

Appendix I presents and describes the source of the identifying variation for Africa that is particularly suitable for this approach as there are far less direct interventions from major suppliers than in Asia. The instrument is based on the shortages caused by conflicts on another continent. If the major shortages are caused by wars in Asia, the remaining variation based on conflict outside Asia is not powerful enough to predict shortages. Major conflicts involving massive coalitions of countries in Asia include the war against Al-Qaeda since 2001 involving about twenty countries, the war in Afghanistan since 2003 involving more than forty countries, and the war in Iraq starting in 2004 and involving around thirty countries. Potentially for this reason the instrument is weak for the sample restricted to Asia (see Section 3). As a result, Asia is excluded from the estimation of the global effect. Splitting Asia into the Middle East and the rest of Asia leads to similar estimates.

2.3 Two stages specification

First stage:

$$ln(Arms^*_{it}+1) = \gamma_0 + \gamma_2 SupplierWarInvolvement_{it} + \boldsymbol{X'_{it}}\Gamma + FE_i + FE_{ct} + \zeta_{it}$$

Second stage:

$$Violence_{it} = \beta_0 + \beta_1 \widehat{ln(Arms^*_{it}+1)} + \boldsymbol{X'_{it}}\lambda + FE_i + FE_{ct} + \epsilon_{it}$$

$\widehat{ln(Arms^*_{it}+1)}$ is the first stage predicted value of the natural logarithm of the value in US$ corrected for inflation. $SupplierWarInvolvement_{it}$ is the weighted average of usual supplier involvement in wars on another continent as described in Section 2.2. All other terms are defined as in (1).

3 Results

3.1 Main model

First, I will present the results for Africa, the region where most internal conflicts took place as shown in Appendix B and suiting particularly well the identification strategy in Section 2.2. Results are extended while excluding Asia due to the weakness of the instrument for that region as shown in Table 5).

Table 3 in Appendix E reports the OLS estimates of the Baseline model. The log of Small Arms and Light Weapons transfers is not significant in any specification. The baseline estimation is biased as the violence in the destination country might reduce arms supply (downward bias) and increase arms demand (upward bias) with the classical measurement errors generating noise (attenuation bias).

Table 4 in Appendix F presents the reduce form estimates. The estimates are negative and statistically significant or close to being significant with p-values below 10% for the onset of internal conflicts and the number of refugees outflow, 10.2% for the number of internal conflicts, and 11% for the log of battle-related deaths. These first results suggest that fewer weapons reduce conflicts in the destination country.

As discussed in Section 2.2 the instrument must be relevant. To assess relevance, refer to the first stage results in Table 3. As expected the sign of the instrument in the first stage is negative. The weighted average of the usual supplier involved in wars on another continent is expected to highlight weapons shortages, leading to a negative sign. In Africa, the region central to the analysis, the p-value is 0.18% and the first stage Kleibergen-Paap F-statistic is slightly below the rule of thumb threshold of 10 (F-stat: 9.688) meaning the instrument is not weak.

However, the p-value is 3% for Asia and the instrument is weak (F-stat=4.736). As explained in Section 2.2, the number of wars in Asia implicating major suppliers weakens the exclusion restriction making the remaining variation too low to identify the effect.

The magnitude of the effect is also economically significant. A change of one unit in the IV, representing the difference between a year where no suppliers are fighting wars outside Africa and versus a year where when all suppliers are, implies a reduction of 97.86% (log-normal estimation: $100 * (exp(-3.849) - 1)$) of the transfers received by country i. In other words, the estimates predict that when all the suppliers are involved in wars on another continent, all the imports stop as the effect is close to 100%. Note that the estimate is similar when the analysis is extended to the world excluding Asia in column (4) in Table 3).

