Arming opposition: Measuring the effect of arms transfers on internal conflict *

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The main contribution of this paper is to provide the first causal estimation of the effect of weapons imports on conflicts in the recipient country for a global set of suppliers. The second main contribution is to suggest a novel approach to correct the errors with a Shift-Share (Bartik) instrument using arbitrary clustering and its implementation in STATA using the command `acreg`. 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 number of refugees from the recipient country. To address endogeneity issues, I am using supply shortages generated by suppliers' war involvement outside the recipient country's continent (Shift-Share 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.

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

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

I. 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."*. 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[3]. While in 2012, Syria, Honduras and Venezuela were the countries with highest lethal violence proportional to their population (Secretariat, Geneva Declaration (2015)). 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 adage *"If you want peace, prepare for war."*(Pearson and Sislin (2001)). Internal conditions favouring conflicts are difficult to manipulate. However, control of arms exports is within the reach of the international community. Hence, should supplier countries send weapons to help or stop weapons deliveries to prevent the escalation of violence?

Using worldwide data from 1992 to 2011, this paper provides, to my knowl-

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.
3. 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/`

edge, the first quantification of the effects of arms imports from a global set of suppliers on conflicts in the recipient country while addressing endogeneity issues. A major barrier to quantify the effect of arms imports on conflict indicators is reverse causality which biases the OLS estimates. Indeed, when a conflict outbreaks the demand for arms increases (upward bias)[4]. On the other hand, violence in the destination country might also reduce the supply (downward bias)[5].

To overcome endogeneity issues 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[6]. 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 substitute them completely. This result invalidates a common arms suppliers argument that if they do not send weapons others will do[7].

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 cate-

4. *"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

5. *"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

6. "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/

7. 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.

gory. 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 "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 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 not captured by the control variables. Using a concrete example: the US deploying forces in 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 IV.B.). 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[8]. 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

8. 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.

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. The results of this paper are robust to all those tests.

The second main contribution of this paper is to suggest an approach to take into account the specific correlation structure between the errors in the Shift-Share (Bartik) setup. Alongside the growing use of Shift-share instruments (290 articles containing the term "Shift-share instrument" or "Bartik instrument" in 2019 compared to 44 five years earlier[9]) a literature highlighting the potential bias of those instrument has emerged (Adao et al. (2019), Borusyak et al. (2018), Goldsmith-Pinkham et al. (2018), and Jaeger et al. (2018)). I suggest a novel way to correct the errors with a Shift-Share (Bartik) instrument using the arbitrary clustering method and suggest an implementation in STATA using the command `acreg` (Colella et al. (2019)). The worry described in Adao et al. (2019) is that the errors might be correlated between countries with a similar set of weights caused by similar values of unobservables. First, I compute a dissimilarity index between the distributions of weights of the Shift-Share for each pair of countries which yields a distance matrix. Second, I use this dissimilarity matrix to allows for a specific correlation between the errors in the variance-covariance matrix using the arbitrary clustering method from Colella et al. (2019).

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

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

of internal conflicts, the number of battle-related deaths and the number of refugees escaping from the country. The main analysis is focused on Africa as about a third of the internal conflicts took place in that region and as it suits particularly well the identification strategy (see Section III.B.). 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 III.B.).

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 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 also 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 IV.D., I show that the instrument does not predict military expenditure, which reinforces the assumption that international arms small arms and light weapons 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 quantify this effect while tackling endogeneity issues

10. 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 insurrection to the detriment of production.

on a global scale is by Benson and Ramsay (2016). However, as the validity of their exclusion restriction is questionable and their approach to addressing the problem prevents from a precise quantification of the effect the question is left unanswered (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).

The second major contribution of this paper is to provide an approach to take into account the potential correlation between the errors unaddressed by standard clustering methods with a Shift-Share (or Bartik) instrument. Thus, this paper contributes to the literature on the statistical properties of the Shift-Share approach (Adao et al. (2019), Borusyak et al. (2018), Goldsmith-Pinkham et al. (2018), and Jaeger et al. (2018)). Furthermore, it also shows the usefulness of the arbitrary clustering in the context of Bartik instrument (Colella et al. (2019)).

