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Detection of UN Arms Embargo Violators and Their Connections to Tax Havens

An empirical analysis of global arms companies in the time period 2005 to 2020

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Abstract

In this thesis, we attempt to detect arms companies that have been involved in UN arms embargo violations and study their connections to tax havens. We hypothesize that the opaque structure of tax havens may provide a cover of the substantial proceeds stemming from illegal arms trade. Our sample consists of data on 108 arms and defense companies in the time period 2005 to 2020. We use an event study approach to investigate whether individual arms companies obtain abnormal returns around an unexpected event that impacts the conflict intensity within an embargo-affected country or region. We base the detection method on the assumption that insiders and well-informed investors are aware of the company's hidden profitable behavior. Thus, a significant abnormal increase (decrease) in the stock price following the news of a hostility-increasing (hostility-decreasing) event may indicate that insiders change their expectations of future earnings. In other words, the insider or well-informed investor expect a shift in arms demand, suggesting that the company is thus guilty of illicit arms trafficking.

Out of 108 global arms companies, we detect 19 possible UN arms embargo violators in five out of the six analyzed embargoes. When we base a list of tax havens on the consensus of three organizations (OECD, Tax Justice Network and IMF), that only includes small states and islands, we do not find evidence that companies with tax havens are more likely to violate arms embargoes. However, when extending the list to include bigger states, suggested by the tax haven lists of both Tax Justice Network (2007) and IMF (2008), we find that companies with tax haven presence are statistically significantly more likely to violate embargoes. In contrast to our expectations, we do not find any evidence that embargo violators with tax haven presence obtain higher abnormal returns around conflict dates than violators without tax haven connections.

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The idea to study arms trades and tax havens originated from the subject Corporate Crime: Detection and Prevention. Consequently, we would like to thank Associate Professor Evelina Gavrilova-Zoutman for inspiring us to gain further insight into the topic.

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Eirik Hagen & Synne Hagen

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1. Introduction

In 2013, a Yemen-bound shipping with 8000 firearms departed from the harbor of Brazil (Paraguassu, 2016). Prepared to receive the cargo was the notorious arms trafficker and rebel commander Fares Mana'a. Three years in advance, the UN imposed sanctions on Mana'a after evidence of him violating the arms embargo in Somalia by providing Al-Shabaab with weaponry. Al-Shabaab is a Somali radical Islamist movement listed as a terrorist group by several nations. In May 2016, two former executives in the largest Brazilian arms company Forjas Tauras were prosecuted for the arms smuggling.

The illicit arms trades are mainly concentrated in areas affected by political unrest, socio-economic inequality and civil wars (Small Arms Survey, n.d.). Small Arms Survey (Karp, 2018) have estimated that there are approximately one billion firearms in the world, of which 85% are in possession of civilians. The circulation and fueling of arms cause human suffering, corrosion of democracies, underdevelopment and foster crime and terrorism. As a measure to restore peace, the UN has historically imposed arms trade bans, commonly referred to as embargoes, on conflict-affected areas and insurgents. Nevertheless, the embargoes have proved to be ineffective as several violations have been recorded yet few of the culprits are prosecuted (Control Arms, 2006).

The arms industry is associated with a high level of secrecy, partly due to the necessity of protecting national interests. However, the industry is frequently linked to questionable deals and corruption scandals, suggesting there is a need of greater transparency and integrity. According to a study from 2015, 2/3 of the examined defense companies had poor or non-existent ethics and anti-corruption programs (Transparency International, 2015).

The lack of prosecuted embargo violators may be a result of the violators' ability to conceal the proceeds and traceability. A possible way of hiding the origin of crime earnings is through exploiting the secrecy benefits of tax havens.[1] There is no doubt that the lack of transparency, regulatory and supervision in such jurisdictions lower the threshold of committing crimes. For instance, the UK arms company Bae Systems has previously been accused of corruption and

[1] When referring to tax havens, we use the terms tax haven, haven, secrecy jurisdiction and offshore financial centers interchangeably.

processing bribes through the anonymous shell company Red Diamond Trading, located in the tax haven British Virgin Islands (Evans & Leigh, 2003).

The purpose of this thesis is twofold. Firstly, to detect possible UN arms embargo violators in the time period 2005 to 2020 through measuring arms companies' stock price effects of events that impact the level of unrest within an embargo. We assume insiders and well-informed investors are likely to have knowledge about an arms company's involvement in embargo breaches. Naturally, only insiders are aware of this, as the non-compliant behavior of the company is kept secret from the public to avoid reputational losses and sanctions. An event that reduce the hostility level within an embargo, e.g. a ceasefire, should result in lower demand for arms and changed investor expectations of the arms company's future earnings. Rational investors thereby sell their stocks and the stock price drops following the news about the event, resulting in negative abnormal returns. Likewise, a hostility-increasing event should lead to positive abnormal returns. We use an event study methodology, based on DellaVigna and La Ferrara (2010), to assess the effects of the 60 selected conflict events on each company's stock price, in order to pinpoint the possible embargo violators.

The detection of violators lays the foundation for the analysis of the two hypotheses of the thesis. The company will not engage in illicit trades if they are not capable of concealing the smuggling activity and crime proceeds. Consequently, we proceed to analyze and discuss whether we find connections between the detected embargo violators and use of the secretive and transparency-lacking tax havens that facilitate concealment of ill-gotten gains. As a result, we aim to test the following hypotheses:

H1: *Arms companies with tax haven presence are more likely to violate arms embargoes.*

H2: *Arms embargo violators with tax haven presence obtain higher abnormal returns.*

The sample consists of market data for 108 arms and defense companies in the above-mentioned time period, and our findings imply that several of them have been involved in illicit trades. An important finding is that companies with tax haven presence are significantly more likely to violate embargoes when we define tax havens in accordance to the consensus of the Tax Justice Network (2007) and IMF (2008) haven lists. Finally, we do not find any evidence

that supports the hypothesis of violators with tax havens obtaining higher abnormal returns around conflict dates.

Our thesis is motivated by the substantial secrecy aspect of the arms industry and tax havens. Illicit arms trade not only contributes to escalation of war and suffering, but also considerable economic and social costs for all countries, in terms of ripple effects such as refugee crises, medical aid costs and military assistance. Regarding the role of tax havens, the existing research implies the jurisdictions are not only used for tax avoidance, but also for illegitimate purposes and thereby facilitate crimes like illegal arms trade. Consequently, we aim to shed light on this welfare topic, and to promote increased allocation of investigation resources to this type of crime.

The remainder of the thesis is structured as follows. In section 2, we will present the theoretical framework of the thesis, i.e. we place the study in context of previous research and central concepts. In the last part of the section, we present and explain the two hypotheses of the thesis. In section 3, we provide explanations of our methodological approach. Furthermore, we present the data collection method and trimming procedures in section 4, while we display our empirical results, limitations and suggestions for future research in section 5. Finally, we present the conclusion in section 6.

2. Theoretical framework

In this section, we present the theoretical framework and central concepts of the thesis. Initially, we provide an overview of related literature. We then explain and define topics that are relevant for understanding the thesis, namely the theoretical stock price, insider trading and the efficient market hypothesis. In addition, we present the characteristics of tax havens and compare several definitions of these jurisdictions. Furthermore, we discuss how these traits facilitate crime. Lastly, we present the two hypotheses of the study and place them in the context of the theoretical framework and previous research.

2.1 Related literature

We aim to contribute to research within forensic economics by detecting possible violations of UN arms embargoes. The lack of transparency in the controversial industry results in difficulties with monitoring trades and detecting possible offenses. Thus, directly linked research on the topic is, to our knowledge, limited. However, our study is based on the proposed method for detecting illegal arms trade provided by DellaVigna and La Ferrara (2010). Through their event studies, they investigate whether individual arms companies obtain significant abnormal returns following an event that impacts the hostility level within an embargo-affected country, as a result of insider trading. More specifically, a significant abnormal increase (decrease) in the company's stock price occurring shortly after a sudden hostility-increasing (hostility-decreasing) event may indicate that the company is involved in illicit trades. The scholars required at least two such significant company reactions, so-called *chains of illegal reactions*, in order to be identified as a violator, and they detected a total of 23 chains in the 8 countries investigated. 19 companies were responsible for the 23 chains, implying that some of the companies were involved in more than one conflict. As the researchers focused on the time period 1990 to 2005, we aim to prolong the research through performing the analysis on the time period 2005 to 2020. Nevertheless, it is essential to mention that neither the study of DellaVigna and La Ferrara (2010) nor our study provide concrete evidence of a company being involved in illicit arms trades. Thus, we will not name the companies identified as culprits.

