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# Trade in Small Arms and Light Weapons: Are embargoes effective?

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**Abstract**

This paper analyses the trade in Small Arms and Light Weapons (SALW) from 1990 to 2017. Our analysis relies on an unbalanced panel of 79,245 observations reporting SALW exports between 9275 pairs of countries. In particular, we study the impact of embargoes on trade in SALW. We use a gravity model framework including, in addition to traditional gravity variables, specifically SALW trade controls. The main results show that: (i) embargoes reduce SALW exports to sanctioned countries by 33%; (ii) an EU embargo appears to determine a decrease of 37% of SALW transfers, whereas for UN embargoes the impact is not significant. In addition, we found no warning signals of sanctions-busting. First, countries do not seem to import a larger number of SALW if neighbours are under an embargo. Second, the findings show that embargoes have no statistically significant effect on the trade in sporting arms. Results are robust to some robustness checks, in particular to endogeneity.

**KEYWORDS**

embargoes, gravity model, Small Arms and Light Weapons

## 1 | INTRODUCTION

The spread of Small Arms and Light Weapons (hereafter SALW) has drawn increased attention from scientists and experts. First, SALW has become a key component in the wave of civil conflicts the world experienced since the end of the Cold War (Benson & Ramsay, 2016; Krause & Mutimer, 2005). Furthermore, the spread of small arms appears to be associated with the intensity of violent crime (Cook & Ludwig, 2000; Duggan, 2001; Siegel et al., 2013) and the increase in suicide by firearms (Andrés & Hempstead, 2011; Lang, 2013). The definition of SALW derives from a UN panel of experts, 'small arms are those weapons designed for personal use, and light weapons are those designed for use by several persons serving as a crew. Small arms include pistols, rifles, carbines and light machine guns; light weapons include heavy machine guns, grenade launchers, portable anti-aircraft and anti-tank systems, and mortars of <100 mm caliber. This category of weaponry also includes ammunition and explosives: cartridges, shells and missiles, anti-personnel and anti-tank grenades, landmines and other explosives' (UN, 1997, pp. 11–12).

This paper investigates the impact of arms embargoes on the trade in SALW between 1990 and 2017. Embargoes are the most common economic sanctions and are frequently imposed to limit arms transfers to countries involved in armed conflicts or to autocratic regimes, which do not respect human rights. However, as acknowledged, embargoes and other types of sanctions often fail because of sanctions-busting, that is practices that overcome the prohibitions (see, among others, Caruso, 2003; Early, 2015; Van Bergeijk, 1995). In fact, sanctions-busting is the basis for the main argument that sanctions lack effectiveness in relation to political objectives, as outlined in Peksen (2019) and Van Bergeijk et al. (2019).

In the case of arms embargoes, it could be suspected that non-compliant exporters take over the business of compliant exporters by providing the embargoed weapons to an importer subject to the embargo, also referred as the 'target country'. Then, trade diversion and other sanctions-busting practices are often cited to explain their failure (see Boucher & Holt, 2009; Tierney, 2005). Whether an embargo is effective or not is a crucial question, particularly with regard to SALW. Indeed, it is believed that SALW can be diverted easily and sanctioned countries often acquire small weapons from neighbouring countries through porous borders (Erickson, 2013). This appears to be confirmed particularly for ammunition.

Therefore, we first verify whether multilateral embargoes appear to be effective in limiting SALW transfers to target countries and then look for sanctions-busting mechanisms. For this, we initially investigate whether countries with neighbours under an embargo increase their SALW imports, interpreting this as a warning signal of likely sanctions-busting. Next, we look at export labels, because of the likelihood, in some cases, that arms embargoes are evaded by dispatching SALW as 'sporting arms' (Parker, 2009; Small Arms Survey, 2004). These weapons originally designed for sporting purposes can be misused (Bevan, 2008). The misuse of sporting labels may be another warning signal of sanctions-busting.

Regarding our methodology, we use a gravity model framework as commonly applied in the international trade literature. In line with this strand of literature, our model combines traditional economic variables with political and military factors. Our analysis relies on an unbalanced panel of 79,245 observations reporting SALW transfers between 9275 pairs of countries and territories from 1990 to 2017.

The results show that embargoes are effective in reducing SALW imports in target countries, specifically by 33%. Interestingly, the findings show that EU sanctions decrease trade by 37%, whereas UN embargoes are ineffective. In addition, we found no evidence of sanctions-busting. First, countries do not seem to import a larger number of SALW if neighbours are under an

embargo. Hence, there is no warning signal of arms diversion to neighbouring countries. Second, the findings show that embargoes have no statistically significant effect on the trade in sporting arms. The latter result confirms the effectiveness of embargoes and the lack of consequential sanctions-busting.

This paper relates to different strands in the literature. The following section summarises the embargoes literature and presents our main hypotheses. Here, we refer only to the trade in Major Conventional Weapon (MCW). The existing literature has applied the gravity model to the study of MCW, highlighting empirically the political factors, which are as important as economic determinants for the international trade in MCW. Bove et al. (2018) claim that oil dependence is crucial in determining the volume of arms trade between two countries: oil-dependent economies are more willing to export arms to oil-rich countries to preserve the political stability of the recipient and, in return, to stabilise the oil trade. Martínez-Zarzoso and Johannsen (2019) implemented a gravity model combining traditional economic determinants with political and security factors. The results indicated that, while political and security factors (such as military and strategic pacts) do affect the propensity of two countries to trade in arms, they do not determine the volume of trade. Akerman and Seim (2014) used social network analysis to demonstrate the role of political affinities in determining MCW trade. They pointed out that, until the end of the Cold War, political affinity was a crucial determinant of patterns of trade. After the Cold War, this factor lost its influence.

The paper is organised as follows. Section 2 presents our main hypotheses. Section 3 introduces the data and Section 4 describes the model. The results are set out in Section 5. Section 6 concludes.

## 2 | HYPOTHESES

This section summarises the existing literature and sets out our main hypotheses. First, since the effectiveness of embargoes is often questioned our leading hypothesis refers to their impact on SALW trade. Previous studies found evidence of compliance with arms embargoes (Martínez-Zarzoso & Johannsen, 2019; Schulze et al., 2017). Brozska (2008) analyses arms embargoes between 1990 and 2005 and finds that arms embargoes do reduce conventional arms imports. Similarly, Erickson (2013) argues that arms embargoes restrained the exports of both small and large conventional weapons from 1981 to 2004. Moore (2010) finds that in cases of UN arms embargoes, most exporting countries comply. Hence, our first hypothesis:

**Hypothesis 1** *Embargoes are effective in reducing SALW trade.*

As noted above, arms diversion and illicit trafficking are a potential cause of embargo failure (Dreyfus & Marsh, 2006; Rogers, 1996; Vines, 2005). Arms can illegally cross borders from neighbouring countries and reach an embargoed state without being detected. This is especially true of small, easily transportable, arms. Hence, our second hypothesis:

**Hypothesis 2** *Trade between pairs of countries increases if the importer has neighbours under an arms embargo, as a sanctions-busting mechanism.*

In addition to the geographical reallocation of trade, to break the effect of embargoes, sporting weapons may be misused. This type of weapon is less subject to export control regimens which

regulate the export of conventional and small arms (Parker, 2009). For instance, two of the most important of these international regimens, the Wassenaar Arrangement and the EU Code of Conduct, explicitly exclude weapons used for hunting or sporting purposes.[1] Export control systems comprise a set of laws and procedures applied to the final destination of the arms exported (OSCE, 2003). The exclusion of sporting arms from these regimens means it is difficult to know who the end-users are.[2] Thus, these weapons may be diverted for criminal and violent activities and misuse (Bevan, 2008).

