Weapons and War: Light on the inter-relationship between arms exports, conflicts and refugee flows

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Abstract This paper provides a first causal estimation of the effect of weapon imports on conflicts in the recipient country for a global set of suppliers. Using small arms and light weapons country-year transfers data from 1992 to 2011, I estimate the effect of arms import on the conflict life-cycle (onset, duration, intensity and termination) and refugees outflow in the recipient country. To address endogeneity issues, I am using supply shortages generated by suppliers' war involvement outside the recipient country's continent (instrumental variable) as exogenous negatives shocks on arms import. The two-stage least squares estimation shows that arms imports increase the onset of internal conflict, the number of internal conflicts, the percentage of battle-related deaths and the number of refugees fleeing the country. The 2SLS model predicts as well that if Europe would stop sending weapons to Africa for a year, it would reduce the number of refugees by 500,000.

Keywords: Internal Conflict, Migration, Rebellion, Arms imports

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

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1 Introduction

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." words from Syrian 16 year old rebels reported by Human Rights Watch (2012)[1]

Small Arms and Light Weapons[2] (henceforth arms or weapons) are the main weapons used in post-Cold War conflicts and the deadliest causing 210,000 deaths in 2016 (Frey (2003); Mc. Evoy and Hideg (2017)). As noted by the Security Council Report in 2013: *"Of the 49 major conflicts in the 1990s, small arms were the key weapons in 47 of them."*. On one hand, arms are widely denounced as offensive tools increasing violence. On the other hand, arms possession is justified by the fact that they provide protection following the Latin adage: *"Si vis pacem, para bellum."*[3] (Pearson and Sislin (2001)). Internal conditions favoring conflict are difficult to manipulate. However, control of arm exports is within the reach of the international community. Should developed countries send weapons to help or stop weapons deliveries to prevent the escalation of violence?

This paper provides the first causal evidence, for a global set of suppliers, of the impact of arm imports on conflicts in the recipient country using world wide data from 1992 to 2011. Note that countries suffering the most from armed violence are usually not weapons producers and thus are countries which require to import them. The United States of America, the United Kingdom, Russia, France and China, were responsible for 70% of the global arms exports in 2017[4]. While in 2012, Syria, Honduras and Venezuela were the countries with highest lethal violence proportional to their population (Secretariat, Geneva Declaration (2015)). Thus, this research focus on the international transfers of Small Arms and Light Weapons.

[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] Small arms are weapons that can be carried and used by one person and light weapons those carried and managed by a crew of people. Following the United Nations General Assembly definition:
Small arms: revolver, self-loading pistols, rifles and carbines, assault rifles, sub-machine guns, and light machine guns. **Light weapons**: heavy machine guns, hand-held under-barrel and mounted grenade launchers, portable anti-tank and anti-aircraft guns, recoilless rifles, portable launchers of anti-tank missile and rocket systems and anti-aircraft missile systems, and mortars of less than 100 mm caliber.

[3] Translated *"If you want peace, prepare for war."* (origin unclear)

[4] Amnesty International: Last accessed 29.06.18. `https://www.amnesty.org/en/latest/news/2017/09/geneva-as-global-arms-trade-surges-states-greenlight-reckless-harmful-deals/`

A major issue when regressing conflict indicator on arms availability is reverse causality which biases the OLS estimates. Indeed, when a conflict outbreaks the demand for arms increases (upward bias)[5]. On the other hand, violence in the destination country might also reduce the supply (downward bias)[6].

To overcome this issue I am using an instrumental variable. Anecdotal pieces of evidence suggest that war effort by a supplier country put pressure on the supply of their arms and ammunition as the stock and production capacity is redirected from the market towards their own needs[7]. The negative sign of the IV in first stage, representing this shortage effect, implies important considerations. First, it shows that the suppliers are constrained with respect to the quantity produced. Second, it demonstrates that when major suppliers experience a shortage, other arms dealers cannot replace them completely. This result invalidate a common arms suppliers argument that if they do not send weapons other will do[8].

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 a continent-year supply shock represented by a set of dummies indicating if each supplier are fighting at least one war on a different continent than the recipient country (time-series variation, the shifter) 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 part is controlled by the continent-year fixed effect as the cross-sectional component is controlled by the country fixed effect.

Potential violation of the exclusion restriction could arise if conflict on another continent drives violence for usual clients of suppliers j more intensely than for unusual clients through other pathways than arms import. Using a concrete example: the US deploying forces in

[5] *"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

[6] *"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

[7] "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/

[8] 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 less appealing, leading to a reduced quantity. For example, if Russia AK-type bullets are not available, the USA are producing as well 7.62x39mm bullets but at a higher price.

Afghanistan following 9/11 is assumed to affect differently the conflict in Burundi (18% of arms import are from the US in the sample) and the conflict in Chad (0% of arms import from the US in the sample) only through the difference in arms supply. To assess the validity of this assumption I run several robustness checks (See Section 4.2). First, arms suppliers might be development aid suppliers as well. In this case, aid might be reduced if the supplier is involved in a war (on another continent). To address this, I control for current and lagged development aid[9]. Second, arms suppliers might intervene directly in a country and fighting a war on another continent might force them to redirect their resources on another conflict. I prevent this channel to play a role by excluding from the instrument any supplier who intervened in country i during the sample and up to fifteen years before. Third, suppliers and recipient countries might have other economic ties and war involvement might influence the export pattern of the arms suppliers for other goods which might be linked to conflict as well. To tackle this issue, I include as a control a weighted average of war on another continent but contrary to the IV, the weights are the percentage of import from each country. Fourth, the growing threat of global Islamist terrorism might as well link conflicts between continents, mainly between Asia and Africa (e.g: Al-Qaeda or ISIL/Daech). To control for this threat of the exclusion restriction I exclude major countries subject to Islamist terrorism in the sample.

Using data on Small Arms and Light Weapons transfers (Norwegian Initiative on Small Arms Transfers) from 1992 to 2011, I show that arms transfers 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. Furthermore, suggestive evidence shows that arms inflow increases the duration of internal conflicts and increase the probability of a cease-fire or peace agreement being signed compared to other conflict outcomes. The central analysis is focused on Africa as almost half of the internal conflicts took place in that region and as it suits particularly well the identification strategy (see Section 3.2). Then the results are extended to the world excluding Asia. Asia is left out as most of the explanatory variation in the first stage comes from shortages caused by a large coalition of suppliers fighting wars in Asia, the remaining variation is too small and the exclusion restriction weaker for this continent (see Section 3.2).