Our thesis is related to the strand of papers that use event studies to investigate market reactions connected to political events. Incerti and Incerti (2019) use the event study methodology to investigate the impact of regime changes on the stock index of the respective country. Their

findings imply that the effects of assassinations are negative abnormal returns of 2%, while the outcome of resignations are positive abnormal returns of 4%. The researchers suggest that the reason the effect of assassinations is lower (in absolute value) might be due to uncertainty in investor expectations. On the other hand, the higher abnormal returns following resignations might imply removal of poor leadership and improved future prospects. Similarly, Guidolin and La Ferrara (2006) explore the stock reactions of diamond mining firms following the sudden death of an Angolan rebel leader and the subsequent ceasefire. The researchers find evidence of decreased abnormal returns of 4 percentage points, indicating that the stock market considered the end of the conflict as negative for mining companies holding concessions in Angola.

We also aim to contribute to literature that investigates the use of tax havens for possible illegitimate purposes. In light of the Panama Paper scandal,[2] researchers have gained access to information about secret offshore vehicles (SOVs), enabling them to examine the corporate use of such offshore services. O'Donovan, Wagner and Zeume (2019) use an event study methodology to analyze the stock price changes of companies with SOVs following the leakage. The scholars detect significant drops in company market values, indicating that the companies used the secret offshore services to conceal crimes like corruption and tax evasion. More specifically, the negative abnormal returns were presumably a consequence of substantial fines and loss of future bribe-linked cash flows due to the disclosure. Hence, the researchers interpreted the market reaction as evidence that the jurisdictions enable illegitimate behavior, and they estimated a loss of USD 174 billion in market capitalization for involved companies. Braun and Weichenrieder (2015) investigate the impact of a tax information exchange agreement (TIEA) on the magnitude of German investments in tax havens. The study shows investments in the jurisdictions decreased by 46%, compared to a control group, following the signing of a TIEA between Germany and the secrecy jurisdiction. These findings indicate that the tax aspect of the jurisdictions is not the solely reason for presence in the haven, but also the secrecy factors that enable concealment of illegal activity.

[2] In 2016, approximately 11.5 million documents were leaked from the Panama-based law firm, Mossack Fonseca, revealing how influential people and corporations used shell companies to conceal criminal activity like tax evasion and corruption (ICIJ, 2016).

2.2 Theoretical stock price

As we base the detection strategy on stock price changes, we consider it relevant to provide the theoretical definition of a stock price. As stated by Gordon and Shapiro (1956), the theoretical stock price is equal to the discounted expected future dividends if investors are rational:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k)^t}$$

P_0 is the stock price at t = 0, D_t is the expected dividends at time *t* and *k* is the discount rate. The formula implies that variation in the stock price is a result of changes in either expected future cash flows or discount rate.

2.3 Insider trading and asymmetric information

To detect potential embargo violators, we rely on the occurrence of insider trading as a result of the insider's knowingness of hidden profitable activity. To understand how market reactions around war event dates can indicate involvement in illicit trades, it is essential to define the concept of insider trading. Insider trading is defined as trades of stocks or other financial instruments undertaken by individuals with access to private information about a public company (Oslo Børs, n.d.). Although the act of insider trading is often linked to fraudulent behavior, insider trading is permitted when certain requirements are met. In several jurisdictions, the trade must be reported to the respective regulatory, normally within few business days, to be considered a conduct of legal insider trading.

Insiders like executives and directors naturally have more information on the financial and strategic situation of a company, as well as future outlooks and opportunities. Thus, the insider has an incentive to profit of the information advantage through trading of stocks. Wu (2019) states that the asymmetric information is a substantial determinant of the insider's abnormal returns. Information asymmetry occurs when one of the parties in a transaction or decision-making process possess more or better information (Goolsbee, Levitt & Syverson, 2013, p. 606).

The phenomenon of insider trading has been widely researched, and studies show insider trading occurs even in cases involving highly confidential and sensitive information. In an event

study of US-backed coups, Dube, Kaplan and Naidu (2011) find evidence of precoup insider trading reflecting the expectations of future profit gains for exposed companies. Similarly, Maloney and Mulherin (2003) explore stock price movements on the day of the Challenger space shuttle explosion in 1986. They find evidence of the market pinpointing the shuttle contractor accountable of the technical error prior to the public announcement of the culprit. More specifically, the market responded within minutes, while the results from the investigation were released several months later.

Based on previous research, we find it reasonable to assume that insiders and well-informed investors are likely to be aware of a company's involvement in illicit arms trafficking and embargo breaches. These trades are naturally kept secret from the public as the company engages in both ethical and legal violations. The investor thereby has an incentive to profit of the present information asymmetry through trading of stocks following news that impact arms demand and accelerates or delays the lifting of an embargo. For instance, a conflict de-escalating event like the signing of a peace agreement between rebels, should result in lower future arms demand and correspondingly lower profits for the company. Hence, rational investors, with possession of this information, should sell their stocks following the event to avoid financial losses.

2.4 Efficient Market Hypothesis

To better understand our approach of analyzing stock market reactions in the days surrounding the conflict event, we will briefly present the fundamental theory of market efficiency. The main idea of the theory is that financial markets are considered efficient if the security prices reflect all available information (Fama, 1970). Fama (1970) states that stock prices follow a random walk, i.e. any changes in the price are random and unpredictable, and the stock price will rapidly adjust to reflect any new information that implies the stock is underpriced or overpriced. Furthermore, the hypothesis also states that stock market investors are rational and that their investments are based upon rational behavior. By interpreting the stock price changes around the conflict date, we assume markets are informationally efficient and that the investment strategy of the investors reflects their rational expectations of the arms company's future earnings.

2.5 Tax havens

Thus far, our main focus has been investor exploitation of knowledge about the arms company's participation in illegal activity. In the following, we will direct the focus to how corporate use of tax havens can facilitate the company's decision of engaging in embargo breaches. One can argue that the structure and nature of such jurisdictions may provide a cover of the substantial proceeds stemming from illicit arms trafficking. A short description of tax haven characteristics is relevant as they are not only attractive due to the level of anonymity they provide. Furthermore, we will provide a list of tax havens in accordance to three different organizations, and we explain why having tax haven presence lowers the cost of law-breaking behavior.

2.5.1 Tax haven definitions

Although an accurate universal definition of a tax haven, also called secrecy jurisdiction, is lacking, there are several sources and organizations that have compiled lists of tax havens. However, the absence of a clear definition has resulted in significant differences in the lists. Nevertheless, the term is used to describe any country or geographical area that allows any foreign individuals or companies minimal or nil tax liabilities (European Parliament, 2018). The structure is commonly combined with high level of secrecy and lack of effective information exchange with other jurisdictions. In a report by the Organisation for Economic Co-operation and Development (OECD, 1998), the organization highlights four key characteristics of tax havens: minimal or no taxation, ring-fencing legislation, lack of transparency and no requirement of considerable activity in the jurisdiction. In the following, we will briefly address these tax haven traits.

The regime offers substantial incentives for foreign capital inflow due to the low taxation. According to a study of multinational companies, approximately 40% of the profits in 2015, equivalent to more than USD 600 billion, were shifted to tax havens (Tørsløv, Wier & Zucman, 2018, p. 3). Moreover, the favorable regulations are offered to non-residents and foreign firms, while residents are subject to other legislation and stricter supervisory. The havens enable corporations to conceal beneficial ownership, financial reports and other central corporate information. As a result, the country of origin is not capable of taking defense measures and detect possible illegal financial flows. In other words, the regime facilitates harmful behavior like tax evasion, corruption, embezzlement and illegal arms trade, as proven through the Panama Paper scandal. Lastly, OECD states the fourth characteristic is no requirement of

considerable activity in the jurisdiction, indicating that the solely purpose of presence is tax benefits and/or the secrecy factors.