In export control systems, including those involving arms embargoes, fewer restrictions are applied to sporting weapons. Many embargoes do not include or exclude sporting weapons explicitly in the sanctioned categories. For instance, the EU embargo targeting China generically uses the word 'arms'. Consequently, many EU members such as Austria, Finland, Germany, Italy and Spain continued to export sporting arms to China (Small Arms Survey, 2004, Ch. 4).[3] Conversely, the EU Embargo on Belarus explicitly allows the export of arms designed for sporting purposes.[4] Therefore, sporting SALW can be exported to target countries under embargoes and then misused for other, violent purposes. This leads us to the next hypothesis:

**Hypothesis 3** *Sporting arms trade increases in the event of embargoes, as a sanctions-busting mechanism.*

Embargoes undertaken by a relatively homogeneous group of countries are likely to be more effective than those of a more diverse group of countries. Specifically, EU measures may be more credible than measures announced by a larger set of countries (e.g. the UN). By a basic transaction costs logic, an agreement between a relatively small, homogeneous group is easier to achieve and more effective than for a larger group of countries (Mueller, 2003). Moreover, the EU has many policy areas that can be included in a broad set of international economic policies, such as trade and development assistance. For trade policy, in particular, the EU has had sole responsibility since the Treaty of Rome, a function now managed by the EU Commission DG for Trade, which in turn makes it even easier to coordinate the actions of Member States (Gstöhl, 2013). To sum up, the EU is perceived as credible in its trade policies. Therefore:

**Hypothesis 4** *EU embargoes are more effective than UN embargoes in curbing SALW trade.*

[1]EU 2008. Common Military List of the European Union. 10 March. 18 April. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2008:098:0001:0032:EN:PDF. WA 2008. Munitions List. Adopted and recorded in app. 5 to the Initial Elements, dated 19 December 1995; last updated 3 December 2008. WA-LIST (08). http://www.wassenaar.org/controllists/.

[2]In export control systems, exporters must specify how the end-user intends to use the items exported (Parker, 2009).

[3]The UK, no longer in the EU, issued a formal communication explaining that its arms exports to China are indeed sporting arms.

[4]https://www.consilium.europa.eu/en/press/press-releases/2020/02/17/belarus-eu-prolongs-arms-embargo-and-sanctions-against-4-individuals-for-one-year/.

# 3 | THE DATA

## 3.1 | Dependent variable

Data on SALW trade are taken from the Norwegian Initiative on Small Arms Transfers (NISAT).[5] NISAT is considered the most reliable database on small arms transfers and provides information on bilateral transfers of SALW among 250 countries and territories[6] from 1962 to 2017, drawing on multiple sources. We consider only data from the United Nations Commodity Trade Statistics Database of the UN Department of Economic and Social Affairs/UN Statistics Division (UN Comtrade).

The decision to rely solely on UN Comtrade was taken in the light of the time span of our research. In fact, it is the only source available for lengthy time periods. Chapter 8 of 'An Introductory Guide to the Identification of Small Arms, Light Weapons, and Associated Ammunition' published by the independent centre Small Arms Survey analyses various sources of data for small arms trade. Concerning Comtrade, the authors write: 'Data from UN Comtrade is particularly useful for identifying and measuring trends in small arms transfers over time and across different regions'. Our paper is based on a lengthy time period and aims to analyse recurring aspects of the small arms trade, hence the choice of UN Comtrade.

In addition, we sought transparency. UN Comtrade comprises customs data, so, needless to say, non-transparent governments can be expected to provide less than reliable data. However, the most important exporters of small arms are western and democratic countries, so UN Comtrade data can be assumed to be transparent. In this respect, according to the Transparency Barometer issued every year by the Small Arms Survey, most major exporters of SALW do report data reliably to UN Comtrade.

The choice of Comtrade leads to the use of export rather than import data. In the international trade literature, imports are usually reckoned to be recorded more accurately than exports because imports generally generate tariff revenues, while exports do not. However, in our case, the situation appears to be reversed since, when considering arms transfers, high-income countries and democracies are more reliable than developing countries and autocracies even in the light of the numerous licenses, controls and checks undertaken. Moreover, according to Bromley and Còbar (2020), importer countries are not reliable reporters of the arms trade. In this context, exports would therefore appear to be a better choice than imports. Hence, we collected the export data for all the countries available. To make up for missing exports, we mirrored imports as is frequent in the literature (see Gaulier & Zignago, 2010). The mirror data are 28% of the total number of observations.

The resulting dataset includes 79,245 observations indicating the US dollar value of the SALW trade between pairs of countries in the period 1990–2017. The dependent variable, $SALW_{ijt}$, is the value of SALW trade between country $i$ and country $j$ in a given year $t$.[7] Furthermore, since SALW includes various types of weapons, we use two alternative dependent variables to disentangle

[5]The NISAT is a project established in December 1997 as a coalition of the International Peace Research Institute in Oslo (PRIO), the Norwegian Red Cross and the Norwegian Church Aid.

[6]The territories include all regions that have a custom or that had a costum for a given period of time (for example Ryukyu Islands were occupied by the United States in 1945 and they became part of Japan only in 1972).

[7]Please note that gravity data are directed. Therefore, we may have both the value of trade from A to B and from B to A.

**TABLE 1** Top 3 largest trading partner in constant 2010 US$ (1990–2017)

| Origin | Destination | Total SALW |
|---|---|---|
| USA | Japan | 11,650,000,000 |
| USA | Taiwan | 7,735,000,000 |
| USA | Canada | 7,168,000,000 |
| **Origin** | **Destination** | **Sporting SALW** |
| Italy | USA | 2,787,000,000 |
| Brazil | USA | 1,926,000,000 |
| Japan | USA | 1,112,000,000 |
| **Origin** | **Destination** | **Military SALW** |
| USA | Japan | 11,610,000,000 |
| USA | Taiwan | 7,731,000,000 |
| USA | UK | 6,791,000,000 |

**TABLE 2** Pairs of trading countries over time

| No. of pairs | No. of years |
|---|---|
| 6383 | 1–10 |
| 1373 | 11–20 |
| 1011 | 21–30 |
| 508 | 28 |

military SALW from sporting SALW.[8] Therefore, we computed Military $SALW_{ijt}$ and Sporting $SALW_{ijt}$, indicating respectively the value of trade in military and sporting SALW between country *i* and country *j* in a given year *t*. We deflated the values at constant 2010 US$ by using the CPI deflator.[9]

There are also differences in the three variables when considering the pairs of trading partners with the largest flows of SALW. As shown in Table 1, the three largest pairs involve the USA and Japan, Taiwan and Canada. This is true for both total and military SALW. For sporting arms only, the pairs of countries with the largest trade flows are the USA as importer and traditional exporters such as Italy and Brazil.

The data are unbalanced and include 9275 pairs of countries trading SALW. Only a small number have data for the whole period, 1990–2017. Table 2 sets out the number of pairs in the dataset and the number of years with recorded transfers.