Finally, Table 4 shows the estimates of two-stage least squares. The log of arms imports has a positive significant effect ($p - value < 0.1$) on the number of internal conflicts, the onset of internal conflicts, the log of battle-related deaths, and the number of refugees. The magnitude is also economically important. A one standard deviation (5.12) increase of the log of arms imports,

Table 3: First Stage

	(1) lnvalue	(2) lnvalue	(3) lnvalue	(4) lnvalue
IV_global_bin	-3.848	-1.780	-2.866	-3.184
	[1.237]	[0.818]	[0.785]	[0.962]
PolityIV	-0.044	0.116	-0.002	-0.055
	[0.076]	[0.081]	[0.046]	[0.054]
ln(GDP PPP)	1.631	-0.447	1.653	2.002
	[0.503]	[1.047]	[0.397]	[0.489]
lnexports	0.170	0.015	0.118	0.151
	[0.062]	[0.032]	[0.035]	[0.044]
internal_conflict_past15	0.366	0.040	0.241	0.335
	[0.525]	[0.816]	[0.328]	[0.361]
Constant	-24.819	27.626	-26.464	-34.402
	[12.313]	[27.510]	[10.044]	[12.225]
N	986	718	3035	2317
adj. R^2	0.195	0.165	0.186	0.206

Standard errors in brackets
Standard error clusterd on the country level.
Country and Year Fixed effects.

increases the number of conflict by 0.002 (level-log: $(0.054/100) * 5.12$), an increase of the onset of internal conflict by 0.8% (level-log with binary outcome: $(0.016/100) * 5.12$), an increase of the number of battle-related deaths of 1.4% (log-log: $0.276 * 5.12$), and a reduction of the number of refugees fleeing the country of 1,096 (level-log with outcome in 10,000 units:$(2.141/100*56)*10000$). In the introduction, another quantification was presented. What is the effect on conflict if the top five arms suppliers to Africa (the US (18.1%), Italy (12.2%), France (9.3%), Spain (9.0%) and China (7.4%)) would stop for a year to send weapons there?

Table 4: Two stage least square estimates for Africa

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) ln(Battle deaths+1)	(5) # of Refugees
$ln(Arms^*_{it}+1)$	0.054	0.036	0.016	0.276	2.141
	[0.031]	[0.026]	[0.008]	[0.159]	[1.083]
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes
N	986	986	986	986	986
adj. R^2	0.444	0.466	-0.136	0.548	0.309

First-stage Kleibergen-Paap F-Stat: 9.688.
Standard error clustered on the country level. Country and contnent-year Fixed effects.

Table 5 reports the two-stage least squares estimates for the world excluding Asia. Due to major direct military interventions of arms suppliers in Asia and the weakness of the instrument for that region (certainly linked), this continent is excluded in the larger analysis[19]. Note that the Kleibergen-Paap F-stat is larger than for Africa (F-Stat: 10.949). Furthermore, the estimates

[19]Similar results are found if only the Middle East is excluded.

remain relatively stable and somewhat smaller as expected with most of the conflicts in Africa and Asia during the period of interest.

Table 5: Two stage least square estimates for the world excluding Asia

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) ln(Battle deaths+1)	(5) # of Refugees
$ln(Arms^*_{it}+1)$	0.048	0.030	0.014	0.218	1.870
	[0.027]	[0.023]	[0.007]	[0.145]	[0.976]
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes
N	2315	2315	2315	2315	2315
adj. R^2	0.456	0.506	-0.121	0.610	0.355

First-stage Kleibergen-Paap F-Stat: 10.949.
Standard error clustered on the country level. Country and continent-year Fixed effects.

3.2 Duration and outcome of conflict

Estimates for the duration and conflict outcome are computed with the same identification strategy. A difficulty regarding identification of the effect is the scarcity of the events. In Africa during the sample, there were 22 ceasefires or peace agreements (36 for the world excluding Asia), 4 rebel victories (5 for the world excluding Asia), 5 government victories (8 for the world excluding Asia) and 28 periods of low intensity for rebels (34 for the world excluding Asia). The results are not statistically significant at the 10% threshold potentially due to low power. Tables 5 and 6 in Appendix G show the two-stage least square estimates.