The suggested channel supporting those results is that arms transfers reflect an increase

[9]This test is in the robustness part as development aid is linked to conflict it is an endogenous control. Furthermore, as arms influence conflict and hence development aid, it is a bad control as well.

in weapons availability among the population, thus facilitating insurrection. Following the contest success function literature, higher "military capacity" increases the probability of the opposition/rebels to win an internal conflict against the government, leading to an increase in fighting effort[10]. Missing the precise information in the available data on the recipient in the destination country (government or civilian), this suggested mechanism is based on the observation that the wide majority of Small Arms and Light Weapons are held by civilians. A recent study by the Small Arms Survey estimates at 84.6% of the 1 million firearms worldwide were held by civilians at the end of 2017 (Karp (2018)). Moreover, in Section 4.3, I show that the instrument does not predict military expenditure, which reinforces the assumption that international arms transfers reflect mostly civilian purchase.

The major contribution of this paper is the causal estimation of the effect of arms import on internal conflict for a global set of suppliers. To my knowledge, the only work trying to asses causally this effect on a global scale is by Benson and Ramsay (2016) which has three main limitations. First, they look only at the intensity of conflict measured in the number of battle deaths and restrict the sample to the countries subject to internal conflict (excluding peaceful country-year observations). Second, non-classical measurement errors bias the results. Their IV is a weighted average of war termination where weight is a notion of distance. The closer war termination, the larger is the weight. As distance are reduced and conflict intensity in the recipient country higher, arms flow through black market might increase. Third, multiple transnational factors questioning the validity of the exclusion restriction are uncontrolled and mentioned in the paper (See Appendix A for more details).

Other research papers are restricted to the United States of America. Dube, Dube and García (2013), show that the end of assault weapons ban in some border US states with Mexico, favouring weapons availability, lead to an increase in homicides on the other side of the border. Magesan and Swee (2018), show that government purchase of US weapons reduce political repression but increase the onset of civil war using a Shift-Share instrument based on the frequency of purchase (Share) and inflation in the US (Shifter).

This 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 and Light Weapons import to the list of facilitating factors. Several seminal papers mentioned arms avail-

[10]The model in Grossman (1991) show 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 insurrection to the detriment of production.

ability as a factor favouring insurgency (Fearon and Laitin (2003)) or making rebellion more viable (Collier and Hoeffler (2004), Collier, Hoeffler and Rohner (2009)) without identifying causally the relationships. This paper is also linked to the international interconnection of conflict as in Durante and Zhuravskaya (2018) who showed that Israeli timed particularly sensitive attacks when US news is predicted to be focused on some other topics. It extends recent analysis on the participation of arms producers in the black market (DellaVigna and La Ferrara (2010)) by showing that even the white market is worrying.

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

Third, it is consistent with the recent literature on relative power between rebels and government forces. Rebel forces usually start weak and as their power grows, violence intensifies, the fighting reduces the uncertainty of relative forces, finally reaching a sufficient power to negotiate peace or ceasefire. (Bapat (2005), Hultquist (2013)).

Fourth, it underscores the direct link between arms import and refugees 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 that a key driver for migration outflow is conflict in the origin country (Hatton (2016)) or threats for personal integrity (Davenport, Moore and Poe (2010)).

Finally, it confirms the suspected relationship between arms transfers and violence revealed by the positive correlation often found in political science literature and reported by NGOs. 'Serious violations of International Humanitarian Law' or 'War crime'[11] are facilitated by the availability of arms (ICRC (1999)). In an ICRC report from 2013, it is mentioned that in most places where they take action, ICRC faces issues caused by weak arms transfers control (ICRC (2013)). Arms proliferation cost goes far beyond direct deaths or injuries as it is identified

[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

as hindering peace, stability and human right respects, it causes population displacement and healing the psychological and physical wound can be very long (Ayuba and Okafor, (2014); Marshall and Gur (2003); Crafts and Smaldone, (2002); Muggah and Berman, (2001); Sislin and Pearson, (2001)).

The paper is structured as follows. Section 2 presents the Data. Section 3 the Empirical Strategy and the Results in Section 4. Finally, Section 6 concludes.

2 Data

My dataset is defined as a country-year panel from 1992 to 2011. Small Arms and Light Weapons became a major issue since the 90s as explained in Appendix B. Furthermore, during the Cold War, the availability of data on arms was less precise, particularly for the Soviet block leading to non-classical measurement errors which would bias the estimates. Using the data on arms from the Norwegian Initiative on Small Arms Transfers, there is about a tenfold increase in the number reported between the end of the 80s and 1992. This stark change might be partly attributed to data availability rather than solely globalization. Thus, my panel starts in 1992 (after the collapse of the Soviet Union) and end in 2011 due to data availability.

2.1 Dependent variable: Conflict

The purpose of this paper is to measure the impact of Small Arms and Light Weapons transfers on the conflict in the recipient country. Conflict is measured using several outcome variables: Number of internal conflicts, the incidence of internal conflicts, the onset of internal conflicts, the number of battle-related deaths. As conflict is known as a driver for refugees I also estimate the direct effect of the violence increase on refugees flows I also use the number of refugees from country i (Hatton (2016); Davenport, Moore and Poe (2010)).

The first set of outcome variables used is the number of ongoing internal conflict, onset and incidence using UCDP/PRIO Armed Conflict Dataset (Gleditsch, et al. (2002), Pettersson and Wallensteen (2015)). A less conventional outcome variable used in this paper is the number of internal conflicts and internationalized internal conflicts. As more weapons might help a new rebel group to fight after different incompatibility over the same territory, it might trigger additional conflict in the same country. The armed conflict definition used 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"* (see Harbom and Hgbladh (2009)). As we can see in Appendix C, the vast majority of internal conflict in the sample took place in Africa and Asia.

Second, the focus is on the intensity of the violence using the number of battle-related deaths from UCDP/PRIO Armed Conflict Dataset (Gleditsch, et al. (2002), Pettersson and Wallensteen (2015)).

Then, this study look at the direct effect of arms import on refugees flows from the recipient country using UNHCR Population statistics database. Refugees are defined in the dataset as *"Refugees include 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, I estimate the effect of arms on the duration of conflict and resolution (continuation, ceasefire or peace-agreement, rebel win, government win or rebel in low activity).

2.2 Explanatory variable: Small Arms and Light Weapons transfers

For measuring Small Arms and Light Weapons transfers, to my knowledge, the most reliable and detailed source of data comes from the Norwegian Initiative on Small Arms Transfers (NISAT). NISAT data contains country-year pairs of authorized transfers value in USD. We can see in Appendix D that on average North America, Europe and Asia are the largest receivers of transfers.

In the econometric framework, arms inflow are measured using the natural logarithm of arms transfers value since the distribution is highly skewed right (Skewness 15.73) and as the model estimated is linear. The drawback with that methodology is that the log of zero is undefined. To overcome this issue the distribution is shifted by one unit: $ln(USD+1)$. Thus, in log, a country in year t that didn't receive any weapons still have a value of zero ($ln(1) = 0$). Furthermore, 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 1,054USD. Finally, the

median is 1.7 million USD and thus with such order of magnitude the slight modification used is very unlikely to influence in any way the result of this study.