[8]Among PRIO assigned weapons types, three categories include sporting weapons, namely "Parts of sporting shotguns", "Sporting rifles", "Sporting shotguns". The others are categorised as military SALW. Military weapons include: ammunition, explosives, missiles, light weapons, military firearms, military weapons, parts of military weapons, pistols and revolvers, parts of pistols and revolvers, parts of shotgun cartridges, parts of small arms, shotgun cartridges, small arms.

[9]The formula used to deflate SALW transfers is SALW2010 = (SALWt*CPI2010)/CPIt. CPI is drawn from http://www.multpl.com/cpi/table.

**TABLE 3** Descriptive statistics

| Variable | Definition | Obs. | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|---|---|
| $SALW_{ij}$ (ln) | Flows of SALW (constant 2010 US$) | 79,242 | 10.912 | 2.987 | −0.114 | 21.072 |
| Sporting $SALW_{ij}$ (ln) | Flows of sporting SALW (constant 2010 US$) | 35,496 | 10.471 | 2.442 | −0.089 | 19.068 |
| Military $SALW_{ij}$ (ln) | Flows of military SALW (constant 2010 US$) | 70,748 | 10.814 | 3.043 | −0.114 | 21.072 |
| $Embargo_j$ | 1 if the importer is under embargo, 0 otherwise | 79,245 | 0.041 | 0.199 | 0 | 1 |
| Neighbours $embargo_j$ | The number of importer's neighbours under embargo | 79,245 | 0.403 | 0.806 | 0 | 5 |
| UN $embargo_j$ | 1 if the importer is under UN embargo, 0 otherwise | 79,245 | 0.018 | 0.134 | 0 | 1 |
| Neighbours UN $embargo_j$ | The number of importer's neighbours under an UN embargo | 79,245 | 0.181 | 0.474 | 0 | 3 |
| EU $embargo_j$ | 1 if the importer is under EU embargo, 0 otherwise | 79,245 | 0.037 | 0.188 | 0 | 1 |
| Neighbours EU $embargo_j$ | The number of importer's neighbours under EU embargo | 79,245 | 0.355 | 0.717 | 0 | 5 |
| $GDPpc_i$ (ln) | Exporter's GDP per capita (constant 2010 US$) | 77,444 | 9.881 | 1.091 | 5.170 | 11.626 |
| $GDPpc_j$ (ln) | Importer's GDP per capita (constant 2010 US$) | 76,292 | 9.258 | 1.424 | 5.102 | 11.626 |
| $Milex_j$ (ln) | Importer's military expenditure (constant 2010 US$) | 70,074 | 21.671 | 2.214 | 10.790 | 27.274 |
| Urban $pop_j$ (ln) | Importer's urban population (% of total population) | 78,123 | 4.118 | 0.408 | 1.689 | 4.605 |
| Male $pop_j$ (ln) | Importer's population, male (% of total population) | 76,654 | 3.908 | 0.056 | 3.816 | 4.340 |
| Civil $conflict_j$ | 1 if the importer has a civil conflict | 79,245 | 0.042 | 0.201 | 0 | 1 |
| Neighbours civil conflict | The number of importer's neighbours having a civil conflict | 79,245 | 0.201 | 0.487 | 0 | 3 |
| $Polity_j$ | Importer's polity score | 71,838 | 6.064 | 5.712 | −10 | 10 |
| Diff $polity_{ij}$ | Difference between the exporter and importer polity score | 69,601 | 4.712 | 5.774 | 0 | 20 |
| Common $currency_{ij}$ | 1 if common currency, 0 otherwise | 78,593 | 0.047 | 0.211 | 0 | 1 |
| $RTAs_{ij}$ | 1 if regional trade agreement, 0 otherwise | 71,399 | 0.307 | 0.461 | 0 | 1 |

### 3.2 | Independent variables

Data for the explanatory variables are from various sources (see Table 3). Data on arms embargoes are from SIPRI which provides information on embargoes implemented by the UN, the EU or other groups of states. Therefore, we construct three variables indicating whether the importing country is subject to an embargo in a given year. We first use all the arms embargoes including those implemented by other groups of nations. We then distinguish between arms embargoes imposed by the UN (both mandatory and non-mandatory) and by the EU. We also create three variables indicating the number of importer's neighbouring countries under an arms embargo (total, EU, UN). Data for neighbouring countries are from COW Direct Contiguity Data, Version 3.20.[10]

Data on GDP per capita (constant 2010 US$), military expenditure, the share of the urban and male populations are from the World Bank. Data on military expenditure are deflated in constant 2010 US$. The democracy score is from the Polity IV Project by Marshall et al. (2018). We create a dummy variable indicating whether a state has undergone civil violence and/or a civil war in a given year. Data on civil conflicts are from the Center for Systemic Peace (CSP), Major Episodes of Political Violence, 1946–2018 (Marshall, 2020). This gathers information on armed conflict defined as 'the systematic and sustained use of lethal violence by organized groups that result in at least 500 directly-related deaths over the course of the episode' (Marshall, 2020, p.1). We also create a dummy variable indicating the number of neighbouring countries of an importer undergoing civil unrest using COW Direct Contiguity Data for neighbouring countries.

Bilateral variables are gathered from the CEPII database (Head et al., 2010).[11]

## 4 | THE MODEL

Our econometric analysis uses a gravity model to investigate the relationship between arms embargoes and bilateral SALW flows. This model dates back to Isard (1954) and Tinbergen (1962), and its adoption is now standard practice to estimate the effect of several economic, cultural and political factors on trade (Baltagi et al., 2015; Head & Mayer, 2014). We adopt a gravity framework to analyse how embargoes impact on SALW inflows. We also control for several factors that may either foster or deter arms trade. Formally, our gravity equation has the following form:

$$\begin{aligned}\ln SALW_{ijt} &= \beta_0 + \beta_1 EMB_{jt} + \beta_2 Neighbor's\, EMB_{jt} \\ &+ \beta_3 GDP_{it} + \beta_4 GDP_{jt} + \beta_5 D_{jt} + \beta_6 diffpol_{ijt} \\ &+ \beta_7 G_{ijt} + \beta_8 MRTs_{ijt} + \delta_{ij} + \tau_t + \varepsilon_{ijt}\end{aligned} \tag{1}$$

[10]Contiguity relationships include both land and sea. We deal only with land contiguity and for each importer first identify the neighboring countries.

[11]Gravity variables consist of a set of bilateral impediments or facilitating factors of trade. They capture features specific to a pair of countries that explain the volume of trade between the two countries while the importer and exporter characteristics describe the propensity of trade/attractiveness of the individual country. They are time-invariant and time-variant. The use of country-pair fixed effects does not allow the use of time-invariant country-pair variables.

Here, $SALW_{ijt}$ is the log of the value[12] of flows of SALW from the exporter, that is country $i$, to the importer, that is country $j$. $EMB_{jt}$ is a dummy variable that indicates if the importer $j$ is under embargo. It controls for the effectiveness of sanctions in reducing the target's imports in SALW. $Neighbor's\ EMB_{jt}$ indicates the number of the importer's neighbours under embargo. It accounts for the presence of illegal trafficking in SALW.

$GDP_{it}$ and $GDP_{jt}$ refer respectively to exporter's and importer's GDP per capita (constant 2010US$), a traditional proxy for a country's economic size. $D_{jt}$ is a vector comprising a set of importer characteristics that may affect the demand for SALW. First, we include the level of military expenditure to check for likely complementarity. Other factors explaining the demand for arms are the shares of the total population that is urban and male. According to a stream of literature, a concentrated urban population increases crime rates (see, e.g., World Bank, 2011). Similarly, a high ratio of males in the total population may bring civil unrest. To face these threats, governments may buy light weapons.