In 2000, OECD aimed to identify tax havens by publishing a list based on the above-mentioned factors. However, the organization has received criticism due to list deficiencies and doubts about their objectivity. Tax Justice Network (TJN), an independent research network, argues that e.g. the OECD member countries Switzerland and Luxembourg should have been on the list, according to OECD's own criteria (Shaxson, 2016). Tax Justice Network has compiled several lists of tax havens. In recent times, the list has been based on a Financial Secrecy Index (FSI). The first published index depended on 12 secrecy indicators including factors like ownership registration, compliance to anti-money laundering recommendations and authority access to information exchange. Similarly, the International Monetary Fund (IMF) published a list in 2008 containing offshore financial centers, which is often used as a synonym for tax havens in academics. The list is in accordance with their definition of an offshore financial center: "An OFC is a country or jurisdiction that provides financial services to nonresidents on a scale that is incommensurate with the size and the financing of its domestic economy" (Zoromé, 2007).

Table 1: OECD (2000), TJN (2007) & IMF (2008) tax haven lists

*Alderney**	*Cayman Islands*	*Jersey*	*Netherlands Antilles*	*St. Vincent & Grenadines*
Andorra	*Cook Islands*	*Liberia**	*Niue*	*Tonga**
Anguilla	*Cyprus*	*Liechtenstein*	*Palau***	*Turks & Caicos Islands*
Antigua & Aruba	*Dominica*	*Maldives**	*Panama*	*US Virgin Islands**
Bahamas	*Gibraltar*	*Malta*	*Samoa*	*Vanuatu*
Bahrain	*Grenada*	*Marshall Islands*	*Sark**	
Barbados	*Guernsey*	*Mauritius*	*Seychelles*	
Belize	*Isle of Man*	*Monaco*	*St. Kitts & Nevis*	
British Virgin Islands		*Montserrat*	*St. Lucia*	
		Nauru		
Bermuda	*Hong Kong*	*Labuan*	*Luxembourg*	*Singapore*
Costa Rica	*Ireland*	*Lebanon*	*Macao*	*Switzerland*
Belgium	*Iceland*	*Netherlands*	*South Africa*	*Turkish Republic of Northern Cyprus*
Campione d'Italia	*Ingushetia*	*New York*	*Taipei*	
Dubai	*London*	*Sao Tome e Principe*	*Tel Aviv*	
Frankfurt	*Madeira*	*Somalia*	*Trieste*	
Hungary	*Marianas*			*Uruguay*
	Melilla			

*Not present in the IMF list
** Only present in the IMF list

In Table 1, jurisdictions defined as tax havens according to the OECD list from 2000, the TJN list from 2007 and the IMF list from 2008 are specified and compared. All listed areas are included in the TJN list. A noteworthy element is that IMF and TJN also include states like Hong Kong and Ireland, not only islands and small-scale states.

2.5.2 Harmful effects of tax haven structures

Schjelderup (2015) argues that the primary goal of tax havens is to provide secrecy. Although companies frequently use tax havens as part of the lawful tax planning activities, the researcher discuss how the level of confidentiality facilitate the existence of asymmetric information. Consequently, the havens enable the company to misreport to its home country and not facing any consequences for their actions. The presence of asymmetric information not only relates to the lack of information exchange, but also lack of effective supervision and the hidden information about beneficial ownership of accounts and assets (Schjelderup, 2015). This is an important aspect in the context of this study, as the havens, through their lack of transparency, reduce the cost of committing crimes like illegal arms trade.

Economic theories state that the choice of committing a crime is essentially based on the individual's rational utility maximization (Becker, 1968). Simply stated, the criminal (the arms company in our case) compares the expected gains to the expected costs of the criminal act, in addition to evaluating the probability of being detected. There might be strategic, economic and political incentives for embargo breaches, while possible costs include compliance and reputational costs. Companies consider the likelihood of being detected and exposed as an embargo violator differently, e.g. based on the differences in effectiveness of supervision, regulations and/or corruption levels[3] in the countries they are headquartered or operate in. Hence, the gains, costs and probability are evaluated differently across companies, depending on e.g. where they are located, their size, the smuggling route or their ability to conceal the proceeds. However, the decision to commit crime also relates to non-monetary aspects, like the corporate governance of the company. The key aspect in terms of having presence in tax havens is that the anonymity the havens provide results in reduced likelihood of being detected as an embargo violator, as the trades go under the radar. The home government of the company might

[3] DellaVigna and La Ferrara (2010) find evidence of positive abnormal returns in arms companies headquartered in high corrupt countries following a conflict-increasing embargo event, while the associated response in arms companies located in low corrupt countries is negative abnormal returns.

not be capable of investigating the company as the havens refuse to exchange information, or the illicit trades go completely undetected. International organizations, like the United Nations Office on Drugs and Crime (UNODC, 2010), argue that the opaque structure creates an exit strategy of criminal liability, and they point specifically at arms traffickers, among others, as owners of shell companies.

2.6 Hypotheses

In the previous sections, we have discussed how the structure of tax havens lowers the cost of engaging in crimes like illegal arms trafficking. In an arms smuggling perspective, there might be several purposes of using secret offshore services. First, the jurisdictions allow the company to conceal the proceeds from illicit trades and thereby lower the probability of being exposed. Secondly, the secrecy regime facilitates financial flows stemming from briberies. Consequently, we aim to firstly test the following hypothesis:

H1: *Arms companies with tax haven presence are more likely to violate arms embargoes.*

Among the embargo-violating companies, companies with tax haven presence should obtain higher abnormal returns due to their ability to shift and hide their profits to a jurisdiction with both lower tax and transparency. At the same time, the secrecy aspect of the tax havens should reduce the probability that the violations will be detected in the future. Hence, the expected future cash flows should reflect the reduced likelihood of monetary and reputational costs in a scenario where the company is revealed as a violator. As a result, our second hypothesis is:

H2: *Arms embargo violators with tax haven presence obtain higher abnormal returns*.

In order to test the connectedness of arms embargo violators and tax havens, we initially conduct individual event studies to identify the possible violators. For companies that are involved in illicit trades, events that suddenly increase (decrease) the intensity of a conflict within an embargo would consequently increase (decrease) the demand for arms, both in the present time and in the future. The detection method consequently relies on stock price changes around the event date, as a result of the investors' changed expectations of the arms company's future cash flows.

3. Methodology

In the following section, we will describe our methodological approach to test the hypotheses of the thesis. First of all, we present the event study framework that enables us to detect possible embargo violators. Hence, we perform individual event studies for each company-event pair. In the final part, we explain the regression models used to draw any inferences regarding our hypotheses.

3.1 Event study framework

We make use of the event study methodology to measure the stock price changes of a conflict-increasing or conflict-decreasing event on firm value in a predefined time window around the event date. The method is often used to measure the market response to a wide range of announcements such as M&As, regulatory changes or election outcomes, to mention a few. However, in this study we measure the *individual* stock price changes for each company of each conflict event to detect any pattern correspondent to illegal behavior. Our methodological approach is in line with the event study framework developed by MacKinlay (1997).

3.1.1 Event date, event window and estimation window

In our study, the events of interest are events that increase or decrease hostilities within an embargo. We treat the day of the incident as the event date. However, if the event occurred in a weekend or another non-trading day, we treat the next trading day as the event date.

The effect on the stock price is measured in a predefined time window called the event window. We conduct this analysis with an event window consisting of three days, spanning from one trading day prior to the event to one trading day after the event date. Our reasoning for including the day prior to the event is that there is, in some cases, hard to determine the exact day of the event. We also include the following trading day to capture any effects on firm value that might arise after the closing of the stock market on the event date (MacKinlay, 1997). We find it reasonable to narrow the event window to three days to isolate the event and prevent any impact from confounding events.

For this study, we use an estimation window of 60 trading days, and its starting point is 70 trading days prior to the event date. The estimation window is required to compute the normal

returns of the arms company. More specifically, the normal returns should reflect the returns if the event did not occur. The illustration in Figure 1 presents the timeline of our event study.