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 availability 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 legal transfers are 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 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 II describes the Data. Section III explains the Empirical Strategy and Section IV the Results. Finally, Section V concludes.

II. Data

My dataset is defined as 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 B and ends in 2011 due to data availability on arms.

II.A. 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

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

effect of the violence increase on refugees flows using 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 paper studies 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).

II.B. 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: $ln(USD + 1)$. 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 legal framework aiming at controlling arms transfers (e.g. the Arms Trade Treaty). On the other hand, the black market is by definition illegal and prohibition of those transfers is already established. 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)).

II.C. *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 supplier country is involved in a conflict 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 III.B., for in-depth explanation of the instrumental variable and identification strategy.

II.D. *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 conflict, taking the value one if there was a conflict on the territory in 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 I: **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 II: **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

III. Empirical Strategy

III.A. Baseline specification

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

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

where $Conflict_{it}$ is one of the outcomes described in Section II.A., $ln(Arms^*_{it} + 1)$ 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 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 (See Section III.D. for arbitrary clustering method used in 2SLS).

III.B. 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.

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:

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

Supply:

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

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

Solving for equilibrium quantity, we obtain:

Equilibrium:

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

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

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

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

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 the 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

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

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 endogeneity arising from this relationship.

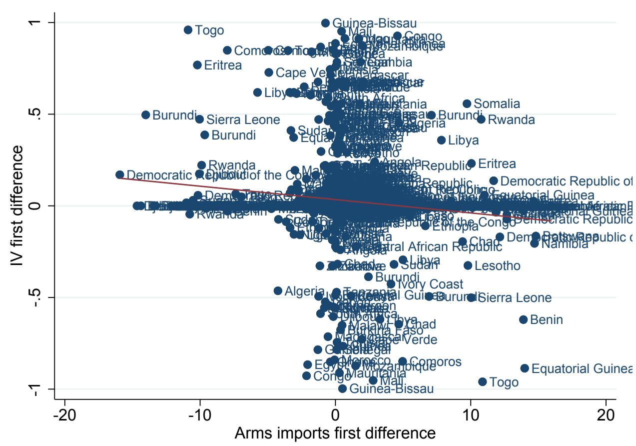
Finally, the instrument is a weighted average built with the interaction of the two sets of variables described above, representing the percentage of usual suppliers involved in wars on a different continent of the recipient country (see equation (5)).

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. Fig-

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

ure I 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 IV.).

Figure I: 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

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).

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. Several factors that might question the validity of the exclusion restriction are tested in Section IV.B.: development aid, direct military intervention in the recipient country, other imports from arms suppliers or international Islamist terrorist action.

Appendix K, 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 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 IV., 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.

III.C. 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:

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

Second stage:

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

$ln(\widehat{Arms^*_{it}}+1)$ 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 III.B.). All other terms are defined as in equation ((1)).

III.D. Arbitrary clustering

Alongside the growing use of Shift-share instruments literature highlighting the potential bias of those instruments has emerged (Adao et al. (2019), Borusyak et al. (2018), Goldsmith-Pinkham et al. (2018), and Jaeger et al. (2018)). In particular, in Adao et al. (2018), it is shown that the residuals between observations with similar distribution of the "shares" might be correlated. This is an issue as the typical robust, clustered or spatial standard errors would not account for this dependence in the variance/covariance matrix. I suggest a novel way to correct the errors with a Shift-Share (Bartik) instrument using the arbitrary clustering method and suggest an implementation in STATA using the command `acreg` (Colella et al. (2019)). First, I compute a similitude index between each pair of countries based on the set of weights of the Shift-Share instrument which yields a distance matrix. Second, I use this distance matrix as the S matrix for arbitrary clustering.

III.D..1 Distance matrix

To compute the similitude between two sets of weights ("share") of two observations, I suggest the use of two measures: Jaccard and Bray-Curtis. Jaccard suits well incidence (presence/absence) data as Bray-Curtis suits well abundance data (continuous value). Note that the weights in a Shift-Share setup are typically fixed over time. Hence, I dropped the t subscript for parsimony in this section.