A key factor in explaining the demand for SALW is civil conflict, which is generally characterised by the use of small weapons. Thus, we account for the presence of civil conflict in the importing country. As a further control for SALW demand, we use the number of neighbouring countries of the importer fighting a civil war. Also included is the level of democracy of the importer. As suggested by De Soysa et al. (2010), autocracies and regimes involved in human rights repression provide small arms to their police forces. $G_{ijt}$ is a vector of time-variant gravity variables that includes two binary variables with value 1 if $i$ and $j$ have a common currency or have regional trade agreements (RTAs). $\delta_{ij}$ are country-pair fixed effects which account for time-invariant bilateral factors influencing arms trade flows. $\tau_t$ represents year-fixed effects and $\varepsilon_{ijt}$ the error term.

The vector $MRTs_{ijt}$ contains multilateral resistance terms based on gravity controls and other bilateral factors.[13] MRTs indicate that bilateral trade patterns do not depend only on bilateral trade costs but also on the trade costs of each country with the rest of the world (Anderson & Van Wincoop, 2003). To control for these terms, we follow Baier and Bergstrand (2009), who derive theory-consistent MRTs from a first-order Taylor series expansion of the Anderson and Van Wincoop (2003) gravity equation. This approach is adopted in several recent studies such as Berger et al. (2013), Agostino and Trivieri (2014), Atalay et al. (2019). MRTs are calculated as follows:

$$MRTs_{ijt} = \sum_{k=1}^{N_k} \left(\theta_{kt} x_{ik}\right) + \sum_{m=1}^{N_m} \left(\theta_{mt} x_{jm}\right) \sum_{k=1}^{N_k} \sum_{m=1}^{N_m} \left(\theta_{kt} \theta_{mt} x_{km}\right) \quad (2)$$

where the indices $k$ and $m$ represent partner countries of the exporter $i$ and the importer $j$, respectively; $x_{ij}$ are observed proxies of bilateral trade costs; $\theta_{kt}$ and $\theta_{mt}$ denote the share of exporter and

[12]As highlighted in Section 3, data on transfers of SALW are at constant 2010US$. The incorrect deflation of nominal trade values by US aggregate price index may give rise to biases via spurious correlation. Baldwin & Taglioni (2006, p. 17) call this the bronze medal mistake arguing that the inclusion of time dummies corrects the error. To address the issue, we replicate all estimates using current values, showing that results are robust.

[13]Namely, MR indexes are calculated using the weighted distance between capitals, contiguity, common language, colonial heritage, common religion, common currency, regional trade agreement, and differences in democracy between exporter and importer.

importer GDP out of worldwide GDP (subscript $w$ stands for world), that is, respectively, $\theta_{kt} = \frac{GDP_k}{GDP_w}$ and $\theta_{mt} = \frac{GDP_m}{GDP_w}$[14]

# 5 | RESULTS

## 5.1 | Baseline results

This section presents estimates from regressing total trade of SALW over the period 1990–2017 (see Table 4). The results confirm our first hypothesis: there is a negative and significant relationship between embargoes on target countries and the inflows of SALW. The figures show that, when the importer is under an arms embargo, SALW imports decrease by 33%. We interpret this result as evidence of the effectiveness of sanctions in reducing inflows of SALW. The analysis of UN and EU embargoes shows that their impact is quite different. The imposition of an EU embargo on the importer leads to a 37% decrease in imports. In the case of the UN, however, the impact of sanctions is not statistically significant. This is in line with hypothesis 4. The EU is able to impose compliance as well as the punishment of free riders to its Member States. The coefficient for the number of the importer's neighbouring countries under embargoes is not significant, providing no evidence of sanctions-busting (hypothesis 2).

Moreover, the results show that the coefficient for military expenditure is positive and significant: an increase of 1% in military expenditure expands SALW imports by nearly 0.3%. This figure indicates complementarity between military expenditure and SALW inflows. Civil conflict is positively correlated with imports of SALW: that is, the presence of civil conflict in the importer country is associated with an increase of about 20% in the volume of its SALW imports. This figure seems to confirm that the wave of civil conflicts that broke out after the end of the Cold War involved largely light weapons. Thus, it is reasonable to expect an increase in SALW inflows in war zones (Mehrl & Thurner, 2020; Pamp et al., 2018). There is no evidence, however, to suggest any link between neighbours at war and small arms imports. The importer level of democracy is also unrelated to trade in SALW.

Interestingly, we also found a positive and significant relationship between SALW inflows and the share of the male population in the importer country. In detail, for a 1% increase in this share, SALW imports increase by about 6%. We interpret this as evidence that where large proportions of the population are male, governments buy more arms for their police forces to prevent civil unrest. Surprisingly, the coefficient for the share of the urban population in the importer country is negative and significant with elasticities of about 1.1. This seems to suggest the existence of scale economies in arming police recruitment.

Finally, the coefficient for importer GDP per capita is positive and significant: this is in line with the literature on the gravity model which argues that the economic dimension of the importer is a proxy for its demand. In detail, an increase of 1% in GDP is correlated with an increase of about 0.3% in SALW imports. Surprisingly, the figures also show a negative association between exporter GDP and SALW flows. This result can be linked to the composition of the world supply of SALW. Since the '90s, some developing countries have become significant exporters of SALW. Brazil, for instance, was the 6th largest SALW exporter over the period 1990–2017.

[14]GDP weights are used in several papers (Agarwal & Wang, 2018; Agostino & Trivieri, 2014; Andersson, 2016; Crivelli & Gröschl, 2016; Ramasamy & Yeung, 2019). An alternative is to use simple averages rather than GDP weights. We replicate our analysis using this alternative; the results are robust.

**TABLE 4** The impact of arms embargoes on total SALW trade

| | Total SALW flows$_{ij}$ (ln) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Embargo$_j$ | −0.436*** | −0.398*** | | | | |
| | (0.120) | (0.119) | | | | |
| Neighbours embargo$_j$ | 0.002 | 0.002 | | | | |
| | (0.034) | (0.034) | | | | |
| UN embargo$_j$ | | | −0.297$^{\dagger}$ | −0.240 | | |
| | | | (0.171) | (0.170) | | |
| Neighbours UN embargo$_j$ | | | −0.113* | −0.111* | | |
| | | | (0.054) | (0.054) | | |
| EU embargo$_j$ | | | | | −0.488*** | −0.463*** |
| | | | | | (0.132) | (0.131) |
| Neighbours EU embargo$_j$ | | | | | 0.012 | 0.014 |
| | | | | | (0.036) | (0.036) |
| GDPpc$_i$ (ln) | −0.278* | −0.286* | −0.284* | −0.282* | −0.280* | −0.288* |
| | (0.128) | (0.130) | (0.129) | (0.131) | (0.128) | (0.130) |
| GDPpc$_j$ (ln) | 0.380** | 0.312* | 0.412** | 0.347* | 0.370** | 0.299* |
| | (0.134) | (0.136) | (0.135) | (0.136) | (0.134) | (0.136) |
| Milex$_j$ (ln) | 0.383*** | 0.365*** | 0.371*** | 0.354*** | 0.384*** | 0.365*** |
| | (0.046) | (0.046) | (0.046) | (0.047) | (0.046) | (0.046) |
| Urban pop$_j$ (ln) | −1.207*** | −1.136*** | −1.136*** | −1.061*** | −1.195*** | −1.127*** |
| | (0.294) | (0.294) | (0.294) | (0.294) | (0.295) | (0.294) |
| Male pop$_j$ (ln) | 6.143*** | 6.040** | 6.712*** | 6.581*** | 6.032** | 5.907** |
| | (1.852) | (1.851) | (1.866) | (1.864) | (1.851) | (1.850) |