In line with the recent insurrection literature as in Hultquist (2013), the increase of arms transfers seems to increase the probability of a ceasefire/peace agreement (p-value:10.1%). The fact that arms increase the probability of a ceasefire and the duration of a conflict is not contradictory with previous results. To estimate the effect on the resolution of conflicts, the dependent variable is simply an indicator variable taking the value one if a ceasefire/peace agreement was signed or if the government won a conflict. In model (2) of Table 5, the positive relationship means that arms increase the probability of a ceasefire/peace agreement being signed against all other outcomes together (conflict continue, no conflict, or conflict ending another way).

3.3 Robustness

Even though a formal test for the exclusion restriction is impossible, several robustness tests discount the threat of instrument exogeneity.

3.3.1 Controlling for development aid

Arms suppliers might be development aid suppliers as well. Arms suppliers fighting wars on other continents might reduce their development aid. US food aid has been shown to increase

the incidence and duration of conflicts in Nunn and Qian (2014). This potential violation of the exclusion restriction might drive the present results as arms suppliers fighting elsewhere reduce their development aid reducing conflict through a aid reduction rather than arms reduction. To prevent this issue, I estimate the model including current and past development aid as controls. To control for development aid, the AidData of Tierney et al. (2011) is utilized. The distribution is highly skewed right with (skewness = 9) leading to a log transformation.

Table 7 in Appendix H.1 shows the two-stage least square estimates are robust to the inclusion of current and lagged development aid as a control variable. I do not control in the main model for aid as it is endogenous and a bad control. Note that the Kleibergen-Paap F-stat is reduced as expected with the introduction of a bad control.

3.3.2 Excluding suppliers who directly intervened in the destination country

A violation of the exclusion restriction could arise if arms suppliers intervene directly in country i. Suppose supplier j participates in a conflict in country i. If supplier j fights a war on another continent it might force this supplier to redirect its resources to another conflict, reducing the intensity of the conflict in country i. To address this issue, the instrument suppliers who participated in a conflict in the recipient country during the sample and up to fifteen years before are excluded. The same dataset of conflict as for the outcome conveys this robustness check.

Table 8 in Appendix H.2 shows that the results are robust to the exclusion from the IV of suppliers who have been involved in a conflict in the destination country during the sample period and up to fifteen years before.

3.3.3 Controlling for a weighted average of imports

Suppliers and recipient countries might have their own particular economic ties. War involvement might influence the export pattern of the arms suppliers for other goods that might influence the economy of the recipient country and hence conflict. To tackle this issue, a weighted average of war on another continent with weights the percentage of import from each country is introduced as a control variable. These weights are different from the IV.

Table 9 in Appendix H.3 shows that results are robust to this weighted average of exporter at war on another continent.

3.3.4 Excluding countries subject to Islamist terrorism

An important part of the identifying variation after 2000 comes from the war against Al-Qaeda or more broadly war against terrorism with conflicts in Afghanistan and Iraq involving a large coalition of arms suppliers. Al-Qaeda and more recently Daesh (ISIL) affect violence globally. This could lead to a violation of the exclusion restriction if for example US intervention in Afghanistan

against Al-Qaeda leads the branch of Al-Qaeda in the Islamic Maghreb (AQIM) in Algeria to react by providing help to Afghanistan. This hypothetical situation would be in line with the results observed. We observe a reduction in violence in Algeria as the US, the origin of 51% of weapons transfers to Algeria, is fighting a war in Afghanistan. This change in violence could be triggered not by a reduction in arms import but by the local terrorist organization AQIM changing focus to support Afghanistan.

A solution to this issue is to remove countries particularly affected by terrorist groups fighting actively on different continents in the sample. Mainly the issue comes from Al-Qaeda and Daesh fighting in Africa and Asia. As a specific link between terrorist groups might be difficult to track, a broader approach excludes major countries subject to terrorist attacks from entities with Islamist affiliation. The top countries by share of terrorist attacks in Africa from 1997 to 2015 are Nigeria (32%), Somalia (21%), Algeria (19%), Libya (7%), and Egypt (6%) in De De Albuquerque (2017)[20].