Jaccard dissimilarity index is defined as one minus the intersection of two sets divided by the union of the two sets.

$$J(I,K) = 1 - \frac{|I \cap K|}{|I| + |K| - |I \cap K|}$$

with I the set of non-null weights for observation I and K the set of non-null weights for observation K. Hence, the Jaccard dissimilarity index represents one minus the proportion of common non-null weights for two observations. This index suits well data where there is a certain distribution between positive and null weights. See Appendix E for numerical examples.

On the other hand, Bray-Curtis similarity index use the difference between the size of the each share

$$BC_{ik} = 1 - \frac{2\sum_{j=1}^{J} min(W_{ij}, W_{kj})}{\sum_{i=1}^{J}(W_{ij} + W_{ik})}$$

with W_{ij} the weight from j in i and W_{kj} the weight from j in k. In this paper, i and k are recipient countries while j are the different arm suppliers. See Appendix E for numerical examples.

By computing all the pairwise distances we obtain a distance matrix:

$$S = \begin{bmatrix} D_{11} & D_{12} & x_{13} & \dots & x_{1N} \\ D_{21} & D_{22} & x_{23} & \dots & x_{NN} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ D_{N1} & x_{N2} & x_{N3} & \dots & x_{NN} \end{bmatrix}$$

with D_{ik}, the Jaccard or Bray-Curtis dissimilarity index between observations i and k.

The idea of computing those dissimilarity indices is to define the strength of the dependence between the errors. This relation should represent the potential relationship to common unobservables between observations with similar weights which will lead the choice between the two indices. If you suspect the unobservables to be associated between observations based only on incidence, meaning that it doesn't matter the size of the weight but only if the weight is non-null, hence Jaccard index will suit better this situation. Moreover, to use Jaccard, you must have a distribution of "shares" of the Shift-Share instrument composed by a mix of null and positive values. If you only have positive values, you would end up only with values of 1. If you suspect the magnitude of the weights to be related with the unobservables or if a wide majority (or all) the weights are non-null, the Bray-Curtis index will suit better your case.

III.D..2 Variance-covariance matrix with arbitrary clustering

In the arbitrary clustering method from Colella et al. (2019) the sandwich formula of the variance/covariance in OLS is defined as:

$$\widehat{VCV(b_{OLS})} = (X'X)^{-1}X'(S \times (ee'))X(X'X)^{-1}$$

with e the residuals ($e \equiv y - Xb_{OLS}$) and S the matrix of dependence (clusters) between residuals.

While in a 2SLS setup the variance/covariance matrix is defined as:

$$\widehat{VCV(b_{2SLS})} = (\hat{X}'\hat{X})^{-1}\hat{X}'(S \times (uu'))\hat{X}(\hat{X}'\hat{X})^{-1}$$

with u the residuals ($u \equiv y - Xb_{2SLS}$) and S the matrix of dependence (clusters) between residuals.

III.D..3 Implementation with STATA command `acreg`

The final step is to choose the dependence structure for the errors. First, you have to choose if there is dependence only below a certain threshold. Recall that we measured the dissimilitude. Hence, a small value reflects low dissimilitude or high similarity. Second, you can also state if the dependence is proportional to the inverse of the dissimilarity computed (Bartlett-kernel method).

First, you can include your distance matrix in the `acreg` command by using the option `dist_mat()`. Then you have to use the option `dist()` and specify below which threshold the two errors are assumed to be dependent. Hence, the S matrix will be composed by 0 and 1 with 1 if D_{ik} is below or equal to the defined threshold (`dist(threshold)`). The threshold must be an integer. Hence, this strategy requires that your similarity index is in base 100, not between 0 and 1. Second, the option `bartlett` will use the magnitude of the inverse of the dissimilarity index to allow for different intensity of the dependence between the errors (using a Bartlett-kernel approach). In other words, if the two observations have a dissimilarity below the threshold, their dependence is reduced proportionally to the inverse of the dissimilarity index. While, if the distance is above the threshold, the dependence will be set to zero as well with the `bartlett` option.