**TABLE 4** (Continued)

| | Total SALW flows$_{ij}$ (ln) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Civil conflict$_j$ | 0.199* | 0.194* | 0.185* | 0.181* | 0.190* | 0.187* |
| | (0.092) | (0.092) | (0.092) | (0.092) | (0.092) | (0.092) |
| Neighbours civil conflict$_j$ | 0.001 | 0.003 | −0.003 | 0.000 | −0.003 | 0.000 |
| | (0.043) | (0.043) | (0.043) | (0.043) | (0.043) | (0.043) |
| Polity$_j$ | 0.004 | 0.015 | 0.007 | 0.018 | 0.004 | 0.015 |
| | (0.011) | (0.012) | (0.011) | (0.012) | (0.011) | (0.012) |
| Diff polity$_{ij}$ | 0.000 | 0.030$^{\dagger}$ | −0.000 | 0.033* | 0.000 | 0.030$^{\dagger}$ |
| | (0.009) | (0.015) | (0.010) | (0.015) | (0.009) | (0.015) |
| Constant | −16.881* | −15.573* | −19.370* | −18.131* | −16.408* | −14.958$^{\dagger}$ |
| | (7.674) | (7.712) | (7.736) | (7.771) | (7.673) | (7.711) |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Gravity controls | Yes | Yes | Yes | Yes | Yes | Yes |
| MRTs | No | Yes | No | Yes | No | Yes |
| Observations | 58,316 | 58,267 | 58,316 | 58,267 | 58,316 | 58,267 |
| Number of pairs | 6574 | 6553 | 6574 | 6553 | 6574 | 6553 |
| $R^2$ within | .021 | .023 | .020 | .023 | .021 | .023 |
| $R^2$ overall | .034 | .034 | .035 | .037 | .033 | .033 |
| $R^2$ betweenness | .005 | .011 | .005 | .012 | .005 | .011 |

*Notes:* Robust standard errors in parentheses are clustered at the country-pair level. Gravity controls are time-variant and include common currency and RTAs (see Table 3).

***$p < .001$, **$p < .01$, *$p < .05$, $^{\dagger}p < .1$.

**TABLE 5** The impact of arms embargoes on the sporting arms trade

| | Sporting SALW flows$_{ij}$ (ln) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Embargo$_j$ | −0.187 | −0.165 | | | | |
| | (0.146) | (0.146) | | | | |
| Neighbours embargo$_j$ | −0.023 | −0.003 | | | | |
| | (0.038) | (0.038) | | | | |
| UN embargo$_j$ | | | −0.066 | −0.005 | | |
| | | | (0.236) | (0.236) | | |
| Neighbours UN embargo$_j$ | | | −0.200** | −0.164* | | |
| | | | (0.070) | (0.069) | | |
| EU embargo$_j$ | | | | | −0.170 | −0.170 |
| | | | | | (0.157) | (0.155) |
| Neighbours EU embargo$_j$ | | | | | −0.028 | −0.007 |
| | | | | | (0.040) | (0.039) |
| GDPpc$_i$ (ln) | 0.019 | −0.040 | 0.018 | −0.039 | 0.018 | −0.042 |
| | (0.151) | (0.153) | (0.151) | (0.153) | (0.151) | (0.153) |
| GDPpc$_j$ (ln) | 1.122*** | 0.997*** | 1.128*** | 1.012*** | 1.124*** | 0.997*** |
| | (0.160) | (0.157) | (0.159) | (0.156) | (0.160) | (0.157) |
| Milex$_j$ (ln) | 0.416*** | 0.388*** | 0.408*** | 0.383*** | 0.416*** | 0.388*** |
| | (0.053) | (0.052) | (0.053) | (0.052) | (0.053) | (0.052) |
| Urban pop$_j$ (ln) | −1.382*** | −1.316*** | −1.319*** | −1.262*** | −1.353*** | −1.301*** |
| | (0.380) | (0.375) | (0.378) | (0.374) | (0.380) | (0.375) |
| Male pop$_j$ (ln) | 4.799* | 4.367* | 5.316** | 4.811* | 4.793* | 4.343* |
| | (1.989) | (1.964) | (1.997) | (1.971) | (1.989) | (1.964) |

**TABLE 5** (Continued)

| | Sporting SALW flows$_{ij}$ (ln) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Civil conflict$_j$ | 0.316* | 0.305* | 0.307* | 0.297* | 0.309* | 0.300* |
| | (0.129) | (0.127) | (0.128) | (0.127) | (0.128) | (0.127) |
| Neighbours civil conflict$_j$ | −0.041 | −0.034 | −0.038 | −0.032 | −0.043 | −0.035 |
| | (0.053) | (0.053) | (0.053) | (0.053) | (0.053) | (0.053) |
| Polity$_j$ | −0.001 | 0.011 | 0.001 | 0.013 | −0.000 | 0.011 |
| | (0.015) | (0.016) | (0.015) | (0.016) | (0.015) | (0.016) |
| Diff polity$_{ij}$ | −0.011 | 0.017 | −0.011 | 0.019 | −0.011 | 0.017 |
| | (0.013) | (0.019) | (0.013) | (0.019) | (0.013) | (0.019) |
| Constant | −25.390** | −21.361* | −27.523** | −23.362** | −25.494** | −21.313* |
| | (8.452) | (8.425) | (8.464) | (8.443) | (8.456) | (8.426) |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Gravity controls | Yes | Yes | Yes | Yes | Yes | Yes |
| MRTs | No | Yes | No | Yes | No | Yes |
| Observations | 27,732 | 27,721 | 27,732 | 27,721 | 27,732 | 27,721 |
| Number of pairs | 3752 | 3744 | 3752 | 3744 | 3752 | 3744 |
| $R^2$ within | .118 | .125 | .118 | .126 | .118 | .125 |
| $R^2$ overall | .090 | .060 | .090 | .062 | .090 | .060 |
| $R^2$ betweenness | .034 | .026 | .034 | .028 | .034 | .026 |

*Notes:* Robust standard errors in parentheses are clustered at the country-pair level. Gravity controls are time-variant and include common currency and RTAs (see Table 3).