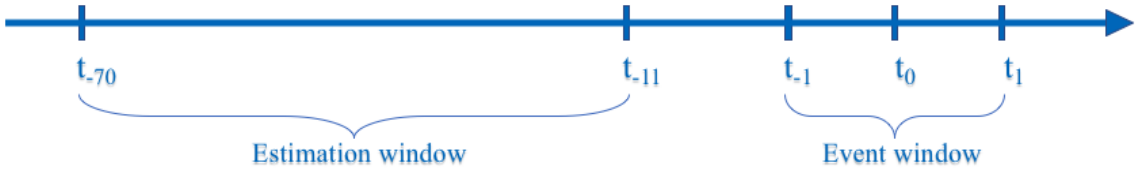

Figure 1: Event study timeline

3.1.2 Market model and estimation of normal return

As we are focusing on return data, we transform the stock prices into natural logarithm returns:

$$R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

The return at time *t* is the natural logarithm of the ratio of the closing price on day *t* and the closing price on the previous trading day *t-1*. The intuition of log transforming is to make the data more consistent with normality (Henderson, 1990).

We estimate normal returns, i.e. the expected returns if the event had not happened, using the market model. Although there are several methods that can be applied, both statistical and economic models, MacKinlay (1997) argues that the gains of more complex models than the market model is limited. By selecting the market model as the estimation method, the return of security *i* at time *t* is defined by the following formula:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

$$E[\varepsilon_{it}] = 0 \qquad Var[\varepsilon_{it}] = \sigma^2_{\varepsilon_i}$$

R_{mt} represents the return of the market index at time *t*, while β_i is the systematic risk of the security. Consequently, β_i reflects the sensitivity of the security relative to the market. Furthermore, α_i is the constant term, meaning the return that does not relate to the market. ε_{it} is the disturbance term, i.e. the abnormal return, of security *i* at time *t* with expected value equal to zero. $\sigma^2_{\varepsilon_i}$ is the variance of the disturbance term and the parameter, in addition to the parameters α_i and β_i, are estimated using the OLS method to compute the normal returns.

3.1.3 Abnormal return calculation

We use the estimated parameters from the market model to compute the abnormal returns in the event window:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$$

As the formula implies, the abnormal return of the security is equal to the difference between the actual return and the expected return at time *t*. More specifically, the abnormal return is the disturbance term that is not explained by the predicted returns generated from the market model-based estimation of normal returns. In reference to subsection 3.1.1, our main interest is the effect on the stock price over the complete event window (t_1, t_2), where t_1 and t_2 denote the first and last day of the event window, respectively. As a result, we aggregate the abnormal returns over the 3-day event window to obtain the cumulative abnormal returns (CAR) for each company-event pair, given as:

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{it}$$

Under the assumption that our estimation window is long enough, the variance of the abnormal returns is the disturbance variance, $\sigma_{\varepsilon_i}^2$, from the market model (MacKinlay, 1997, p. 21). The variance of the cumulative abnormal returns over the event window $\sigma_i^2(t_1, t_2)$ is the number of event days, in our case three days, multiplied by the variance of the abnormal returns:

$$\sigma_i^2(t_1, t_2) = (t_2 - t_1 + 1)\sigma_{\varepsilon_i}^2$$

3.1.4 Significance testing and statistical errors

We test the null hypothesis that the cumulative abnormal returns over the event window for company *i* are equal to zero. A true null hypothesis suggests that the company act in a compliant manner in the arms trade context. Moreover, if the null hypothesis is rejected due to significant negative (positive) cumulative abnormal returns as a result of a hostility-increasing (hostility-decreasing) event, this would also imply compliant behavior. The reasoning is that the event delays (accelerates) the embargo lifting and correspondingly delays (accelerates) possible legal sales. On the other hand, if the rejection of the null hypothesis is due to significant negative (positive) cumulative returns as a result of a conflict-decreasing (conflict-increasing) event, the

company may be involved in illicit trades. We derive parametric test statistics, under the assumption of jointly normally distributed abnormal returns (MacKinlay, 1997, p. 21), for each company-event pair using the following formula:

$$t_{CAR} = \frac{CAR_i(t_1, t_2)}{\sqrt{\sigma^2(CAR_i(t_1, t_2))}}$$

The test statistic, t_{CAR}, is the cumulative abnormal returns $CAR_i(t_1, t_2)$ divided by the standard deviation of the cumulative abnormal returns $\sqrt{\sigma^2(CAR_i(t_1, t_2))}$ for the specific company-event pair in the event window. The computed test statistic is compared to the respective significance threshold in order to determine whether we can reject the null hypothesis. In our study, the significance threshold is set to 5%.

We acknowledge that a single significant reaction might not be sufficient to claim the company is involved in illicit trades, as the above-described test procedure can result in both false positives and false negatives. In the context of our study, this relates to either incorrectly stating that the arms company has been involved in embargo breaches, or incorrectly stating that the arms company is not an embargo violator. To identify embargo violators for the testing of our two main hypotheses, we consequently require two significant company reactions, consistent with non-compliant behavior, within the same embargo to be categorized as an illegal arms trader.[4]

3.2 Cross-sectional analysis

Having detected the possible embargo violators through the event studies, we proceed to test the hypotheses of the thesis by conducting a cross-sectional study. In the following, we will present the regression models and the variables of interest.

3.2.1 Hypothesis 1 regression model

The regression model for our first hypothesis is defined by the following formula:

$$d_{violator} = \alpha + \beta_1 d_{Tax\ haven} + \beta_2 Abroad\_Percent + \beta_3 d_{OECD} + \beta_4 Ln(size) + \varepsilon_i$$

[4]Similar to DellaVigna and La Ferrara (2010).

For this model, we make use of the Linear Probability Model (LPM). Hence, our dependent variable, $d_{violator,}$ is binary and thereby takes the value 1 if the company is identified as an illegal arms trader from the conducted event studies, zero otherwise. Our independent variable, $d_{Tax\ haven}$, is a binary variable equal to one if the company has an affiliate located in a tax haven, zero otherwise. Consequently, β_1 will capture the difference in the probability of embargo breaches if the company is present in a tax haven, compared to a company with no tax haven presence. This coefficient will provide evidence that either supports or contradicts our first hypothesis.

We choose to include Abroad_Percent, d_{OECD} and Ln(size) as our control variables for this regression model. Abroad_Percent is the proportion of affiliates located abroad relative to the total corporate group. This variable will control for variation that is due to differences in global presence in the company sample. Furthermore, d_{OECD} is a binary variable equal to one if the company is headquartered in an OECD country, zero otherwise. This variable will control for variation based on whether the company is headquartered in a developed country or not, in accordance to the OECD criteria. Lastly, Ln(size), is the natural logarithm of the total corporate group. As the firm size naturally varies across companies, we aim to narrow the range of this variable by taking the natural logarithm to make it less sensitive to extreme values and mitigate issues with heteroskedasticity (Wooldridge, 2002, p. 193).

3.2.2 Hypothesis 2 regression model

Furthermore, the regression model for our second hypothesis is defined by the following formula:

$$CAR_i = \alpha + \beta_1 d_{Tax\ haven} + \beta_2 d_{OECD} + \beta_3 Ln(Size) + \varepsilon_i$$

In this model, the dependent variable, CAR_i, is the cumulative abnormal returns calculated from the individual event studies. To consider that we have both positive and negative events related to conflict intensity, we take the absolute value of CAR_i in order to adjust for the type of event that has occurred. In resemblance with the model from our first hypothesis, $d_{Tax\ haven}$ equals one if the company is present in a tax haven. Likewise, β_1 will provide evidence that either supports or contradicts our second hypothesis. The control variables included in this model are d_{OECD} and Ln(Size). β_2 will capture the difference between abnormal returns for companies that are headquartered in OECD countries compared to non-OECD countries. β_3 will capture the variation in CAR_i that is explained by firm size.

We apply the OLS method to estimate the parameters in the regression models. This method assumes that the error term has constant variance across individuals or observations, which is defined as homoscedasticity. However, MacKinlay (1997, p.33) argues that there is no reason to expect that the residuals are homoscedastic when performing a cross-sectional regression on the abnormal returns. Although heteroskedasticity does not cause OLS estimates to be biased, the consequence is rather that the standard test procedures are no longer valid (Wooldridge, 2002, p. 101). Consequently, we apply the robust standard errors suggested by White (1980) to handle the issue.