III.D..4 Application

Table III describes the distribution of the two suggested indices. First, both indices for Africa show that some countries have a dissimilarity of 1 with respect to their distribution of the "shares" as the maximum value is 1. Second, we can see that the smallest similarity for Africa is 38.3% for Jaccard while it's 23.7% for Bray-Curtis implying that some countries have quite similar supply composition. Third, the table show that the mean dissimilarity for the Africa is relatively high with 91.46% and 85.4% for Jaccard and Bray-Curtis respectively. In other words, approximately 90% of the supply structure is different between two countries on average. In the case of this research, the correlation between the two indices is 0.992 suggesting that each countries have few suppliers and many zeros. Finally, the observation for Africa are also valid for the world as the values are similar.

TABLE III: **Dissimilarity indices**

	Min.	1^{st} Quartile	Median	Mean	3^{rd} Quartile	Max.
Africa						
Jaccard	0.383	0.883	0.943	0.9146	0.980	1.000
Bray-Curtis	0.237	0.790	0.892	0.854	0.961	1.000
World						
Jaccard	0.319	0.811	0.897	0.867	0.957	1.000
Bray-Curtis	0.190	0.682	0.813	0.782	0.917	1.000

To construct the dependence matrix S based on those weights we face two choices. First, we could set a threshold and allow for correlation between the errors for observations with a dissimilarity index below this threshold. Second, we could use a continuous the Bartlett-kernel approach to allow for dependence below a certain threshold but the larger the dissimilarity, the smaller the intensity of this dependence.

To explore the results using this strategy, I will use four different options. First, I fix the threshold to the 1^{st} quartile. By doing so, I create clusters of observations in the variance-covariance matrix between the one-quarter of the observations with the lowest dissimilarity. Then, I use as the threshold, the median and 3^{rd} quartile. Finally, I remove the threshold (set to 0) and use the Bartlett-kernel approach. The results are presented in Section IV.C..

IV. Results

First, I will present the results for Africa, the region where most of internal conflicts took place (see Appendix C) and suiting particularly well the identification strategy (see Section III.B.). Second, results are then extended while excluding Asia due to the weakness of the instrument for that region (see Table VI).

In Table IX in Appendix F 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 X in Appendix G 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 III.B. the instrument must be relevant. To assess the relevance we can refer to the first stage results in Table IV. 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 III.B., 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 IV).

TABLE IV: First Stage

Dep.Var.: $ln(Arms^*_{it}+1)$	(1) Africa	(2) Asia	(3) World	(4) 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 V 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[18] (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 V: 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

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

Then, Table VI 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[19]. 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.

IV.A. Duration and outcome of conflict

Using the same identification strategy, I compute the estimates for the duration and conflict outcome. Note that a difficulty regarding the identification

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

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

TABLE VI: 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

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

of the effect is the scarcity of the events. In Africa, during the sample, there was only 22 ceasefires or peace agreements (36 for the world excluding Asia), 4 rebels 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). Hence, the results are not statistically significant at the 10% threshold potentially due to low power. Table XI and Table XII in Appendix H show the two-stage least square estimates.

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 XI, 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).

IV.B. Robustness

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

IV.B..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 XIII in Appendix IA. 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.

IV.B..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 XIV in Appendix IB. 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.

IV.B..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 XV in Appendix IC. shows that the results are robust to the inclusion of a weighted average of general exporter at war on another continent.

IV.B..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).

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)[20], 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 XVI in Appendix ID.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,

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"

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, 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.

IV.C. Arbitrary clustering

The typical worry discussed in the literature about Shift-Share instrument is that the errors might be correlated between observations with similar sets of weights (the "share" of the Shift-Share instrument) reflecting common values of unobservables. This issue might not be addressed by standard clustering methods. Thus, I use the arbitrary clustering framework (Collela et al. (2019)) to take this dependence in the variance-covariance matrix into account (cf: Section III.D.). The results are robust to this modification. More specifically, it reduces the standard deviation and hence increases the significance of the coefficient and the F-stat of the first stage.