***$p < .001$, **$p < .01$, *$p < .05$ .

**TABLE 6** The impact of arms embargoes on the military arms trade

| | Military SALW flows$_{ij}$ (ln) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Embargo$_j$ | −0.442*** | −0.406** | | | | |
| | (0.130) | (0.129) | | | | |
| Neighbours embargo$_j$ | 0.026 | 0.027 | | | | |
| | (0.038) | (0.038) | | | | |
| UN embargo$_j$ | | | −0.358$^{\dagger}$ | −0.315$^{\dagger}$ | | |
| | | | (0.189) | (0.189) | | |
| Neighbours UN embargo$_j$ | | | 0.014 | 0.010 | | |
| | | | (0.059) | (0.060) | | |
| EU embargo$_j$ | | | | | −0.461** | −0.434** |
| | | | | | (0.146) | (0.145) |
| Neighbours EU embargo$_j$ | | | | | 0.029 | 0.032 |
| | | | | | (0.039) | (0.039) |
| GDPpc$_i$ (ln) | −0.252$^{\dagger}$ | −0.242$^{\dagger}$ | −0.255$^{\dagger}$ | −0.238$^{\dagger}$ | −0.253$^{\dagger}$ | −0.244$^{\dagger}$ |
| | (0.143) | (0.143) | (0.143) | (0.144) | (0.143) | (0.143) |
| GDPpc$_j$ (ln) | 0.156 | 0.094 | 0.187 | 0.127 | 0.153 | 0.088 |
| | (0.145) | (0.148) | (0.146) | (0.148) | (0.145) | (0.148) |
| Milex$_j$ (ln) | 0.368*** | 0.357*** | 0.359*** | 0.350*** | 0.367*** | 0.356*** |
| | (0.050) | (0.051) | (0.051) | (0.051) | (0.050) | (0.051) |
| Urban pop$_j$ (ln) | −1.190*** | −1.120*** | −1.163*** | −1.088*** | −1.184*** | −1.118*** |
| | (0.326) | (0.327) | (0.327) | (0.328) | (0.326) | (0.327) |
| Male pop$_j$ (ln) | 5.969** | 5.801** | 6.303** | 6.123** | 5.904** | 5.721** |
| | (2.007) | (2.012) | (2.018) | (2.021) | (2.006) | (2.010) |

TABLE 6 (Continued)

| | Military SALW flows$_{ij}$ (ln) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Civil conflict$_j$ | 0.215* | 0.208* | 0.199* | 0.193* | 0.206* | 0.200* |
| | (0.097) | (0.097) | (0.097) | (0.097) | (0.097) | (0.097) |
| Neighbours civil conflict$_j$ | 0.027 | 0.028 | 0.021 | 0.023 | 0.023 | 0.025 |
| | (0.047) | (0.047) | (0.047) | (0.047) | (0.047) | (0.047) |
| Polity$_j$ | 0.008 | 0.018 | 0.009 | 0.020 | 0.008 | 0.018 |
| | (0.012) | (0.014) | (0.012) | (0.014) | (0.012) | (0.014) |
| Diff polity$_{ij}$ | 0.002 | 0.029$^{\dagger}$ | 0.002 | 0.031$^{\dagger}$ | 0.002 | 0.029$^{\dagger}$ |
| | (0.010) | (0.017) | (0.011) | (0.017) | (0.010) | (0.017) |
| Constant | −14.037$^{\dagger}$ | −12.921 | −15.510$^{\dagger}$ | −14.524$^{\dagger}$ | −13.748$^{\dagger}$ | −12.534 |
| | (8.332) | (8.424) | (8.375) | (8.459) | (8.334) | (8.424) |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Gravity controls | Yes | Yes | Yes | Yes | Yes | Yes |
| MRTs | No | Yes | No | Yes | No | Yes |
| Observations | 51,955 | 51,907 | 51,955 | 51,907 | 51,955 | 51,907 |
| Number of pairs | 6208 | 6187 | 6208 | 6187 | 6208 | 6187 |
| $R^2$ within | .019 | .020 | .018 | .020 | .019 | .020 |
| $R^2$ overall | .025 | .027 | .026 | .030 | .025 | .026 |
| $R^2$ betweenness | .006 | .013 | .006 | .014 | .006 | .013 |

*Notes:* Robust standard errors in parentheses are clustered at the country-pair level. Gravity controls are time-variant and include common currency and RTAs (see Table 3).

***$p < .001$, **$p < .01$, *$p < .05$, $^{\dagger}p < .1$.

### 5.2 | Types of arms

Below, we run estimations separating the data for sporting and military weapons, where significant differences emerge. Tables 5 and 6 show the results. First, the impact of embargoes changes according to the type of arms analysed. On the one hand, we found no significant relationship between arms embargoes and sporting weapons. The imposition of an embargo does not lead to an increase in the inflows of sporting arms in the target. That is, we do not find any evidence of sanctions-busting (hypothesis 3). Such lack of evidence on sporting arms cannot be considered fully conclusive because the presence of civil conflict in the importer country leads to an increase of 35% in its imports of sporting arms.

On the other hand, embargoes reduce military arms imports by about 33% (35% in the case of EU embargoes). Moreover, the coefficient for UN embargoes is also negative and significant at 10%, indicating that these embargoes reduce the trade in military SALW by 27%. Notably, we also found that the increase in inflows of military SALW associated with the presence of civil conflict is about 22%. Interestingly, there is a positive and significant association with military expenditure for both sporting and military weapons with an elasticity of 0.4.

A noteworthy difference in the trade of sporting and military weapons lies in the association between a country's economic dimensions and its trade. When analysing sporting arms, the coefficient of the importer's GDP per capita is positive and significant with an elasticity of 1. Conversely, in the analysis of military weapons, the association is not significant. The interpretation of these figures suggests that the demand for military weapons is not driven by wealth. Furthermore, for military arms, there is a negative but weakly significant association between exporter GDP and its exports, while this association is not significant for sporting arms.

## 6 | ROBUSTNESS CHECKS

### 6.1 | Endogeneity concerns: entropy balancing

To check the robustness of baseline results, we address possible biases arising from endogeneity. Two potential sources of endogeneity are omitted variables bias and reverse causality between the dependent variable, that is SALW flows and the variable of interest, that is arms embargoes. Although we believe that the use of fixed effects and a comprehensive set of control variables prevent potential omitted variable bias, we cannot ex ante exclude reverse causality. It may be more difficult to impose an embargo on targets that are also large buyers of small arms. Conversely, countries may be more willing to cut the supply of SALW to partners whose imports of this commodity are already low.[15] In the case of multilateral arms embargoes, the contractual power of the single state may not be relevant. However, especially in the EU, we cannot rule out that powerful countries may prevail in avoiding the imposition of embargoes on their most important partners.

[15]No study so far has dealt with the issue of reverse causality in establishing a causal link between arms embargoes and small arms trade. Nevertheless, this issue has been faced in recent studies analyzing the impact of economic sanctions (Adam & Tsarsitalidou, 2019; Jing et al., 2003; Neuenkirch & Neumeier, 2015, 2016). Studying the effect of unilateral economic sanctions on trade, Afesorborg (2019) argues that exporters are more likely to impose sanctions on their small commercial partners.