4. Data

4.1 Company selection, market data and trimming

We identified the arms companies included in the analysis based on two criteria. The company had to either be on the list of top 100 arms-producing and military service companies or have a classification code related to arms manufacturing.

The top 100 list is provided by Stockholm International Peace Research Institute (SIPRI, 2019), an institute focusing on armed conflicts, disarmament and arms control. The ranking contains the companies with the highest revenues derived from arms sales. We retrieved the list based on 2018 revenues, both because it is the latest published ranking and the majority of the companies recur between years.

By including companies with the Standard Industrial Classification (SIC) codes described in Table 2, we extended the sample to include smaller companies that did not reach a place in the SIPRI ranking. The four digit-code represents the primary business activity of a company, and it was introduced by the U.S. government in the 1930s. We identified companies through a SIC code search on Compustat, a database containing financial and statistical information on global firms. We accessed the database through Wharton Research Data Services (WRDS).

Table 2: Overview of SIC codes

SIC Code	Industry
2892	Explosives
3482	Small Arms Ammunition
3483	Ammunition, Except for Small Arms
3484	Small Arms
3489	Ordnance and Accessories
3761	Guided Missiles and Space Vehicles
3764	Guided Missile and Space Vehicle Propulsion Units and Propulsion Unit Parts
3769	Guided Missile Space Vehicle Parts and Auxiliary Equipment
3795	Tanks and Tank Components

Note. The codes and descriptions are retrieved from NAICS Association (n.d.).

Furthermore, we collected the CUSIP or ISIN belonging to each company to enable the retrieval of security prices from January 1, 2004, to September 1, 2020, from Compustat. CUSIP and

ISIN are unique codes assigned to securities, and companies lacking any of these codes were consequently excluded from the sample. The purpose of including data from 2004 is to have sufficient data for our estimation window. In addition, we retrieved the respective historical market index of each company to operate as a benchmark to compute abnormal returns. We collected the index data from Yahoo! Finance and Wall Street Journal for the above-mentioned time period.

Finally, we performed data trimming procedures to obtain the final sample. Firstly, we removed the daily price observations with no corresponding market index observation. Secondly, we excluded companies with securities defined as penny stocks in 80% of the observed time period. In our analysis, we define penny stocks as stocks traded at one unit or less of their local currency. Lastly, we excluded extreme outliers, defined as the top and bottom 1/10 000 of the company return observations.

The application of the above-described procedures resulted in a sample consisting of 108 companies. As illustrated in Figure 2, approximately half of the companies are headquartered in North America with the majority located in the US. The tables in subsection A.1 and A.2 in the appendix provide more detailed company information and their respective market indices.

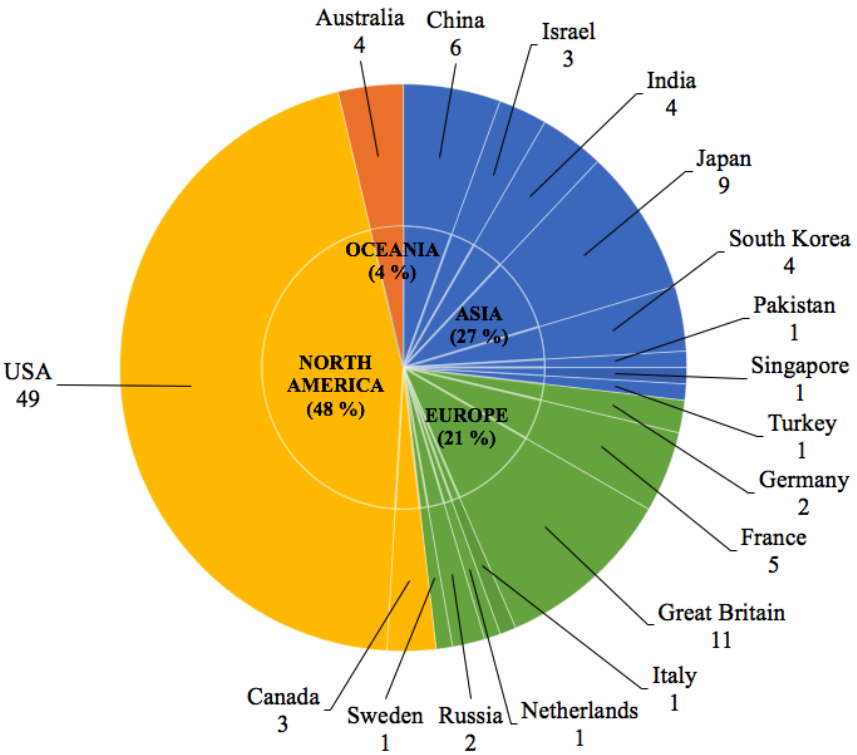

Figure 2: Geographical distribution of the company sample

4.2 Arms embargo selection

SIPRI provides a historical list of the countries, geographical areas and groups that have been under an arms embargo imposed by the UN, EU or other countries/organizations. As the company sample consists of global companies with headquarters on different continents, the selected arms embargoes had to be enforced by the UN. Thus, the embargo applies to all companies in the study. The embargoes had to be in force at some point in the time period 2005 to 2020.

To ensure a more clear-cut selection of embargoes, we gathered information about events within each embargo from ACLED,[5] a non-governmental organization collecting data on conflicts worldwide. The data includes reports on incidents such as armed clashes, protests, explosions and peace agreements. Furthermore, we developed restrictions in order to focus on a smaller selection of embargoes. First, we excluded embargoes with less than 1000 reported incidents.[6] Most of the embargoes had far more than 1000 events, resulting in this value as our choice of cut-off. Secondly, for all embargoes, we extracted the events with at least one fatality and obtained the 99th percentile as a measure for the most violent events. The final sample consists of embargoes with at least ten events within this percentile.[7] Through the process above, our aim was to ensure that we had a sufficient number of incidents and high conflict intensity. Finally, there should not have been an extensive intervention from the US or UN to decrease the possibility of false positives as a result of legal sales to these actors.[8] The latter restriction is based on the methodology of DellaVigna and La Ferrara (2010).

The above-described restrictions resulted in 6 embargoes. Table 3 presents the embargoes, targeted forces and the date of effectiveness.

[5] ACLED [Dataset]. Publicly available at https://acleddata.com/data-export-tool/
[6] Countries excluded as a result of the first criteria are Cote d'Ivoire, Eritrea, North Korea, Rwanda, Sierra Leone and Liberia.
[7] Countries excluded as a result of the second criteria are Iran, Lebanon and South Sudan.
[8] Country excluded as a result of the third criteria is Iraq. We avoid events in the year of 2011 in Libya due to extensive UN intervention.

Table 3: Selected embargoes

Country/Area	Target	Effective date
Central African Republic	Non-governmental forces	December 5, 2013
Democratic Republic of Congo	Non-governmental forces	July 28, 2003
Libya	Non-governmental forces	February 26, 2011
Somalia	Entire country	January 23, 1992
Sudan (Darfur region)	Entire region	July 30, 2004
Yemen	Non-governmental forces	April 14, 2015

Note. The country/area under embargo, target and effective date are retrieved from SIPRI (n.d.).

4.3 Event selection

In this thesis, we focus on both positive and negative incidents related to domestic tensions in each country. The event should have either increased or decreased the conflict intensity to the extent that it may have affected the demand for arms. We used the event data from ACLED to select the events of interest within each embargo. As the reports lacked adequate events related to peacekeeping and information about the importance of incidents, we supplemented the retrieval with qualitative reading on the conflicts in the six countries and regions.

Initially, we identified rebel groups that have been heavily involved in the conflicts through the ACLED data. As the purpose is to find multiple significant company reactions corresponding with illegal behavior, we believe our analysis is strengthened by mainly focusing on events involving the same actors within the same embargo. Furthermore, our aim was to avoid any events involving or directly impacting US or UN forces to eliminate the influence on arms demand stemming from legal sales, in resemblance with the embargo selection. We based the decision on whether the event increased or reduced conflict intensity on a qualitative assessment of conflict history. For example, September 28, 2015, hundreds of inmates were freed in an Anti-Balaka-initiated prison break in Central African Republic. The country is marked by religious strife, namely between the Christian Anti-Balaka militia and the Muslim Séléka militia. Hence, we consider it reasonable to assume the event intensified the conflict. Contrarily, the Central African government reached a peace agreement with 14 armed groups on February 2, 2019, suggesting a de-escalation of the civil war and lower future arms demand.