IV.D. 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 VII 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 VII: 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)).

V. Conclusion

Although Small Arms and Light Weapons wrongdoings have been observed by NGOs, mentioned in empirical research and studied theoretically, convincing global quantification exercise of international arms transfers on conflict remained missing. Reverse causality and data availability might have been a key issue. Filling this gap, this paper provides, to my knowledge, the first quantification of the effects of arms imports from a global set of suppliers on conflicts in the recipient country while addressing endogeneity issues.

The two-stage least square estimates predict a positive effect of arms import on the number of internal conflicts, the onset of internal conflict, the number of battle-related deaths, and the number of refugees fleeing the destination country. The evidence of this positive effect presented in this paper has two practical 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 favouring 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. Furthermore, it provides a strategy to assess if countries or group of countries fuel conflict or not and assess if treaties are efficient or not. Hence, potentially helping the international community to assess responsibility and impose sanctions.

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[21], 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

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

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."*[22] or 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 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. 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.

The second major contribution of this paper is to provide an approach to correct for the specific correlation structure between the errors with Shift-Share instrument. As the use and critics of Shift-Share instrument are growing, providing an approach and showing the implementation might reduce this worry.

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 fact that 84.6% of the Small Arms and Light Weapons were possessed by civilians in 2017 (Karp (2018)), showing that the instrument does not predict military expenditure and that this mechanism is in line with the insurrection literature, this research suggests that increase in arms inflow represents 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

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

23. 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`

(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. Although Small Arms and Light Weapons wrongdoings have been observed by NGOs, mentioned in empirical research and studied theoretically, convincing global quantification exercise of international arms transfers on conflict remained missing. Reverse causality and data availability might have been a key issue. Filling this gap, this paper provides, to my knowledge, the first quantification of the effects of arms imports from a global set of suppliers on conflicts in the recipient country while addressing endogeneity issues.

The two-stage least square estimates predict a positive effect of arms import on the number of internal conflicts, the onset of internal conflict, the number of battle-related deaths, and the number of refugees fleeing the destination country. The evidence of this positive effect presented in this paper has two practical 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 favouring 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. Furthermore, it provides a strategy to assess if countries or group of countries fuel conflict or not and assess if treaties are efficient or not. Hence, potentially helping the international community to assess 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'[24].

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

24. 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

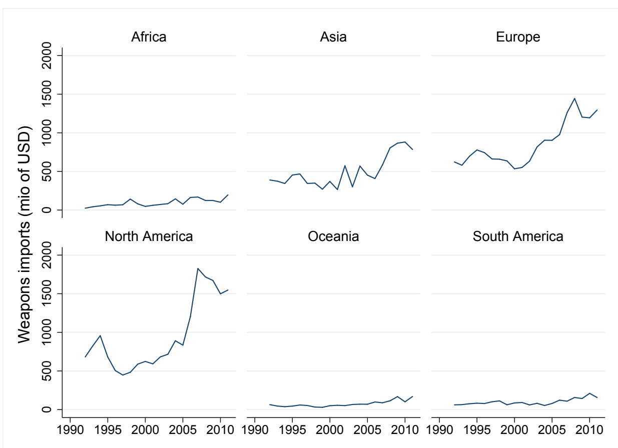
Appendix C Internal conflict

Figure II: Number of internal conflict accross time and continent

Source: UCDP PRIO

Appendix D Weapons transfers

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



Source: NISAT

Appendix E Dissimilarity index examples

In this section, I am going to illustrate the computation and differences between Jaccard and Bray-Curtis indices with the four examples in Table VIII. I and K are different observations with different distributions of weights.

TABLE VIII: Weights ("share") distribution examples

(a) Example 1

	$j=1$	$j=2$	$j=3$
I	0.6	0.4	0
K	0.6	0.4	0

(b) Example 2

	$j=1$	$j=2$	$j=3$
I	0.1	0.9	0
K	0.5	0.5	0

(c) Example 3

	$j=1$	$j=2$	$j=3$
I	0.1	0.9	0
K	0.5	0	0.5

(d) Example 4

	$j=1$	$j=2$	$j=3$
I	1	0	0
K	0	1	0

EA. Jaccard similarity

Example 1: $J_{ik} = 1 - \frac{2}{2+2-2} = 0$. I and K have exactly the same categories of j null and non-null leading to a value of 1, perfect similarity.