**TABLE 7** The impact of arms embargoes on the SALW trade (entropy balancing)

| | Total SALW flows$_{ij}$ (ln) | | | Sporting SALW flows$_{ij}$ (ln) | | | Military SALW flows$_{ij}$ (ln) | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Embargo$_j$ | −0.339* | | | −0.336$^{\dagger}$ | | | −0.357* | | |
| | (0.151) | | | (0.190) | | | (0.164) | | |
| Neighbours embargo$_j$ | 0.071 | | | 0.072 | | | 0.107 | | |
| | (0.073) | | | (0.100) | | | (0.082) | | |
| UN embargo$_j$ | | 0.075 | | | 0.213 | | | −0.214 | |
| | | (0.221) | | | (0.309) | | | (0.240) | |
| Neighbours UN embargo$_j$ | | −0.122 | | | −0.219 | | | −0.039 | |
| | | (0.106) | | | (0.134) | | | (0.114) | |
| EU embargo$_j$ | | | −0.414* | | | −0.382$^{\dagger}$ | | | −0.354$^{\dagger}$ |
| | | | (0.167) | | | (0.223) | | | (0.185) |
| Neighbours EU embargo$_j$ | | | 0.088 | | | 0.048 | | | 0.135$^{\dagger}$ |
| | | | (0.074) | | | (0.096) | | | (0.081) |
| Constant | −6.525 | −19.585 | −3.644 | 28.236 | 8.813 | 32.485 | −30.110 | −33.172 | −29.331 |
| | (30.462) | (30.533) | (30.491) | (33.481) | (35.548) | (33.644) | (33.734) | (33.497) | (33.847) |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 54,981 | 54,981 | 54,981 | 25,701 | 25,701 | 25,701 | 48,791 | 48,791 | 48,791 |
| Number of pairs | 4794 | 4794 | 4794 | 2598 | 2598 | 2598 | 4499 | 4499 | 4499 |
| $R^2$ | .594 | .594 | .595 | .677 | .677 | .677 | .588 | .587 | .588 |
| $R^2$ within | .047 | .046 | .047 | .144 | .144 | .144 | .044 | .042 | .044 |

*Notes:* The table shows the average treatment effect on the treated obtained by weighted least squared regression. Pre-treatment characteristics are listed in Tables A.1 and A.2 in the appendix. Robust standard errors in parentheses are clustered at the country-pair level.

***$p < .001$, **$p < .01$, *$p < .05$, $^{\dagger}p < .1$.

To deal with possible endogeneity, following Afesorborg (2019) and Neuenkirch and Neumeier (2016), we use a matching approach that assumes that the imposition of arms embargoes is a treatment, and estimates the Average Treatment effect on Treated (ATT); that is, the impact of arms embargoes on the trade in small arms. The ATT is defined as the difference in means for the outcome variable (the average trade flow in small arms between country $i$ and $j$) between the treated group (country-pairs where the destination is under embargo) and the control group (country-pairs where the destination is not under embargo). To obtain a synthetic control group as similar as possible to the treated group we use entropy balancing (Hainmueller, 2012). According to this method, weights are assigned to observations not subject to treatment and are used in regression analysis with the treatment indicator as explanatory variable. These weights are computed to satisfy preset balanced constraints from sample moments of pre-treatment characteristics.[16] Formally, the ATT is defined as follows:

$$\tau_{att} = E\left[SALW_{ij}(1) \,|\, T = 1, X = x)\right] - E\left[SALW_{ij}(0) \,|\, T = 0, X = x)\right] \tag{3}$$

Here, the first component is the expected bilateral trade flows in small arms ($SALW_{ij}$) for observations where the destination country is under embargo, conditioned on a vector of pre-treatment characteristics ($X$); the second component is the expected trade for the re-weighted control group. In line with the existing literature (Afesorborg, 2019; Neuenkirch & Neumeier, 2016), we select factors, as pre-treatment characteristics, that determine the imposition of an embargo as well as bilateral flows. The former include political regime, physical integrity violations and the occurrence of civil and international conflict, while the latter entails gravity variables, the importer's military expenditure and demographic controls. Tables A.1 and A.2 in the Appendix show the mean comparison of these variables before and after entropy balancing.

The figures presented in Table 7 are in line with our main results. However, we also find a reduction at the 10% significance level in sporting arms that was not in the baseline results. Interestingly, this confirms that there is no increase in the imports of sporting weapons after the imposition of an arms embargo.

## 6.2 | Further robustness checks

Below, we test the robustness of our results by considering some inaccuracies in the data. Sometimes the data on arms trade are not totally accurate. In particular, in some cases, shipments include not only SALW but other equipment and military devices. For instance, when reporting the export of munitions and explosives from the USA to Taiwan in 2016 (value: 580,870,416 US dollars), NISAT includes a note stating that the shipment may have included arms not strictly defined as SALW. In our sample, 297,983 records (about 76% of the total) are categorised as cases of exclusively SALW exports while the remainder may have included conventional weapons and other equipment.[17] A significantly less important inaccuracy in

[16]In this case, the balance constraints entail equal covariate means across the treatment and the control group.

[17]NISAT original data do not include the total value of SALW trade between a pair of countries but does include records indicating the value of the export in dollars and the type of SALW involved in a given year. Our dependent variable is obtained summing up all SALW transfers between pairs. To exclude inaccuracies, where they are reported, we do not add up these transfers.

**TABLE 8** The impact of arms embargoes on the SALW trade (no inaccuracies)

| | Total SALW flows$_{ij}$ (ln) | | | Military SALW flows$_{ij}$ (ln) | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Embargo$_j$ | −0.267* | | | −0.245$^{\dagger}$ | | |
| | (0.122) | | | (0.137) | | |
| Neighbours embargo$_j$ | −0.012 | | | 0.008 | | |
| | (0.033) | | | (0.037) | | |
| UN embargo$_j$ | | −0.125 | | | −0.122 | |
| | | (0.171) | | | (0.201) | |
| Neighbours UN embargo$_j$ | | −0.120* | | | 0.012 | |
| | | (0.055) | | | (0.061) | |
| EU embargo$_j$ | | | −0.346* | | | −0.312* |
| | | | (0.134) | | | (0.155) |
| Neighbours EU embargo$_j$ | | | −0.013 | | | 0.002 |
| | | | (0.035) | | | (0.039) |
| Constant | −15.807* | −17.836* | −15.179$^{\dagger}$ | −15.494$^{\dagger}$ | −16.506$^{\dagger}$ | −14.978$^{\dagger}$ |
| | (7.814) | (7.833) | (7.825) | (8.629) | (8.607) | (8.640) |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Gravity controls | Yes | Yes | Yes | Yes | Yes | Yes |
| MRTs | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 52,065 | 52,065 | 52,065 | 44,597 | 44,597 | 44,597 |
| Number of pairs | 5932 | 5932 | 5932 | 5474 | 5474 | 5474 |
| $R^2$ within | .032 | .032 | .032 | .027 | .027 | .027 |
| $R^2$ overall | .067 | .069 | .067 | .058 | .061 | .058 |
| $R^2$ betweenness | .036 | .037 | .036 | .037 | .037 | .036 |

*Notes:* Robust standard errors in parentheses are clustered at the country-pair level. Gravity controls are time-variant and include common currency and RTAs (see Table 3). Other controls are included as in the baseline model (Tables 4–6).
$^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$, $^{\dagger}p < .1$.

the data is that in a few cases the NISAT highlights cases of re-exports (1.6% of the total only). Table A.3 in the Appendix reports the percentage share of these inaccuracies in the data. Needless to say, in the light of such magnitude, this impreciseness in the data has to be handled with care. We have constructed an alternative sample for total, sporting and military weapons by excluding inaccuracies. Therefore, we re-estimate our empirical models to take this into account (Table 8).

Estimates show that our main results are robust. However, the estimated impact of embargoes on arms imports is significantly weaker. When excluding the aforementioned inaccuracies, the reduction in imports of SALW due to the imposition of an embargo (total or EU) is on average 10 points lower.

Furthermore, we have removed outliers, namely values of SALW trade below 10% and above 90% (Table 9). Also in this case estimates confirm the robustness of our main results.