To ensure the events may have attracted the attention of investors and insiders, we required all events to have attained sufficient media coverage. More precisely, we required that the event must have been covered by at least one internationally recognized news provider. The media

had to be in the top 50 of "Top Websites Ranking" for worldwide news and media, measured by website traffic (SimilarWeb, 2020). More detailed information about the 60 events and their impact on conflict intensity is described in subsection A.3 in the appendix.

4.4 Tax havens and corporate structure

We retrieved company structure information for the entire company sample from Orbis Database, provided by Bureau van Dijk. The retrieved data contains information about corporate structure and affiliate locations for each company, and the data is based on the company information as of 2019 or 2020, i.e. the most recent updated data. We retrieved the latest available information for companies that are inactive.

Due to the lack of consensus regarding which jurisdictions that are considered to be tax havens, we introduce two lists we choose to refer to as "black list" and "grey list". The black list contains jurisdictions that recur in all of the tax haven lists by OECD (2000), Tax Justice Network (2007) and IMF (2008). In other words, the black list contains the jurisdictions within the black bracket in Table 1 from subsection 2.5.1. Furthermore, the grey list is based on jurisdictions that recur in both the IMF and Tax Justice Network lists, i.e. the jurisdictions within the grey bracket.

Table 4: Summary statistics of the company sample

	Company sample	
	Mean	Standard deviation
Tax haven		
Black list	0.35	0.48
Grey list	0.58	0.50
OECD	0.87	0.34
Size	222.86	365.22
Abroad percent	0.36	0.31

As we can observe from Table 4, 35% of the companies have presence in tax havens when it is defined by the black list, while the proportion is equal to 58% when defining tax haven in accordance with the grey list. Furthermore, 87% of the companies are headquartered in an OECD[9] country and the average corporate group in our sample consists of 223 companies. Lastly, the average company has a global presence equal to 36% relative to their total corporate group.

[9] OECD memberships based on 2020 list (OECD, n.d.).

5. Empirical analysis

In the following section, we present the findings from the empirical analysis. Initially, we will examine the results from the individual event studies and detect possible UN arms embargo violators. In the second and third subsections, we discuss and provide the tax haven regression results. Lastly, we acknowledge the limitations of the study and evaluate their impact on the results.

5.1 Detection of arms embargo violators

The cumulative abnormal returns (CAR) should reflect the insiders' changed views on future cash flows as a result of the positive or negative shift in demand for arms. For companies that are not involved, CAR should either be unaffected or have the opposite effect. For instance, events that lead to a reduced probability of the embargo being lifted would have a negative effect on CAR, due to their reduced chances of trading arms legally in the foreseeable future. Considering that we have a great variety of events in our study, the sign of CAR will naturally change depending on whether the company is compliant or not. Therefore, the definition of a violation-implying reaction, hereby referred to as an *illegal reaction*, is if CAR is significantly different from zero and has a positive (negative) sign on an intensity-increasing (decreasing) event. As previously mentioned, we require at least two illegal company reactions within the same embargo-affected country to be considered as an embargo violator.

Table 5: Example of individual event study results

Central African Republic			**Company 1**		**Company 2**	
Event ID (1)	**Event date (2)**	**Hostility effect (3)**	**CAR [-1,1] (%) (4)**	**T-statistic (5)**	**CAR [-1,1] (%) (6)**	**T-statistic (7)**
1	12/05/2013	↑	(+) 0.27	(+) 0.1128	(-) 0.12	(-) 0.0599
2	01/31/2014	↑	(-) 0.31	(-) 0.1348	(-) 2.07	(-) 1.0229
3	04/09/2014	↑	(+) **5.81**	(+) **2.9817**	(-) 0.57	(-) 0.2821
4	05/28/2014	↑	(+) 0.30	(+) 0.1610	(-) 0.07	(-) 0.0356
5	06/24/2014	↑	(-) 0.86	(-) 0.4734	(+) **3.82**	(+) **2.0738**
6	09/28/2015	↑	(+) **5.65**	(+) **2.5351**	(-) 4.58	(-) 1.5811
..	..	..	..	..	..	..
10	02/02/2019	↓	(-) 2.75	(-) 0.8929	(+) 2.72	(+) 1.0359

Table 5 presents an example of how the detection of violators is conducted for two of the companies in the embargo-affected country Central African Republic. Column (1) and (2) represent the unique ID and date of the event. In this example, we only present seven out of ten events in the country. Furthermore, column (3) shows the impact the event had on the conflict intensity within the country, whereby upward (downward) arrow symbolizes increasing (decreasing) level of conflict intensity. For each of the companies, the cumulative abnormal return is displayed in column (4) and (6), while the associated t-statistics are stated in column (5) and (7). Illegal reactions are marked with bold text.

As we can observe from the table, Company 1 has two illegal reactions within the embargo and is consequently defined as a violator. The events occurred on April 9, 2014, and September 28, 2015, and both events contributed to increased conflict intensity. The cumulative abnormal returns for the company are 5.73% on average for the two events. Contrarily, Company 2 has only one illegal reaction within the embargo. Thus, based on the set requirements from the methodology, we do not categorize this company as a violator.

The cumulative abnormal returns for Company 1 appear to be more consistent with the behavior of an embargo-violating company. For example, on event 10, the company has a negative return on a conflict-decreasing event, though it is not significant. Contrarily to Company 1, the returns are inconsistent for Company 2. For instance, on event 2 and 10, the cumulative abnormal returns are more in line with the behavior of a law-abiding company, even though these are as well not significant. This illustrates the concerns regarding false positives in our analysis and why we require a chain of illegal reactions within the embargo to define the company as a violator. The following table presents the number of illegal reactions and chains from the conducted event studies.

Table 6: Illegal reactions and chains

Embargo	Company-event pairs	Illegal reactions	Illegal chains
Central African Republic	765	26	4
Libya	734	33	4
Yemen	798	20	0
Democratic Republic of Congo	809	28	6
Somalia	798	24	3
Sudan (Darfur region)	706	23	2
Total	**4764**	**154**	**19**

We analyzed a total of 4764 company-event pairs, and 154 of them were classified as illegal reactions. Further on, these reactions led to identification of 19 different illegal chains for 19 different companies. As a result, 19 out of 108 companies were categorized as violators. Out of the 19 illegal chains, one of them consisted of four illegal reactions, while the rest consisted of two. We identified illegal chain reactions in five out of the six analyzed embargoes. Of the countries with chains, the Democratic Republic of Congo has the highest number with its six detected chains, while Sudan has the lowest number with its two chains. The only nation we did not detect any chains in was Yemen. When comparing our findings to those of DellaVigna and La Ferrara (2010), we find only one company that was detected as a violator in both studies.[10]

To summarize our findings, our results indicate several violations of UN arms embargoes in the time period 2005 to 2020. However, due to the risk of false positives and false negatives, the event studies may have either failed to detect or classified too many as culprits. Although the evidences are not concrete and sufficient to prove an act of arms embargo violation, it brings forth companies and embargoes that are worth investigating closer. As a result, the thesis contributes to strengthen the use of event study methodology as an investigation tool in an industry known to be complex and difficult to monitor.

5.2 Embargo violators and presence in tax havens

Having detected the violators in the first part of the empirical analysis, we aim to compare violators with non-violators in terms of exploitation of tax havens. More specifically, we believe having presence in tax havens will simplify the process of concealing proceeds from illicit trades. As a result, this subsection seeks to test the following hypothesis:

H1: *Arms companies with tax haven presence are more likely to violate arms embargoes.*

In the following table, we provide summary statistics that compare the detected violators to the non-violators.

[10] Note, however, that DellaVigna and La Ferrara (2010) investigated different embargoes in a different time period, namely Angola, Ethiopia, Liberia, Rwanda, Sierra Leone, Somalia, Sudan and Yugoslavia in 1990-2005.