Example 2: $J_{ik} = 1 - \frac{2}{2+2-2} = 0$. Recall that the Jaccard is made for incidence data and do not take into account the size in each category which is why this situation is similar to the first.

Example 3: $J_{ik} = 1 - \frac{1}{2+2-1} = 2/3$. I and K have only category $j = 1$ which is non-null for both.

Example 4: $J_{ik} = 1 - \frac{0}{1+1-0} = 1$. Indeed, no common categories have non-null values between I and K.

EB. Bray-Curtis similarity

Example 1: $BC_{ik} = 1 - \frac{2(0.6+0.4+0)}{((0.6+0.6)+(0.4+0.4)+(0+0))} = 0$.

Example 2: $BC_{ik} = 1 - \frac{2(0.1+0.5+0)}{((0.1+0.5)+(0.9+0.5)+(0+0))} = 0.4.$

Example 3: $BC_{ik} = 1 - \frac{2(0.1+0+0)}{((0.1+0.5)+(0.9+0)+(0+0.5))} = 0.9.$

Example 4: $BC_{ik} = 1 - \frac{2(0+0+0)}{((1+0)+(0+1)+(0+0))} = 1.$

EC. Comparison between Jaccard and Bray-Curtis

The major difference between the two indices is that Jaccard index is made for incidence data as Bray-Curtis use the magnitude of the weights. First of all, we can see with the four examples above that the order of the four indices is the same (except that the two first have the same value for Jaccard). Smallest dissimilarity for example 1, then example 2, then 3 and finally example 4. Second, we can see that for case 2, Jaccard gives a smaller value than Bray-Curtis. This is due to the fact that the Jaccard index does not take into account the difference in weight while Bray-Curtis does. So, from the perspective of the Jaccard index, observation I and K have the same distribution in example 2. On the other hand, Bray-Curtis, reflects a higher dissimilarity because the weights are non-null but different. For extreme case (exactly similar or completely different), the two indices give the same value (1, 0).

To conclude, the Jaccard index might be a relevant measure if there is mostly a distribution of non-null (with similar magnitude) against null values or if you face incidence data. On the other hand, Bray-Curtis is more precise and relevant with abundance data (when the magnitude of the difference reflect a relevant difference between the observations).

Appendix F 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).

TABLE IX: Baseline model - OLS estimates for Africa

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) ln(Battle deaths+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.

Appendix G Reduced form (Africa)

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

TABLE X: Reduced Form estimates for Africa

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) ln(Battle deaths+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.

Appendix H 2SLS estimates for the duration and the outcome of the conflict

TABLE XI: 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.

TABLE XII: Two stage least square estimates for the world excluding Asia

	(1) Duration	(2) Ceasefire	(3) Rebels win	(4) Gov. win	(5) Rebels low activity
$ln(Arms^*_{it}+1)$	0.069	0.039	0.004	-0.001	0.005
	(0.045)	(0.025)	(0.005)	(0.003)	(0.004)
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes
N	2315	2315	2315	2315	2315
adj. R^2	0.482	0.484	0.022	-0.029	-0.060

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

Appendix I Robustness tables

IA. 2SLS estimates while controlling for current and lagged aid

TABLE XIII: Two stage least square: Controlling for current and lagged aid

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) ln(Battle deaths+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.

IB. 2SLS estimates while excluding from the IV suppliers involved in conflict in the recipient country

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

	(1)	(2)	(3)	(4)	(5)
	# Internal Conflict	Incidence	Onset	ln(Battle deaths+1)	# 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.

IC. 2SLS estimates while controlling for ontrolling for a weighted average of suppliers of all imports at war

TABLE XV: 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(Battle deaths+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.