It is worth mentioning that this research is focused on the authorized market and thus do not include the black market data and this for two reasons. First, this paper focus on the effect of legal transfers. From a policy recommendation point of view, assessing this effect might reinforce or discard the latest legal framework, the Arms Trade Treaty. On the other hand, the black market is by definition illegal and prohibition of those transfers is already established. Second, the availability of data for a covert market is scarce and biased towards less sophisticated pathways (resulting in interception and observation). As some transfer might be unreported (see: NISAT database public user manual) and black-market 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 (Woolridge (2010)). Hence, to solve endogeneity arising from measurement errors and reverse causality, I use an instrumental variable.

2.3 Instrumental Variable: Weighted average of arms suppliers war involvement

The instrumental variable belongs to the Bartik or Shift-Share family of instruments. Thus, 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 (from the recipient country). The shock is captured as a set of binary variables taking the value one if a country is in conflict for all arms suppliers using the UCDP/PRIO Armed Conflict Dataset (Gleditsch, et al. (2002), Pettersson and Wallensteen (2015)). 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 3.2, for in-depth explanation of the instrumental variable and identification strategy.

2.4 Control variables: Democracy index, GDP, arms exports and past conflict

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 differently democracies, anocracies or autocracies (Henderson, (1991); Poe and Tate, (1994); Rummel, (1995); Krain (2000); Herge (2001)). Thus, 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) (Marshall and Jaggers (2002); Eckstein and Gurr (1975)) based on criterion as: Competitiveness of Executive Recruitment, Constraint on Chief Executive or Competitiveness of Political Participation (not exhaustive). PolityIV data are reported only for countries with more than half a million population which exclude smaller countries from the sample.

The GDP in Power Purchase Parity from constant USD come from the World Development Indicators (The World Bank (2012)). For reasons similar to arms imports the log is applied to the data. Higher GDP might influence the violence level in the country but at the same time, the number of arms imported.

Note that, one outcome being refugees flow, the population would be a bad control. However, results are similar to the inclusion of the population as a control and as expected, weaker.

Finally, two other potential sources of weapons are included as controls. The effect of arms import might differ if locally, 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. In the econometric framework, similarly to arms import the value of the export is measured in log ($log(USD + 1)$). The second control is an indicator variable for past internal conflict. Internal 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

3 Empirical Strategy

3.1 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 2.1, $ln(Arms^*_{it} + 1)$ is the natural logarithm of the value of weapons import in USD corrected for inflation plus one. X_{it} is a vector of controls containing the Polity IV scale, the log of GDP, an indicator variable if there was at least one internal conflict in the last fifteen years and the log of arms exports plus one. 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.

3.2 Identification strategy

To address the endogeneity issue, I am using an Instrumental Variable. The instrument belongs to the Shift-Share family (or Bartik). The IV is based on a Supply Shifter. The shock will shift the supply affecting the equilibrium quantity but doesn't directly shift the demand and affect conflict in the recipient country through arms imports.

Anecdotal evidence suggests that war involvement by a supplier country generate supply shortage as they redirect their stock and production towards self-need: *"Russia conflict could cause ammo shortages in the U.S."* AL.com (18.03.2014)[12] *"US forced to import bullets from Israel as troops use 250,000 for every rebel killed"* Independent.co.uk (24.09.2005)[13].

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:

$$\begin{aligned} ln(Arms_{it}^{S}+1) = \quad & \beta_0 + \beta_1 Price_{it} + \beta_2 Conflict_{it} + \beta_3 SupplierWarInvolvement_{it} \\ & + \boldsymbol{X_{it}'}B + FE_i + FE_{ct} + \nu_{it} \end{aligned} \tag{3}$$

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 $ln(Arms_{it}^{*}+1)$ which can be instrumented using the exogenous supply shifter *"SupplierWarInvolvement"*.

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

[13] 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

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 using an interaction between a shifter (the shock) and a share (to what extent the observation i is affected). The first component of the instrument, the "shift", is a set of indicator variable $x_{jt,-c}$ which 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 country takes place in the recipient country or its region[14] as it would violate the exclusion restriction by influencing directly violence in country i. To prevent this issue, I am using wars outside recipient country continent (represented by the subscript "$-c$"). This main effect is controlled by the continent-year fixed effect. Furthermore, note that I am using an indicator variable instead of the number of conflicts. Indeed, the number of conflicts in the UCDP dataset might reflect the number of different issue 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 United States of America conflict against Al-Qaeda in Afghanistan. The hypothesis made here is that the pressure on the supply depends on the difference between peacetime and war, but not on the number of wars. Results are comparable using the number of conflicts but as we would expect, the first stage is weaker. Furthermore, also in the idea that the shock must be large enough to influence arms supply, I constructed this indicator variable using only interstate conflict, internationalized internal conflict and extra systemic armed conflict[15]. Again, the results are comparable without excluding internal conflict but also somewhat weaker.

Second, this time-varying supply shock is interacted with a sensitivity to the shock similar to Nunn and Qian (2014) approach, the share. 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 who 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 and thus, the main effect is controlled by the country fixed effect to avoid

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

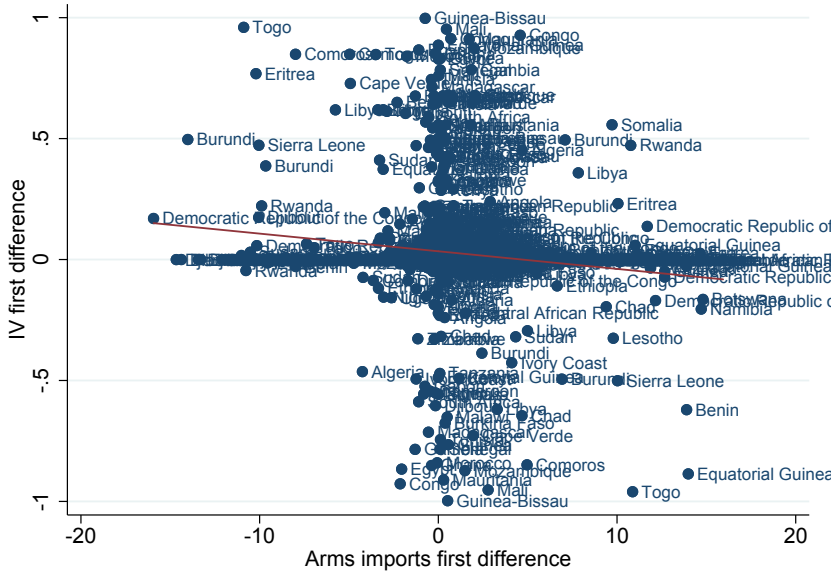
[15]UCDP/PRIO Armed Conflict Dataset Codebook definition: *" Extrasystemic armed conflict occurs between a state and a non-state group outside its territory."*

endogeneity arising from this relationship.

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 different continent 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 context of this paper, 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 Africa. Indeed, as the graph shows the first difference for both variables, we can see that there is more observation in the top left and bottom right quadrant, meaning that years when more suppliers where at war are associated with fewer weapons import and the reverse. The relevance is assessed statistically using the Kleibergen-Paap F-stat. The rule of thumb is that this statistic must be above the threshold of 10 (See the results, Section 4).