Table 10 in Appendix H.4 presents the estimates for Africa excluding those top five countries containing 85% of the terrorist attacks by groups with Islamist affiliation from 1997 to 2015. The first-stage Kleibergen-Paap F-Stat is 10.086, even stronger than before the exclusion of those countries revealing the instrument is not weak. Furthermore, the effect of arms import is statistically significant at the 10% threshold for the onset of conflict and the number of refugees. The p-values for the numbers of internal conflicts and battle-related increases to 13.1% and 13.7% compared to the estimates without exclusion of Nigeria, Somalia, Algeria, Libya and Egypt. This result is expected as the sample reduces from 986 observation in Africa to 913. Finally, the magnitudes of the estimates remain relatively stable.

3.4 Arbitrary clustering

The typical worry in the literature on the Shift-Share instrument is that the errors might be correlated between observations with similar sets of weights in the share of the instrument reflecting common values of unobservables. This issue might not be addressed by standard clustering methods. The arbitrary clustering framework Colella et al. (2019) takes this dependence in the variance-covariance matrix into account as discussed in Section D. Results are robust to this modification. More specifically, arbitrary clustering reduces the standard deviation and increases the significance of the coefficient and the F-stat of the first stage.

3.5 Channels

The transfers observed are mainly non-military and reflect larger availability for the population but more likely availability to armed groups. First, in a recent report Karp (2018) by the Small

[20]A study by the "FOI, Swedish Defense Research Agency" summarizes data from the "Global Terrorism Database", "Big, Allied and Dangerous" and the " Congressional Research Service"

Arms Survey, 85% of the one billion firearms worldwide were held by civilians at the end of 2017. Second, the instrument does not predict military expenditure. Table 6 reports the estimates of the instrument regressed on military expenditure in National Material capabilities dataset from Correlates of War. The worry that the instrumental variable is also predicting military expenditure is alleviated as the coefficients are far from being significant as in the p-value of 74% for Africa.

Table 6: IV used to predict Military expenditure

	(1)	(2)	(3)	(4)
Dep.Var.: Military expenditure	Africa	Asia	World	Excluding Asia
Supplier War Involvement	-0.052	0.533	0.167	0.028
	[0.156]	[0.233]	[0.113]	[0.122]
Controls	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes
N	892	665	2844	2179
adj. R^2	0.280	0.235	0.281	0.301

Standard error clusterd on the country level.
Country and Year Fixed effects.

Table 7: Two stage least square estimates fo Africa

	(1)	(2)	(3)	(4)	(5)
	State-based	Non-state	One-sided	$ln(civilians\ deaths+1)$	$ln(fighters\ deaths+1)$
$ln(Arms^*_{it}+1)$	0.044	0.029	0.068	0.312	0.266
	[0.030]	[0.018]	[0.034]	[0.152]	[0.151]
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes
Mean Dep. Var.	0.294	0.207	0.342	1.397	1.511
N	986	986	986	986	986
adj. R^2	0.451	0.533	0.255	0.340	0.488

First-stage Kleibergen-Paap F-Stat: 9.688.
Standard error clustered on the country level. Country and Year Fixed effects.

Table 8: Two stage least square estimates for the world excluding Asia

	(1)	(2)	(3)	(4)	(5)
	State-based	Non-state	One-sided	$ln(civilians\ deaths+1)$	$ln(fighters\ deaths+1)$
$ln(Arms^*_{it}+1)$	0.031	0.037	0.052	0.231	0.219
	[0.027]	[0.019]	[0.028]	[0.133]	[0.134)
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes
Mean Dep. Var.	0.181	0.121	0.198	0.787	0.874
N	2315	2315	2315	2315	2315
adj. R^2	0.536	0.498	0.451	0.459	0.562

First-stage Kleibergen-Paap F-Stat: 9.688.
Standard error clustered on the country level. Country and Year Fixed effects.