ID. 2SLS estimates while excluding top five countries subject to Islamist terrorism

TABLE XVI: Two stage least square - Excluding top five countries subject to Islamist terrorism

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) ln(Battle deaths+1)	(5) # 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.

Appendix J 2SLS with Arbitrary clustering

The results of the 2SLS estimates for Africa and the World excluding Asia using the arbitrary clustering method are shown in this Section. Table XVII and XVIII present the results using the Jaccard similarity index, while Table XIX and XX present the results using the Bray-Curtis similarity index

TABLE XVII: 2SLS with arbitrary clustering using the Jaccard similarity index (Africa)

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) ln(Battle deaths+1)	(5) # of Refugees
Threshold: first quartile					
$ln(Arms^*_{it}+1)$	0.054*	0.036	0.016**	0.276*	2.142**
	(0.030)	(0.025)	(0.007)	(0.160)	(1.059)
N	986	986	986	986	986
adj. R^2	0.591	0.616	-0.033	0.724	0.441
First-stage Kleibergen-Paap F-Stat: 9.926.					
Threshold: median					
$ln(Arms^*_{it}+1)$	0.054*	0.036	0.016**	0.276*	2.142**
	(0.029)	(0.025)	(0.008)	(0.160)	(1.043)
N	986	986	986	986	986
adj. R^2	0.591	0.616	-0.033	0.724	0.441
First-stage Kleibergen-Paap F-Stat: 9.914.					
Threshold: third quartile					
$ln(Arms^*_{it}+1)$	0.054*	0.036	0.016**	0.276*	2.142**
	(0.028)	(0.024)	(0.007)	(0.163)	(1.089)
N	986	986	986	986	986
adj. R^2	0.591	0.616	-0.033	0.724	0.441
First-stage Kleibergen-Paap F-Stat: 10.022.					
Bartlett					
$ln(Arms^*_{it}+1)$	0.054*	0.036	0.016**	0.276*	2.142**
	(0.030)	(0.024)	(0.007)	(0.157)	(1.051)
N	986	986	986	986	986
adj. R^2	0.591	0.616	-0.033	0.724	0.441
First-stage Kleibergen-Paap F-Stat: 10.856.					
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Arbitrary clustering method using several threshold and continuous value (bartlett).
Country and Continent-Year Fixed effects.

TABLE XVIII: 2SLS WITH ARBITRARY CLUSTERING USING THE JACCARD SIMILARITY INDEX (WORLD EXCLUDING ASIA)

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) $ln(Battledeaths+1)$	(5) # of Refugees
Threshold: first quartile					
$ln(Arms^*_{it}+1)$	0.048*	0.030	0.014**	0.218	1.871*
	(0.026)	(0.022)	(0.006)	(0.142)	(0.961)
N	2317	2317	2317	2317	2317
adj. R^2	0.576	0.612	-0.001	0.725	0.472
First-stage Kleibergen-Paap F-Stat: 11.094.					
Threshold: median					
$ln(Arms^*_{it}+1)$	0.048*	0.030	0.014**	0.218	1.871**
	(0.026)	(0.023)	(0.006)	(0.146)	(0.932)
N	2317	2317	2317	2317	2317
adj. R^2	0.576	0.612	-0.001	0.725	0.472
First-stage Kleibergen-Paap F-Stat: 10.672.					
Threshold: third quartile					
$ln(Arms^*_{it}+1)$	0.048*	0.030	0.014**	0.218	1.871**
	(0.025)	(0.022)	(0.006)	(0.145)	(0.907)
N	2317	2317	2317	2317	2317
adj. R^2	0.576	0.612	-0.001	0.725	0.472
First-stage Kleibergen-Paap F-Stat: 10.567.					
Bartlett					
$ln(Arms^*_{it}+1)$	0.048*	0.030	0.014**	0.218	1.871**
	(0.025)	(0.021)	(0.006)	(0.145)	(0.896)
N	2317	2317	2317	2317	2317
adj. R^2	0.576	0.612	-0.001	0.725	0.472
First-stage Kleibergen-Paap F-Stat: 11.403.					
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Arbitrary clustering method using several threshold and continuous value (bartlett).
Country and Continent-Year Fixed effects.