Figure 1: Correlation between the first difference of the proportion of suppliers at war on another continent (IV) and the first difference of log of arms imports for Africa



Source: NISAT, UCDP/PRIO

Second, an instrument must be exogenous meaning that it affects the outcome variable only through the instrumented variable. Let me illustrate this, using examples. Spain which

provided 14.04% of the weapons to Angola in the sample joined forces to Operation Enduring Freedom (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 detachment"*(Patterns of Global Terrorism 2002, p.48). This is resulting in an increase of the instrument the same year for Angola of 0.14 representing that fourteen percent more of the suppliers are now involved in conflicts on another continent, here Spain being involved in the war against Al-Qaeda. The same year the 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 in a period of low activity (less than 25 battle-related deaths)[16] in the UCDP Conflict Termination dataset. The participation of Spain in Operation Enduring Freedom is used as 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."* (Human Rights Watch, Angola: Between War and Peace in Cabinda (2004), p.5). 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[17].

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. Meaning in the context of the example above, that Spain war against Al-Qaeda isn't influencing violence in Angola by FLEC-R and FLEC-FAC more than other African countries who do not import arms from Spain (e.g. Burundi who do not import arms from Spain in the sample) through other channels than arms. 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. Thus, we have to be careful only about how the interaction might violate the exclusion restriction.

Appendix E, presents and describe the source of the identifying variation for Africa. Africa is particularly suitable for this approach as there are far less direct interventions from major

[16]Definition from UCDP Conflict Termination Dataset Codebook v.2-2015

[17]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).

suppliers in Africa 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 (about twenty countries), the war in Afghanistan since 2003 (above forty countries) and the war in Iraq since 2004 (around thirty countries). Potentially for this reason, as we will see in Section 4, the instrument is weak for the sample restricted to Asia. So, this continent is excluded from the estimation of the global effect. Note that by splitting Asia into the Middle East and the rest of Asia leads to similar estimates.

Several factors that might question the validity of the exclusion restriction are tested in Section 4.2: development aid, direct military intervention in the recipient country, other imports from arms suppliers or international Islamist terrorist action. Furthermore, a typical worry with Shift-share instruments is that the variation is driven by a small subset of suppliers. As shown in Borusyak et al. (2018), for a valid Shift-share instrument we require "Many independent shocks". One aspect to reinforce the belief in this assumption is that the share is sufficiently dispersed. To do so, I computed the Herfindahl index (Henceforth HH)[18] for each continent. To do so, I computed the average share for each supplier by continent and computed the Herfindahl index using those averages: Africa $HH = .0507$, Asia $HH = .0752$, Europe $HH = .0779$, North America $HH = .1967$, Oceania $HH = .1681$, South America $HH = .1651633$. An Herfindhal index lower than 0.15 indicates an unconcentrated industry. The central region of interest, Africa, is clearly below this threshold while other regions are below as well or slightly above except for North America.

3.3 Two stages specification

The strategy to solve endogeneity is to predict the $ln(Arms_{it} + 1)$ with the instrument in a first stage and then in the second stage, using the predicted values $ln(\widehat{Arms_{it}} + 1)$ to measure the causal effect of arms import on violence.

First stage:

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

[18] Herfindahl index= $\sum_{j=1}^{N} s_j^2$. The HH index varies from 0 to 1, with 1 indicating a monopolistic market and 0.01 a highly competitive industry.

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 and $SupplierWarInvolvement_{it}$ is the weighted average of usual supplier involvement in wars on another continent (as described in Section 3.2). All other terms are defined as in equation (1).

4 Results

First, I will present the results for Africa as it's where most of internal conflicts took place (see Appendix C) and because it suits particularly well the identification strategy (see Section 3.2). Second, results are then extended (see Table 5).

In Table 14 in Appendix 6 we can see the OLS estimates of the Baseline model. The log of Small Arms and Light Weapons transfers is not significant in any specification. As said in the introduction, the baseline estimation is biased as the violence in the destination country might reduce arms supply (downward bias), increase arms demand (upward bias) and the classical measurement errors generate noise (attenuation bias). Even though the coefficients are not significant we can notice that the sign vary. The conditional correlation is if anything, positive except for the number of refugees.

Then, Table 15 in Appendix 7 presents the estimates of the IV on the outcome without a structural model, the reduced form. The estimates are negative and statistically significant or close to being significant with a p-value below 10% for the onset of internal conflicts and the number of refugees outflow, a p-value of 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 3.2 the instrument must be relevant. To assess the relevance we can refer to the first stage results in Table 3. As expected the sign of the instrument in the first stage is negative. Recall that the weighted average of usual supplier involved in wars on another continent is expected to highlight weapons shortages, hence the negative sign. In the region

central to my analysis, Africa, the p-value is 0.18% and the first stage Kleibergen-Paap F-stat is slightly below the rule of thumb threshold of 10 (F-stat: 9.688), meaning that the instrument is not weak.

However, the p-value is "only" 3% for Asia and the instrument is weak (F-stat=4.736). As explained in Section 3.2, due to the number of wars in Asia implicating major suppliers, the exclusion restriction is weaker and the remaining variation might be 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 a year where 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 (see column (4) in Table 3).

Table 3: First Stage

	(1)	(2)	(3)	(4)
Dep.Var.: $ln(Arms^*_{it} + 1)$	Africa	Asia	World	Excluding Asia
Supplier War Involvement	-3.849***	-1.780**	-2.867***	-3.185***
	(1.237)	(0.818)	(0.785)	(0.962)
Controls	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes
N	986	718	3035	2317
adj. R^2	0.195	0.165	0.186	0.206
Kleibergen-Paap F-stat	9.688	4.736	13.298	10.949

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard error clustered on the country level. Country and continent year fixed effects.

Finally, Table 4 shows the estimates for the 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. Let's consider the implication on violence if the top five suppliers of arms in Africa would stop completely their exports. During the sample, 56% of arms in Africa originated from the following five countries: USA (18.08%), Italy (12.16%), France (9.25%), Spain (9.04%) and China (7.4%). Thus, if those countries stop their arms export the model

predict a decrease of number of internal conflict 0.03[19] (level-log: $0.054/100 * 56$), a decrease of the onset of internal conflict by 0.8% (level-log with binary outcome: $0.016/100 * 56$), a decrease of the number of battle-related deaths of 15.5% (log-log: $0.276 * 56$) and a reduction of the number of refugees fleeing the country of 11,989.6 (level-log with outcome in 10,000 units:$(2.141/100 * 56) * 10000$).

Table 4: Two stage least square estimates for Africa

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) $ln(Battledeaths + 1)$	(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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. First-stage Kleibergen-Paap F-Stat: 9.688.
Standard error clustered on the country level. Country and Year Fixed effects.