**TABLE 9** The impact of arms embargoes on the SALW trade (excluding values of export between 10% and 90% of export)

| | Total SALW flows$_{ij}$ (ln) | | | Sporting SALW flows$_{ij}$ (ln) | | | Military SALW flows$_{ij}$ (ln) | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| Embargo$_j$ | −0.342*** | | | −0.021 | | | −0.326** | | |
| | (0.099) | | | (0.137) | | | (0.106) | | |
| Neighbours embargo$_j$ | 0.007 | | | −0.030 | | | 0.032 | | |
| | (0.030) | | | (0.031) | | | (0.032) | | |
| UN embargo$_j$ | | −0.171 | | | 0.000 | | | −0.147 | |
| | | (0.138) | | | (0.206) | | | (0.152) | |
| Neighbours UN embargo$_j$ | | −0.033 | | | −0.154** | | | 0.054 | |
| | | (0.048) | | | (0.057) | | | (0.052) | |
| EU embargo$_j$ | | | −0.429*** | | | −0.022 | | | −0.379** |
| | | | (0.110) | | | (0.133) | | | (0.118) |
| Neighbours EU embargo$_j$ | | | 0.018 | | | −0.034 | | | 0.037 |
| | | | (0.032) | | | (0.031) | | | (0.034) |
| Constant | −2.955 | −4.731 | −2.219 | −15.630* | −16.516* | −15.662* | 2.425 | 1.263 | 2.942 |
| | (6.147) | (6.160) | (6.153) | (7.478) | (7.463) | (7.483) | (6.936) | (6.948) | (6.940) |
| Time FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Country-pair FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Gravity controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| MRTs | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 46,425 | 46,425 | 46,425 | 22,087 | 22,087 | 22,087 | 41,442 | 41,442 | 41,442 |
| Number of pairs | 5824 | 5824 | 5824 | 3213 | 3213 | 3213 | 5542 | 5542 | 5542 |
| $R^2$ within | .035 | .035 | .035 | .112 | .113 | .112 | .026 | .025 | .026 |
| $R^2$ overall | .020 | .020 | .019 | .018 | .019 | .018 | .019 | .020 | .018 |
| $R^2$ betweenness | .009 | .010 | .010 | .007 | .008 | .007 | .010 | .011 | .010 |

*Notes:* Robust standard errors in parentheses are clustered at the country-pair level. Gravity controls are time-variant and include common currency and RTAs (see Table 3). Other controls are included as in the baseline model (Tables 4–6).

***$p < .001$, **$p < .01$, *$p < .05$ .

## 7 | CONCLUSION

This research analyses the effectiveness of multilateral embargoes on the Small and Light Weapons (SALW) trade. We constructed a panel dataset for the period 1990–2017 based on 9275 pairs of countries. The analysis relied upon UN Comtrade data provided by the NISAT project. Specifically, we employ a gravity model whose dependent variable is the value of SALW transfers between each pair of countries and the main explanatory variable is the existence of a multilateral arms embargo on the importer. We distinguish between EU and UN embargoes. The results show that: (i) embargoes reduce SALW imports to sanctioned countries by 33%; (ii) an EU embargo appears to determine a decrease of 37% of SALW transfers, whereas for UN embargoes the impact is not significant. Hence, multilateral embargoes are effective in limiting small arms trade when they are imposed by the EU, while the UN struggles to make effective embargoes, probably due to a lack of coordination.

For an in-depth analysis, we considered whether signals of sanctions-busting can be detected empirically. First, we looked for SALW diversion to neighbouring countries. The results show that countries do not seem to import a larger number of SALW if neighbours are under an embargo. Second, we analysed the special case of sporting arms. Notably, sporting arms are less strictly regulated than military SALW. Embargoes apparently do not have an impact on the trade of sporting arms even if this result cannot be considered fully conclusive. This suggests that labelling in SALW trade in some cases could make a difference. Overall, however, we found no clear-cut evidence of sanctions-busting.

This research suggests that international cooperation in limiting the SALW trade may be effective but cohesion among states and the proper categorisation of different types of arms are crucial.

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### DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are freely available and all sources are thoroughly described in the article. However, the data are also available from the corresponding author upon reasonable request.

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## APPENDIX

**TABLE A1** Mean comparison of covariates before entropy balancing

| | Embargoes | No embargoes | Differences | *T* test | *p*-Value |
|---|---|---|---|---|---|
| $GDPpc_i$ (ln) | 9.84 | 9.86 | 0.02 | 0.61 | .54 |
| $GDPpc_j$ (ln) | 7.88 | 9.23 | 1.35 | 60.71 | .00 |
| $Milex_j$ (ln) | 21.66 | 21.56 | −0.10 | −2.07 | .04 |
| Urban $pop_j$ (ln) | 3.86 | 4.11 | 0.26 | 30.66 | .00 |
| Male $pop_j$ (ln) | 3.91 | 3.91 | 0.00 | −4.57 | .00 |
| Common $Currency_{ij}$ | 0.01 | 0.05 | 0.04 | 19.82 | .00 |
| $Rta_{ij}$ | 0.18 | 0.34 | 0.16 | 19.24 | .00 |
| Diff $polity_{ij}$ | 9.80 | 4.37 | −5.44 | −43.93 | .00 |
| Civil $conflict_j$ | 0.11 | 0.04 | −0.07 | −10.27 | .00 |
| International $conflict_j$ | 0.02 | 0.00 | −0.02 | −6.15 | .00 |
| $Polity_j$ | −1.47 | 6.41 | 7.88 | 66.01 | .00 |
| Physical $violence_j$ | 3.78 | 2.15 | −1.63 | −87.42 | .00 |

**TABLE A2** Mean comparison of covariates after entropy balancing

| | Embargoes | No embargoes | Differences | *T* test | *p*-Value |
|---|---|---|---|---|---|
| $GDPpc_i$ (ln) | 9.84 | 9.84 | 0.00 | −0.01 | .99 |
| $GDPpc_j$ (ln) | 7.88 | 7.88 | 0.00 | 0.01 | .99 |
| $Milex_j$ (ln) | 21.66 | 21.66 | 0.00 | −0.01 | .99 |
| Urban $pop_j$ (ln) | 3.86 | 3.86 | 0.00 | 0.00 | 1.00 |
| Male $pop_j$ (ln) | 3.91 | 3.91 | 0.00 | 0.00 | 1.00 |
| Common $Currency_{ij}$ | 0.01 | 0.01 | 0.00 | 0.07 | .95 |
| $Rta_{ij}$ | 0.18 | 0.18 | 0.00 | 0.01 | .99 |
| Diff $polity_{ij}$ | 9.80 | 9.80 | 0.00 | −0.03 | .97 |
| Civil $conflict_j$ | 0.11 | 0.11 | 0.00 | 0.00 | 1.00 |
| International $conflict_j$ | 0.02 | 0.02 | 0.00 | 0.00 | 1.00 |
| $Polity_j$ | −1.47 | −1.47 | 0.00 | 0.04 | .97 |
| Physical $violence_j$ | 3.78 | 3.78 | 0.00 | −0.04 | .97 |

**TABLE A3** % Share of inaccuracies in the data

| | Small Arms only | | Re-export | | Total |
|---|---|---|---|---|---|
| | Num | % | Num | % | Num |
| Sporting SALW | 0 | 0 | 1467 | 1.68 | 87,389 |
| Military SALW | 90,402 | 30 | 4931 | 1.64 | 300,996 |
| Total SALW | 90,402 | 23 | 6398 | 1.65 | 388,385 |

*Notes:* The data supporting the findings of this study are freely available and all sources are thoroughly described in the article. However, the data are also available from the corresponding author upon reasonable request.