Table 7: Summary statistics of violators and non-violators

	Violators		**Non-violators**	
	Mean	Standard deviation	Mean	Standard deviation
Tax haven				
Black list	0.37	0.50	0.35	0.48
Grey list	0.79	0.42	0.54	0.50
OECD	0.84	0.37	0.88	0.33
Size	229.11	205.65	221.53	391.82
Abroad percent	0.34	0.32	0.36	0.31
Company total	19		89	

As we can observe from the table, the proportion of companies with tax haven presence is greater for violators than non-violators regardless of the tax haven lists. However, the difference is more significant when we define havens by the grey list. Among the companies, 84% of the violators are headquartered in an OECD country versus 88% for non-violators. The average company identified as a violator has a bigger corporate group, but it has a lower global presence compared to the non-violators. To draw any inferences regarding our hypothesis, we apply the regression model as defined in subsection 3.2.1.

Table 8: Regression results- embargo violators and presence in tax havens

	Dependent variable: 1 if violator, 0 otherwise			
	(1)	(2)	(3)	(4)
$d_{\text{Tax haven}}$	0.013	-0.070	0.149**	0.274**
	(0.078)	(0.110)	(0.069)	(0.106)
Abroad_Percent		-0.127		-0.164
		(0.136)		(0.133)
d_{OECD}		-0.071		-0.092
		(0.120)		(0.112)
Ln(Size)		0.041*		-0.015
		(0.022)		(0.023)
Constant	0.171***	0.148	0.089**	0.211*
	(0.045)	(0.126)	(0.043)	(0.121)
Observations	108	108	108	108

The values in parentheses are the robust standard errors. Statistical significance is denoted with *, ** and ***, representing 10%, 5% and 1% significance level, respectively.

Table 8 is divided into two parts and presents our results from running the regression. In the two initial columns, the dummy for tax haven presence is defined by the black list described in section 4.4. Thus, if the company has presence in at least one jurisdiction that recur on all of the tax havens lists by OECD (2000), Tax Justice Network (2007) and IMF (2008), $d_{\text{Tax haven}}$ equals one. In the two final columns, the dummy equals one if the company is present in any of the jurisdictions defined as tax havens by both Tax Justice Network (2007) and IMF (2008). The main purpose of introducing these two different interpretations of tax havens is to examine whether our results are consistent between the definitions.

In column (1), we only include the dummy for presence in tax haven. The coefficient is, as expected, positive. However, it is not significant, and the interpretation is that companies with tax haven presence, according to the black list, are only 1.3% more likely to violate embargoes than those without. When we in column (2) include our control variables, we observe that this coefficient remains non-significant and decreases to -7%. This indicates that, in our sample, companies with presence in any of these jurisdictions are less likely to violate embargoes. Consequently, our hypothesis is not supported. The interpretation of the Abroad_Percent is that the likelihood of embargo violation decreases marginally when the global presence increases. More specifically, a one percentage point increase in global presence leads to a 0.127% decrease in the likelihood of violation. Furthermore, companies that are headquartered in OECD countries are 7.1% less likely to violate embargoes than companies that are not, all else equal. However, the coefficients for the two latter variables are non-significant. For our last variable, a relative increase in the size of the company leads to a statistically significant increase in the likelihood of violation, at a 10% level.

For columns (3) and (4), we extend the list of jurisdictions to include the ones that OECD did not define as tax havens (grey list). In column (3), we observe that companies with presence in any of these jurisdictions are 14.9% more likely to violate embargoes. The difference in likelihood increases to 27.4% when we include all variables in column (4) and the coefficient is significant at a 5% level for both columns. This is in line with our expectations and we can consequently say that our hypothesis is supported, given that we define tax havens according to the grey list. Moreover, an increase in the global presence has a negative impact on the likelihood of violation. This also applies for companies that are located in OECD countries, and both of these results are in line with our findings from the previous paragraph, although still non-significant. Lastly, we observe that a relative increase in firm size has a slightly negative

effect on the likelihood of violation, and the coefficient is no longer significant. However, this is in contrast with our findings from column (2), both regarding firm size and tax haven presence. A possible explanation for this is that there are one or more relatively large companies that we have identified as violators that are present in a tax haven according to the grey list, but not according to the black list.

Our results appear to be inconsistent between the different definitions of tax havens. The overall probability is both higher and statistically significant when we define tax havens according to Tax Justice Network (2007) and IMF (2008) in the last two columns. This result is somewhat unexpected as the black list includes only the jurisdictions that all the organizations have agreed upon. One might assume that the jurisdictions included in the black list are more used for illegitimate purposes, but this might not be the case. As a result, this emphasizes the lack of consensus between the different lists of tax havens. A more consistent observation is that companies with headquarters in OECD countries have, on average, a negative impact on the probability of embargo violation. One can argue that these companies have a higher threshold of committing crimes compared to non-OECD companies due to higher associated costs (e.g. reputational) and they thereby contribute to a lower proportion of the violators.

In order to test whether our results are robust, we extend our analysis by examining each embargo in isolation. Given our findings in Table 8, we will only define tax havens according to the grey list.

Table 9: Regression results- comparison of embargoes

	Dependent variable: 1 if violator, 0 otherwise				
	Central African Republic	Libya	Democratic Republic of Congo	Somalia	Sudan
	(1)	(2)	(3)	(4)	(5)
$d_{\text{Tax haven}}$	0.049	0.064	0.043	0.054	0.064
	(0.035)	(0.047)	(0.064)	(0.045)	(0.064)
Abroad_Percent	-0.111*	-0.068	-0.002	0.069	-0.053
	(0.066)	(0.106)	(0.052)	(0.056)	(0.041)
d_{OECD}	-0.022	-0.042	0.038	0.009	-0.075
	(0.069)	(0.069)	(0.026)	(0.011)	(0.072)
Ln(Size)	-0.006	0.006	-0.006	-0.008	-0.0004
	(0.015)	(0.010)	(0.010)	(0.009)	(0.009)
Constant	0.091	0.056	0.004	-0.006	0.067
	(0.084)	(0.077)	(0.011)	(0.013)	(0.072)
Observations	108	108	108	108	108

The values in parentheses are the robust standard errors. Statistical significance is denoted with *, ** and ***, representing 10%, 5% and 1% significance level, respectively.

In Table 9, each column represents the unique embargo. Our dependent variable is equal to one if the company has been identified as a violator within the embargo, zero otherwise. Naturally, Yemen is not included as we did not detect any chains of reactions in this country. As we can observe from the table, companies with tax haven presence are on average more likely to violate embargoes. The results are consistent between the different embargoes, but the coefficients are not significant. However, this could indicate that a tax haven presence matter regardless of the conflict. Among the different embargoes, tax haven presence has the highest effect on embargo violation in Libya and Somalia with an increased likelihood of 6.4%. Contrarily, the Democratic Republic of Congo has the lowest with a likelihood of 4.3%. Lastly, we observe that our control variables appear to be consistent across the different embargoes, except for some insignificant deviations.

Based on our findings from Table 8 and Table 9, there is sufficient evidence to assume that companies with tax haven presence are on average more likely to violate embargoes, given that we define tax havens according to the grey list. Consequently, the results imply that our hypothesis is supported.

5.3 Tax havens and abnormal returns

In the following subsection, we will isolate the companies detected as violators and examine the illegal reactions that were used to identify the company as an embargo violator. By doing this, we aim to analyze whether companies with offshore affiliates in tax havens obtain higher abnormal returns around conflict events. Hence, we test the following hypothesis:

H2: *Arms embargo violators with tax haven presence obtain higher abnormal returns.*

In resemblance with subsection 5.2, we adjust the dummy for tax haven based on the two lists of tax havens. In addition, we will not differentiate between the embargoes due to the limited sample size.

Table 10: Regression results- tax havens and abnormal returns

	Dependent variable:	
	CAR [-1,1]	
	(1)	(2)
$d_{Tax\ haven}$	0.012	-0.034
	(0.008)	(0.025)
d_{OECD}	-0.039***	-0.042***
	(0.014)	(0.012)
Ln(Size)	-0.008***	0.0002
	(0.002)	(0.005)
Constant	0.128***	0.127***
	(0.008)	(0.007)
Observations	40	40
R^2	0.629	0.636

The values in parentheses are the robust standard errors. Statistical significance is denoted with *, ** and ***, representing 10%, 5% and 1% significance level, respectively.