Then, Table 5 reports the two-stage least squares estimates for the world excluding Asia. As argued earlier, due to major direct military interventions of arms suppliers in Asia and the weakness of the instrument for that region (both certainly linked), I excluded this continent for the larger analysis[20]. Note that the Kleibergen-Paap F-stat is larger than for Africa (F-Stat: 10.949). Furthermore, the estimates remain relatively stable, somewhat smaller which is expected as most of the conflicts took place in Africa and Asia for the period of interest.

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

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) $ln(Battledeaths + 1)$	(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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. First-stage Kleibergen-Paap F-Stat: 10.949.
Standard error clustered on the country level. Country and continent-year Fixed effects.

[19]Interpretation of the coefficient: On the 54 countries in Africa it would reduce the number of conflict by 1.5 $(0.03 * 54)$

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

4.1 Duration and outcome of conflict

Using the same identification strategy, we can compute the estimates for the duration and conflict outcome. Note that a difficulty regarding the identification of the effect is the scarcity of the events. In Africa, during the sample, there was only 22 ceasefires or peace agreements, 4 rebels victories, 5 government victories and 28 periods of low intensity for rebels. In line with recent insurrection literature, the increase of arms transfers seems to increase conflict duration (p-value: 12.2%) and increase the probability of a ceasefire/peace agreement being signed (p-value:10.1%) (Hultquist (2013)). Note that the fact that arms increase the probability of a ceasefire and the duration of a conflict is not contradictory with previous results. To estimates 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 etc. So, in the model (2) of Table 6, 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 in another way).

Table 6: Two stage least square estimates for Africa

	(1) Duration	(2) Ceasefire	(3) Rebels win	(4) Gov. win	(5) Rebels low activity
$ln(Arms^*_{it}+1)$	0.082	0.046	0.005	-0.001	0.004
	(0.052)	(0.027)	(0.005)	(0.004)	(0.004)
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes
N	986	986	986	986	986
adj. R^2	0.437	0.400	0.036	-0.012	-0.026

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. First-stage Kleibergen-Paap F-Stat: 9.688.
Standard error clustered on the country level. Country and Continent-Year Fixed effects.

4.2 Robustness

Even though we cannot formally test for the exclusion restriction, I run several robustness tests to discard important threat of the instrument exogeneity.

4.2.1 Controlling for development aid

Arms suppliers might be development aid suppliers as well. As arms suppliers are fighting wars on other continents, they might reduce their development aid. Furthermore, US food aid as been shown to increase the incidence and duration of conflicts (Nunn and Qian (2014)). This potential violation of the exclusion restriction might drive the results reported in the paper: as arms suppliers are fighting elsewhere, they reduce their development aid which reduces conflict through a reduction of aid and not through a reduction of arms availability. To prevent this issue, I estimate again the model including current and past development aid as a control.

To control for development aid, I used the AidData (Tierney et al. (2011)). The distribution is highly skewed right (skewness= 9), I used a log transformation and add one to the value to prevent observation with no aid being dropped. The shift of the distribution is unlikely to influence the results as the minimal aid 1508 USD and the median is half a billion USD.

Table 7 shows that 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 an endogenous and bad control. Note that the Kleibergen-Paap F-stat is reduced which was expected with the introduction of a bad control.

4.2.2 Excluding suppliers who directly intervened in the destination country

A violation of the exclusion restriction could arise if arms suppliers intervene directly in the country i. Let say supplier j participate in a conflict in country i. Then, if supplier j fight a war on another continent it might force this supplier to redirect its resources to another conflict, hence reducing the intensity of the conflict in country i. To address this issue we exclude from the instrument suppliers who participated in a conflict in the recipient country in the sample and up to fifteen years before. I use the same dataset of conflict as I used for the outcome to convey this robustness check (UCDP/PRIO Armed Conflict Dataset (Gleditsch, et al. (2002), Pettersson and Wallensteen (2015))).

Table 8 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.

Table 7: Two stage least square: Controlling for current and lagged aid

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) $ln(Battledeaths+1)$	(5) # of Refugees
Estimates for Africa (Controlling for current aid)					
$ln(Arms^*_{it}+1)$	0.047*	0.030	0.013**	0.217	1.867*
	(0.027)	(0.023)	(0.007)	(0.145)	(0.974)
N	2315	2315	2315	2315	2315
adj. R^2	0.459	0.507	-0.117	0.611	0.357
First-stage Kleibergen-Paap F-Stat: 8.269.					
Estimates for Africa (Controlling for lagged aid)					
$ln(Arms^*_{it}+1)$	0.060*	0.043	0.017**	0.327*	2.278*
	(0.033)	(0.028)	(0.008)	(0.174)	(1.152)
N	985	985	985	985	985
adj. R^2	0.412	0.439	-0.163	0.519	0.282
First-stage Kleibergen-Paap F-Stat: 8.472.					
Estimate for the world excluding Asia (Controlling for current aid)					
$ln(Arms^*_{it}+1)$	0.047*	0.030	0.013**	0.217	1.867*
	(0.027)	(0.023)	(0.007)	(0.145)	(0.974)
N	2315	2315	2315	2315	2315
adj. R^2	0.459	0.507	-0.117	0.611	0.357
First-stage Kleibergen-Paap F-Stat: 11.030.					
Estimate for the world excluding Asia (Controlling for lagged aid)					
$ln(Arms^*_{it}+1)$	0.046*	0.030	0.013**	0.214	1.869*
	(0.028)	(0.024)	(0.007)	(0.146)	(0.981)
N	2286	2286	2286	2286	2286
adj. R^2	0.482	0.517	-0.110	0.621	0.361
First-stage Kleibergen-Paap F-Stat: 10.550.					
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Standard error clustered on the country level. Country and Continent-Year Fixed effects.

4.2.3 Controlling for a weighted average of imports

Suppliers and recipient countries might have particular economic ties. War involvement might influence the export pattern of the arms suppliers for other goods which might influence the economy of the recipient country and hence, conflict. To tackle this issue, I include as a control a weighted average of war on another continent but contrary to the IV, the weights are the percentage of import from each country.

Table 8: Two stage least square - Excluding from the IV suppliers involved in conflict in the recipient country

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) $ln(Battledeaths+1)$	(5) # of Refugees
Estimates for Africa					
$ln(Arms^*_{it}+1)$	0.053*	0.036	0.016**	0.274*	2.131*
	(0.031)	(0.026)	(0.008)	(0.159)	(1.080)
N	986	986	986	986	986
adj. R^2	0.445	0.467	-0.137	0.549	0.311
First-stage Kleibergen-Paap F-Stat: 9.719.					
Estimate for the world excluding Asia					
$ln(Arms^*_{it}+1)$	0.049*	0.031	0.013**	0.214	1.862*
	(0.027)	(0.023)	(0.006)	(0.142)	(0.958)
N	2315	2315	2315	2315	2315
adj. R^2	0.453	0.502	-0.111	0.612	0.358
First-stage Kleibergen-Paap F-Stat: 11.289.					
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Standard error clustered on the country level. Country and Continent-Year Fixed effects.