As weapons flow to country i, availability is wider for the population leading to better technology of war and an increase in time invested in insurrection to the detriment of production by the population as noted in Grossman (1991).The Georeferenced Event Dataset (GED) from UCDP in Pettersson and Oberg (2020); Sundberg and Melander (2013) reveals that the victims are primarily

civilians. The GED contains data on violent events classified into three categories: state-based violence, non-state violence, and one-sided violence. State-based violence defines events when the government fights one or several armed groups. Non-state violence categorizes violent events between organized non-state actors. One-sided violence defines violence from the government or an armed group against civilians. The dataset contains estimates of deaths for fighters and civilians. Table 7 and 8 show the two stage least squares estimates for Africa and for the word excluding Asia. All the results point in the same direction with the civilians the biggest losers. For Africa, the increase in deaths following an increase in arms transfer is larger for civilians than for fighters. Furthermore, the largest increase in probability is for one-sided violence with state-based violence not significant for Africa and the world. For the world in Table 8, non-state violence is statistically significant as well.

Small arms and light weapons imports thus fuel violence against civilians or between armed groups but not against the government. Indeed, government control of the trade inflow on its territory could reduce availability in case of insurrection. This result highlights again the necessity of arms control at a global level. If the government protects itself by controlling weapons inflow, it might be able to save civilians lives. If the recipient country government is not willing to control weapons, the international community can take the step.

Finally as arms continue to flow, rebels group eventually grow stronger increasing their military capacity and making it harder to lead to a total victory, leading to a higher probability of a resolution of the conflict by ceasefire or peace-agreement as discussed in Bapat (2005) and Hultquist (2013).

4 Conclusion

From the Vietnam War to the conflict between FARC and the Colombian government, small arms have been used in internal conflict – often to commit atrocities against the civilian population. Nonetheless, there is substantial scepticism about the notion that arms cause conflict – the Rwandan genocide, for example, was partly perpetrated by machetes and other primitive means. Reverse causality and data availability have been key challenges. Filling this gap, this paper provides the first causal evidence of the effects of arms exports from a global set of suppliers on conflicts in the recipient country while addressing endogeneity issues. Additionally, the present paper is provides an approach to correct for the specific correlation structure between errors with Shift-Share instrument.

The two-stage least square estimates predict a positive effect of arms import on the number of internal conflicts, the onset of internal conflicts, the number of battle-related deaths, and the number of refugees fleeing the destination country. Moreover, civilians are the predominant victims of the induced violence as the probability of one-sided violent events significantly increases and the effect on deaths of civilians is larger than fighters. The evidence of this positive effect in this paper has two practical implications. First, the identification strategy discards the argument of

arms suppliers that if they do not send weapons others will do so. Second, it confirms that arms export is a tool within reach of the international community to influence conditions relevant to conflict. Hence, the present results reinforce the legitimacy of the recently adopted legal framework of the Arms Trade Treaty (ATT) aiming to tighten control of arms transfers. Furthermore, the present approach provides a strategy to assess whether countries or group of countries fuel conflict and assess the efficiency of treaties helping the international community assess responsibility and impose sanctions.

With thousands of refugees drowning each year in the Mediterranean and 2017 a record year with 68.5 million displaced people[21], the global migration crisis is manifest. However, the response of developed countries to the situation is highly criticized by observers like Human Rights Watch. Responses include the situation in Europe where *"The focus of EU policy over the past three years has been on preventing arrivals, outsourcing responsibility to countries outside the EU, and downgrading refugee protection inside the EU"*[22] and in the US where families were separated and people placed for days in frigid cells called *"hieleras"* (freezers)[23]. The direct positive effect of arms transfers on refugee flow measured in this paper should draw attention to the responsibility of arms suppliers on the displacement of people. The model predicts that if the European suppliers stopped exporting arms to Africa for a year, the number of refugees would fall by approximately 500,000 per year. Interestingly, major arms suppliers as the United States of America and countries in the UE are the ones pointed out by Human Rights Watch for ill-treatment on the migrants.

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