TABLE XIX: 2SLS with arbitrary clustering using the Bray-Curtis similarity index (Africa)

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) ln(Battle deaths+1)	(5) # of Refugees
Threshold: first quartile					
$ln(Arms^{*}_{it}+1)$	0.054*	0.036	0.016**	0.276*	2.142**
	(0.030)	(0.025)	(0.007)	(0.160)	(1.059)
N	986	986	986	986	986
adj. R^2	0.591	0.616	-0.033	0.724	0.441
First-stage Kleibergen-Paap F-Stat: 9.926.					
Threshold: median					
$ln(Arms^{*}_{it}+1)$	0.054*	0.036	0.016**	0.276*	2.142**
	(0.030)	(0.025)	(0.008)	(0.160)	(1.043)
N	986	986	986	986	986
adj. R^2	0.591	0.616	-0.033	0.724	0.441
First-stage Kleibergen-Paap F-Stat: 9.899.					
Threshold: third quartile					
$ln(Arms^{*}_{it}+1)$	0.054*	0.036	0.016**	0.276*	2.142**
	(0.028)	(0.024)	(0.007)	(0.164)	(1.089)
N	986	986	986	986	986
adj. R^2	0.591	0.616	-0.033	0.724	0.441
First-stage Kleibergen-Paap F-Stat: 10.122.					
Bartlett					
$ln(Arms^{*}_{it}+1)$	0.054*	0.036	0.016**	0.276*	2.142**
	(0.030)	(0.024)	(0.007)	(0.157)	(1.051)
N	986	986	986	986	986
adj. R^2	0.591	0.616	-0.033	0.724	0.441
First-stage Kleibergen-Paap F-Stat: 10.856.					
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Arbitrary clustering method using several threshold and continuous value (bartlett).
Country and Continent-Year Fixed effects.

TABLE XX: 2SLS WITH ARBITRARY CLUSTERING USING THE BRAY-CURTIS SIMILARITY INDEX (WORLD EXCLUDING ASIA)

	(1) # Internal Conflict	(2) Incidence	(3) Onset	(4) $ln(Battledeaths + 1)$	(5) # of Refugees
Threshold: first quartile					
$ln(Arms^*_{it} + 1)$	0.048*	0.030	0.014**	0.218	1.871*
	(0.026)	(0.022)	(0.006)	(0.142)	(0.961)
N	2317	2317	2317	2317	2317
adj. R^2	0.576	0.612	-0.001	0.725	0.473
First-stage Kleibergen-Paap F-Stat: 11.094.					
Threshold: median					
$ln(Arms^*_{it} + 1)$	0.048*	0.030	0.014**	0.218	1.871**
	(0.026)	(0.023)	(0.006)	(0.146)	(0.932)
N	2317	2317	2317	2317	2317
adj. R^2	0.576	0.612	-0.001	0.725	0.473
First-stage Kleibergen-Paap F-Stat: 10.672.					
Threshold: third quartile					
$ln(Arms^*_{it} + 1)$	0.048*	0.030	0.014**	0.218	1.871**
	(0.025)	(0.022)	(0.006)	(0.145)	(0.907)
N	2317	2317	2317	2317	2317
adj. R^2	0.576	0.612	-0.001	0.725	0.473
First-stage Kleibergen-Paap F-Stat: 10.567.					
Bartlett					
$ln(Arms^*_{it} + 1)$	0.048*	0.030	0.014**	0.218	1.871**
	(0.025)	(0.021)	(0.006)	(0.145)	(0.896)
N	2317	2317	2317	2317	2317
adj. R^2	0.576	0.612	-0.001	0.725	0.473
First-stage Kleibergen-Paap F-Stat: 11.403.					
Controls	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	Yes

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Arbitrary clustering method using several threshold and continuous value (bartlett).
Country and Continent-Year Fixed effects.

Appendix K Instrument underlying variation

The shortage shocks are generated by various conflict and suppliers being affected on the whole sample. Table XXI 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 are 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.

TABLE XXI: **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 XXII: **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												

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