Table 9 shows that the results are robust to the inclusion of a weighted average of general exporter at war on another continent.

4.2.4 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 and conflict 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, the US intervene in Afghanistan against Al-Qaeda leads another branch as Al-Qaeda in the Islamic Maghreb (AQIM) in Algeria to react by providing help to "The Base" in Afghanistan. This hypothetical situation would be in line with the results observed. We observe a reduction in violence in Algeria as the US, origin of 50.54% of the weapons transfers in Algeria, is fighting a war in Afghanistan but the change in violence isn't triggered by a reduction in arms import but by the local terrorist organization (AQIM) changing it's focus (from local violence to support in Afghanistan).

Table 9: Two stage least square - Controlling for a weighted average of suppliers of all imports at war

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) $ln(Battledeaths+1)$	(5) # of Refugees
Estimates for Africa					
$ln(Arms^*_{it}+1)$	0.065	0.046	0.020**	0.346	2.985*
	(0.039)	(0.034)	(0.010)	(0.211)	(1.519)
N	986	986	986	986	986
adj. R^2	0.383	0.418	-0.240	0.494	0.130
First-stage Kleibergen-Paap F-Stat: 7.700.					
Estimate for the world excluding Asia					
$ln(Arms^*_{it}+1)$	0.054	0.033	0.017**	0.293	2.794**
	(0.034)	(0.029)	(0.009)	(0.187)	(1.368)
N	2306	2306	2306	2306	2306
adj. R^2	0.431	0.495	-0.188	0.568	0.152
First-stage Kleibergen-Paap F-Stat: 8.176.					
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Standard error clustered on the country level. Country and Continent-Year Fixed effects.

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, I use a broader approach by excluding major countries subject to terrorist attacks from entities with Islamist affiliation. In Albuquerque (2017)[21], the top countries by their share of terrorist attacks in Africa from 1997 to 2015 are Nigeria (32%), Somalia (21%), Algeria (19%), Libya (7%) and Egypt (6%).

Table 10 presents the estimates of 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 and reveals that 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. As the p-value for the number of internal conflicts and the number battle-related deaths is increased to 13.1% and 13.7% respectively, compared to the estimates without exclusion of Nigeria, Somalia,

[21] 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"

Algeria, Libya and Egypt which is expected as the sample, not quite large to start (986 observation in Africa) with is reduced (913 observations). Finally, quantitatively, the magnitude of the estimates remains relatively stable.

Table 10: Two stage least square - Excluding top five countries subject to Islamist terrorism

	(1)	(2)	(3)	(4)	(5)
	# Internal Conflict	Incidence	Onset	$ln(Battledeaths+1)$	# of Refugees
Estimates for Africa					
$ln(Arms^*_{it}+1)$	0.042	0.028	0.011*	0.228	2.073*
	(0.027)	(0.022)	(0.006)	(0.150)	(1.060)
N	913	913	913	913	913
adj. R^2	0.503	0.492	-0.073	0.553	0.328
First-stage Kleibergen-Paap F-Stat: 10.086.					
Estimate for the world excluding Asia					
$ln(Arms^*_{it}+1)$	0.048*	0.030	0.014**	0.218	1.870*
	(0.027)	(0.023)	(0.007)	(0.145)	(0.976)
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: 10.969.					
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Standard error clustered on the country level. Country and Continent-Year Fixed effects.

4.3 Channels

The transfers observed are mainly non-military and thus reflect larger availability for the population. First, in a recent report by the Small Arms Survey, 84.6% of the 1 million firearms worldwide were held by civilians at the end of 2017 (Karp (2018)). Second, the instrument does not predict military expenditure. Table 11 reports the estimates of the instrument regressed on Military expenditure using National Material capabilities dataset from Correlates of War. The worry that the instrumental variable is also predicting military expenditure is alleviated as the coefficient are far from being significant (p-value=74% for Africa). Note that the coefficient is significant in Asia, reinforcing the choice of excluding this region from the analysis. Again this is potentially explained by the fact that major arms suppliers are directly involved in conflicts in Asia.

Table 11: IV used to predict Military expenditure

Dep.Var.: Military expenditure	(1) Africa	(2) Asia	(3) World	(4) 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

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Standard error clusterd on the country level.

Country and Year Fixed effects.

As weapons are flowing to country i, the availability is wider for the population, leading to a better technology of war and an increase in time invested in insurrection to the detriment of the production by the population (Grossman (1991)). This fact is also in-line with the seminal papers mentioned in the Introduction: arms availability favours insurgency (Fearon and Laitin (2003)) or makes rebellion more viable (Collier and Hoeffler (2004), Collier, Hoeffler and Rohner (2009)).

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 (Bapat (2005), Hultquist (2013)).

4.4 Validity of the Shift-Share instrument

In this section I will run test on the validity of the instrument specific to the Shif-Share instruments using the approach described in Borusyak et al. (2018). The starting point is a rewriting of the IV coefficient in terms of industry (supplier) average exposure

4.4.1 Identifying suppliers level variation

5 Conclusion

Although Small Arms and Light Weapons wrongdoings have been observed by NGOs, mentioned in empirical research and studied theoretically, convincing global causal analysis of in-

ternational arms transfers on conflict remained missing. Reverse causality and data availability might have been a key issue. Filling this gap, this paper provides the first causal estimates of the effects of arms imports from a global set of suppliers on conflicts in the recipient country.

To solve the issue of endogeneity, arms import are instrumented by supply shortages measured by a weighted average of usual suppliers war involvement on a different continent than the recipient country. As arms suppliers go at war elsewhere, their production and supply are redirected towards themselves. Using Small Arms and Light Weapons country-year transfers data (NISAT) from 1992 to 2011, the two-stage least squares estimates revealed a positive relationship between arms imports and violence. The estimated models predict a positive causal effect of arms on the number of internal conflicts, the onset of internal conflict, the number of battle-related deaths, and number of refugees fleeing the destination country.

The evidence of the causal effect presented in this paper has two policy implications. First, the identification strategy discards the common arms suppliers argument that if they do not send weapons others will do. Second, it confirms that arms export is a tool within the reach of the international community to influence condition favoring conflict. Thus, this work reinforces the legitimacy of the recently adopted legal framework, the Arms Trade Treaty (ATT), aiming at tightening the control on arms transfers.

With thousands of refugees drowning each year in the Mediterranean and the fact that 2017 was a record year with 68.5 million displaced people[22], it is manifest that we are facing a global migration crisis. However, the answer of developed countries to the situation is highly criticized by observers like Human Rights Watch. Whether we look at 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."*[23] or in the US where families were separated and people placed for days in frigid cells called *"hieleras"* (freezers)[24]. The direct positive effect of arms transfers on refugees flow measured in this paper might draw some 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 it would reduce the number of refugees by approximately 500,000 persons per year

[22]Human Rights Watch: Last accessed 29.06.18. https://www.hrw.org/news/2018/06/26/eu-decisive-moment-migration-policy

[23]Human Rights Watch: Last accessed 29.06.18. https://www.hrw.org/news/2018/06/18/towards-effective-and-principled-eu-migration-policy

[24]Human Rights Watch: Last accessed 29.06.18. https://www.hrw.org/report/2018/02/28/freezer/abusive-conditions-women-and-children-us-immigration-holding-cells

representing. 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.

Data quality remains a clear caveat. Missing the precise information of arms recipient (governmental or private) makes it difficult to pin down the channel by which arms influence conflicts. Based on the simple statistics that 84.6% of the Small Arms and Light Weapons were possessed by civilians in 2017 (Karp (2018)) and showing that the instrument does not predict military expenditure, this research suggests that increase in arms inflow represent the population arming, facilitating violent action against the government. However, better data might remain difficult to obtain as the major source, the Norwegian Initiative on Small Arms Transfers (NISAT) has been shut down in October 2017.

Future research would be helpful to identify more precisely the channel in which arms inflow influence conflict in the recipient country. Furthermore, using this identifying strategy might help to quantify specific suppliers influence on conflict helping the international community to asses responsibility and impose sanctions.

Appendix A Details on Benson and Ramsey (2016) validity of the exclusion restriction

Benson and Ramsey (2016) aimed at measuring the global causal effect of arms transfer on conflict in the destination country. To instrument arms import they use a weighted average of war termination where the weights are the closeness to arms recipient using the idea that war termination relaxes partially the pressure on global arms demand and that after conflict weapons remaining are more easily passed to closer countries. The distance used to estimate the closeness is either geographical or network distance. Given that larger weight is attributed to the end of a conflict as it is close, transnational economic or strategic factors uncontrolled in Benson and Ramsay (2016), cast doubt on the validity of the exclusion restriction. Gleditsch (2007) showed that transnational ethnic/political/economic ties matter in conflict onset. Example of transnational factors includes: conflict-induced refugees flow which might spread conflict by *inter alia* facilitating the displacement of arms (Salehyan and Gleditsch (2006)). On the other hand, using the network distance might link more strongly countries which are not direct neighbours but the geographic link being not clear it poses difficulty to asses the exogeneity of the instrument. This caveat is mentioned by the authors. To approach the issue they run simulations with an arbitrary value of the international contagion effect. If anything, the conclusion of this sensitivity test shows that the effect of arms on conflict seems positive. However, even if we accept this approach, quantification exercise remains imprecise.

Appendix B Background: Small Arms and Light Weapons raising issue and international context

Above and beyond being particularly deadly, SALW are inexpensive to manufacture (less than 100 US$ for an AK-47 (Brauer (2007)) and due to their facility to operate (children easily use AK-47 in war zones (Killicoat (2007)) are very 'popular' in civil wars. SALW have other characteristics that make them difficult to control and particularly deadly as they are easily transported, concealed, kept, relatively inexpensive and easy to use (ICRC (1999)). More than 1 billion of small arms are responsible for about 210,000 deaths in 2016 (Mc. Evoy and Hideg (2017), Karp (2018)).

During the Cold War, the two blocks following an arms race policy built substantial arms production capacity and had accumulated considerable stock. The end of the Cold War marked a turn on the arms market and conflict type. Following disarmament policies to show their goodwill towards the former enemy, the two blocks members transferred tremendous amounts of weapons to developing countries which represented with the border openings and globalization, one of the three main factors defined by the ICRC of increasing arms availability (ICRC (1999)). Furthermore, without a clear enemy to focus their military power and possessing such production capacity, the blocks turned their exports to the global market (Yanik (2006)). Then, there has been a progressive shift on the arms market from major conventional weapons to SALW. From 1984 to 1994 the global exports for major conventional weapons has been reduced by half (ICRC (1999)) while the market for SALW kept increasing (NISAT dataset).

One reason for this shift is the parallel shift of dominant conflict type from interstate-wars to internal conflict during the Cold War and after (Wallensteen and Sollenberg (1998); Marshall and Gurr (2003)) as SALW are more adapted to internal conflict (ICRC (1999)) and human right violations (Frey (2003); Frey (2013)). Since major ICRC (ICRC (1999)) and UN reports (UN General Assembly resolution A/RES/50/146 (1996)) pointing out the danger of SALW proliferation, there has been a growing awareness on the matter. In 2000, Kofi Annan, UN Secretary-General at the time, described small arms as 'weapons of mass destruction'[25].

Answering the raising issue of SALW, the international community discussed and developed control mechanisms. The Program of Action, approved in 2001, is a United Nation program that mandate state members a specific role to fight illicit SALW market. Then, the Firearm Protocol adopted the same year plays the role to facilitate the application of international law in the context of SALW regulations. In 2005, the International Tracing Instrument was adopted to help to trace the origin of SALW. More recently, on December 2014, the Arms Trade Treaty (ATT) entered into force to reinforce the legal framework and particularly to contain "misuse" of SALW (for an extensive list of control process and instrument see: A Guide to the UN Small Arms Process (2016)).

Despite such an international focus, enforcement remain weak. For example, in 2019 the UK, a country who signed the ATT, has been accused of fueling violence by providing massively weapons to Saudi Arabia currently at war with Yemen. As causal evidence and effect quantifi-

[25]Annan, Kofi. 2000 Freedom from Fear: Small Arms. Report of the Secretary-General to the Millenium Assembly of the United Nations; A/54/2000, p. 52. New York, NY: United Nations General Assembly. 27 March

cation remain missing, filling this gap might help to reinforce the case that arms suppliers have a direct responsibility in numerous deaths.

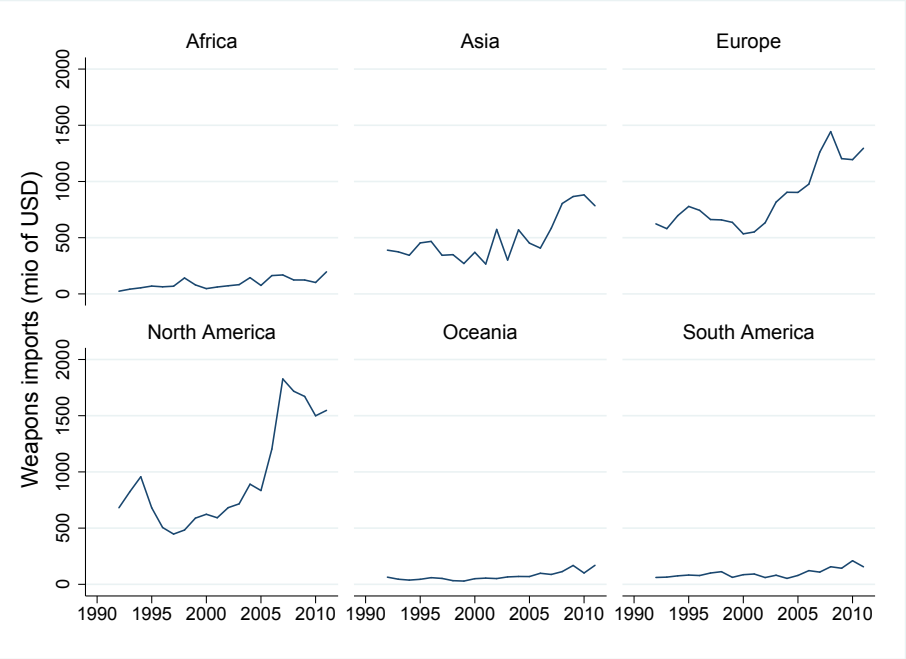
Appendix C Internal conflict

Figure 2: Number of internal Conflict accross time and continent

Source: UCDP PRIO

Appendix D Small Arms and Light Weapons transfers:

Figure 3: Small Arms and Light Weapons transfers across time and continent



Source: NISAT

Appendix E Instrument underlying variation

The shortage shocks are generated by various conflict and suppliers being affected on the whole sample. Table 12 on the next page shows the number of conflict by year and supplier for the twenty biggest suppliers of arms in Africa. First, we can see that during the 90s, there are not many suppliers involved in conflict outside Africa (neither in Africa). The first one being Russia conflict in 1993 against Parliamentary forces, then 1994-1996 against the Chechen Republic of Ichkeria and Pakistan conflict in the Kashmir region against India in 1997. The first major shock is the OTAN offensive in Kosovo in 1999 involving nine of the 20 major suppliers, the same year there is a total of 19 suppliers involved in a conflict outside Africa compared to zero in 1998. Then in 2001, following the 9/11 terrorist attacks, the global war against al-Qaeda starts, implicating Australia, Canada, France, Germany, Italy, Poland, Turkey and the United Kingdom (UCDP/PRIO data). During the second part of the sample 2001-2011, there is several major conflicts outside Africa: War in Afghanistan (2001, 2002-end of the sample), War in Iraq (2004-end of the sample) and War in Yemen since 2009.

6 OLS estimates

The OLS estimates are not significant due to the endogeneity. As conflict outbreaks it increases the demand for arms (upward bias) but might decrease the supply (downward bias).

7 Reduced form (Africa

The reduced form estimates show how the instrument is negatively associated with the outcome. This result imply that larger supply shortage (larger value of the instrument) is negatively correlated with violence in the destination country.

Table 12: **Top 20 weapons supplier to Africa war involvement on another continent (UCDP/PRIO data)**

Country	**Exports (USD)**	%	**1992**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**2000**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**2011**
Total # of suppliers	-	-	2	1	1	1	1	2	0	19	2	9	17	14	20	23	31	26	29	26	31	32
Total # of conflicts	-	-	5	1	1	1	1	2	0	19	2	11	18	26	70	77	64	67	75	63	69	68
USA	342.0 mio	18.08%								1		2	1	3	5	5	5	6	5	5	5	6
Italy	230.0 mio	12.16%								1		1	1	2	5	5	1	1	2	2	2	2
France	175.0 mio	9.25%								1		1	1	2	2	2	1	1	2	3	3	3
Spain	171.0 mio	9.04%								1			1	1	5	2	1	1	2	2	2	2
China	140.0 mio	7.40%																				
Brazil	91.9 mio	4.86%																				
Pakistan	76.5 mio	4.04%						1		1			2	2	2	2	2		3	3		2
United Kingdom	75.0 mio	3.97%								1		2	1	3	5	5	5	6	4	3	2	2
Singapore	53.4 mio	2.82%																		2	2	2
Germany	49.6 mio	2.62%																				
Israel	45.1 mio	2.38%																				
Czech Republic	43.9 mio	2.32%								1					5	3	4	5	5	3	2	2
Congo	39.2 mio	2.07%																				
Russia	35.8 mio	1.89%		1	1	1	1												1			
South Africa	34.3 mio	1.81%																				
Switzerland	32.3 mio	1.71%															1	1				
Austria	30.3 mio	1.60%															1	1	2		2	2
Turkey	24.1 mio	1.27%								1		1	1				1	1	2	2	2	2
Ukraine	21.1 mio	1.12%													3	3			2	2	2	2
Portugal	14.6 mio	0.77%								1					5	3	1	1	2	2	2	2
Cyprus	12.4 mio	0.66%																				

Table 13: **Top 20 weapons supplier to Asia war involvement on another continent (UCDP/PRIO data)**

Country	**Exports (USD)**	**%**	**1992**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**2000**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**2011**
Total # of suppliers	-	-	8	8	3	5	6	11	20	36	10	15	23	18	19	22	9	7	16	16	16	13
Total # of conflicts	-	-	13	15	3	5	7	18	41	58	18	17	24	20	19	22	9	7	18	19	22	16
USA	3280 mio	31.24%								1		1	1	1	1	1	1	1	1	1	1	1
Italy	1090 mio	10.38%								1	1	1	1	1	1							
Germany	744 mio	7.09%																				
Brazil	706 mio	6.73%																				
Switzerland	534 mio	5.09%																				
South Korea	463 mio	4.41%																				
Belgium	388 mio	3.70%								1					1	1						
United Kingdom	328 mio	3.12%								1	2	1	1	1	1	1	1	1				
France	277 mio	2.64%								1		1	1	1	1	1	1			1	2	1
China	273 mio	2.60%																				
Czech Republic	256 mio	2.44%								1					1				1	1		
Austria	220 mio	2.10%																				
Spain	154 mio	1.47%								1			1	1	1	1						
Russia	151 mio	1.44%																	1			
Poland	149 mio	1.42%								1		1	1	1	1	1						
Turkey	136 mio	1.30%								1		1	1									
Bulgaria	116 mio	1.11%																				
Slovakia	105 mio	1.00%												1	1	1						
Cyprus	85.3 mio	0.81%																				
Yugoslavia	82.8 mio	0.79%	4	3						1												

Table 14: Baseline model - OLS estimates for Africa

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) $ln(Battledeaths+1)$	(5) # of Refugees
$ln(Arms^*_{it}+1)$	0.002	0.002	0.001	0.025	-0.063
	(0.005)	(0.005)	(0.001)	(0.034)	(0.117)
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes
N	987	987	987	987	987
adj. R^2	0.014	0.024	0.025	0.084	0.050

Standard error clustered on the country level. Fixed effects are on the country and continent-year level.
The sample is restricted to Africa.

Table 15: Reduced Form estimates for Africa

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) $ln(Battledeaths+1)$	(5) # of Refugees
Supplier War	-0.207	-0.140	-0.061**	-1.062	-8.242**
Involvement	(0.124)	(0.105)	(0.024)	(0.653)	(3.705)
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes
N	986	986	986	986	986
adj. R^2	0.024	0.029	0.030	0.091	0.062

Standard error clustered on the country level. Country and continent-year Fixed effects. Sample restricted to Africa.

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