Table 10 presents the results from running the regression. Tax havens are defined by the black list and grey list in column (1) and column (2), respectively. For column (1), we see that companies with tax haven presence obtain 1.2 percentage points higher abnormal returns than those without. Contrarily, when we define tax havens according to the grey list, they obtain 3.4

percentage points less. Given these mixed and non-significant results, the hypothesis is not supported.

Moreover, we find that being headquartered in an OECD country has a significant negative impact on CAR for both columns. More precisely, they obtain approximately 4 percentage points lower abnormal returns compared to non-OECD companies. These results are as expected because these companies may face both higher fines, reputational damage and other costs if they are revealed as an illicit arms trader. Given that investors are rational, the future expected cash flows should be adjusted according to these potential costs.

Furthermore, we find that a relative increase in firm size has a statistically significant negative impact on CAR for column (1). This could be explained by the fact that the gains from participating in an illicit trade would be higher, relative to the ordinary income, for smaller companies. Another explanation might be that larger arms companies tend to have more diversified product portfolios, and an arms contract would contribute to a smaller share of revenues. However, this effect is approximately non-existent in column (2). As mentioned in subsection 5.2, there might be one or more large companies identified as violators that are only present in tax havens when it is defined according to the grey list, but not according to the black list. From the summary statistics in subsection 5.2, we know that 79% of the identified violators have presence in a tax haven according to the grey list. Hence, the sample size might be too small to draw any statistical conclusion regarding the impact of tax havens.

To examine if the results are consistent, we introduce robustness tests by changing the dependent variable to different measures of returns. These are the cumulative abnormal returns for the event day and the trading day after the event (CAR [0,1]), the abnormal return on the event day (AR) and the raw returns on the event day (Returns). The results are shown in Table 11.

Table 11: Regression results- tax havens and abnormal returns, robustness

	Dependent variable:					
	CAR [0,1]		AR		Returns	
	(1)	(2)	(3)	(4)	(5)	(6)
$d_{Tax\ haven}$	0.011	-0.036	0.005	-0.028*	0.005	-0.030*
	(0.010)	(0.029)	(0.006)	(0.016)	(0.006)	(0.017)
d_{OECD}	-0.037***	-0.040***	-0.031**	-0.034**	-0.035***	-0.038***
	(0.013)	(0.014)	(0.013)	(0.013)	(0.012)	(0.012)
Ln (Size)	-0.009***	-0.001	-0.004	0.002	-0.003	0.003
	(0.002)	(0.007)	(0.002)	(0.003)	(0.002)	(0.004)
Constant	0.114***	0.114***	0.058***	0.058***	0.060***	0.060***
	(0.011)	(0.010)	(0.013)	(0.013)	(0.012)	(0.012)
Observations	40	40	40	40	40	40
R^2	0.567	0.576	0.449	0.474	0.480	0.505

The values in parentheses are the robust standard errors. Statistical significance is denoted with *, ** and ***, representing 10%, 5% and 1% significance level, respectively.

In Table 11, tax havens are defined according to the black list and grey list for columns with odd and even numbers, respectively. In resemblance with our findings in Table 10, we observe that companies with tax haven presence defined by the black list obtain higher abnormal returns, although still non-significant. Contrarily, this effect is negative when we define tax havens according to the grey list and the results are consistent between the different measures of returns. However, we observe that the effect is significantly negative in column (4) and (6).

Moreover, like our findings from Table 10, we find that companies with headquarters in OECD countries obtain significantly negative abnormal returns compared to non-OECD countries. This effect is statistically significant for all columns at the 1% significance level, except columns (3) and (4) where it is 5%. Likewise, the effect from firm size also appears to be consistent between the different measures of returns. However, the effect is only significantly negative in column 1. Overall, the (abnormal) returns decrease when the event window decreases, as expected. Naturally, this is explained by the fact that the returns are aggregated over a shorter time period.

To summarize, we do not find any evidence that companies with tax haven presence obtain higher abnormal returns. Even though we find a slightly positive overall effect when we define

a tax haven according to the black list, the effect is not significant, and our hypothesis is consequently not supported. This may indicate that there are other factors than presence in tax havens that explain the difference in abnormal returns between embargo violators. The most noteworthy effect on abnormal returns seems to be the size and whether the company is headquartered in an OECD country or not.

5.4 Limitations and further research

In this subsection, we will acknowledge limitations of our analysis and make suggestions for further research. First of all, most of the selected embargoes are targeted at non-governmental forces. Although we have attempted to identify conflict events that do not involve governmental or UN/US forces, the change in arms demand might stem from these actors, i.e. legal sales. Our reasoning is that the government might be mobilizing to crack down on insurgents. However, one can argue that any sales to embargo-affected countries are considered controversial.

Furthermore, we have only considered whether a company has an affiliate in any of the jurisdictions in accordance with the two definitions of tax havens. Hence, we have not considered potential differences regarding transparency and information exchange standards between tax havens. In addition, we have based the identification strategy of violators over 15 years, while the tax haven analysis is based on presence in tax haven at a specific moment of time, i.e. the most recent company information. Thus, we have not considered any changes in tax haven presence over the time period.

For further research, it would be interesting to identify a measure that enables the researcher to differentiate between jurisdictions that are known to be uncooperative versus the cooperative. The purpose would be to identify jurisdictions that are more commonly used by potential embargo violators, and thereby address tax havens that should be monitored more closely. In addition, one can use the methodology on a bigger sample size by including more embargoes, companies, events and years. A potential benefit of extending the sample is to gain more observations for our second hypothesis testing, which we acknowledge may be too small to find significant relationships in this thesis. Another benefit would be to detect companies that have chains of illegal reactions in more than one embargo, and thereby strengthen the suspicion of involvement in embargo violations.

6. Conclusion

In this thesis, we have detected possible UN arms embargo violations by global arms companies and analyzed the violators' connections to tax havens. Using the event study methodology, we assessed the stock price reactions of arms companies around the date of several conflict incidents within six embargoes. The presence of abnormal returns suggests that insiders and well-informed investors, who we assume are aware of the company's involvement in embargo breaches, change their expectations of the company's future earnings as a result of increased or decreased arms demand within the embargo. The event study approach enabled us to detect 19 possible embargo violators, out of a sample consisting of 108 arms companies, in the time period 2005 to 2020. Furthermore, we have presented theory that explains how the structure of tax havens facilitate crimes, and thereby lower the cost of involvement in illegal arms trade. As a result, we aimed to test our main hypotheses: 1) arms companies with tax haven presence are more likely to violate arms embargoes and 2) arms embargo violators with presence in tax havens obtain higher abnormal returns. To draw an inference on the hypotheses, we conducted empirical analyzes of the findings from the event studies.

Our findings are somewhat mixed as we have tested the hypotheses based on two different lists of tax havens, one including recurring jurisdictions in the OECD (2000), Tax Justice Network (2007) and IMF (2008) lists, and the other in accordance with only Tax Justice Network (2007) and IMF (2008). When defining tax haven based on the first list, our findings suggest that companies with tax havens are less likely to violate embargoes, but the result is non-significant. Contrarily, when using the latter list, we find that companies with tax haven presence are statistically significantly more likely to violate embargoes. Hence, our findings could indicate that embargo violators possibly use tax havens to hide the origin of proceeds stemming from illegal arms trade. Regarding the second hypothesis, we did not find any significant results that indicate that violators with presence in tax havens obtain higher abnormal returns around conflict dates. However, an interesting finding is that violators headquartered in OECD countries obtain statistically significantly lower returns compared to violators in non-OECD countries. We interpret these results as reflecting the higher cost of committing crimes when headquartered in a developed country.

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Appendix

A.1 List of arms and defense companies

No.	Company	Country	Obs.	Source
1	AECOM	USA	3351	SIPRI
2	Airbus SE	Netherlands	4264	SIPRI
3	Allen-Vanguard Corp	Canada	1429	SIC
4	Allied Defense Group Inc. (The)	USA	1929	SIC
5	Amphenol Corp	USA	4191	SIPRI
6	Anhui Jiangnan Chemical Industry Co Ltd	China	2994	SIC
7	Armor Holdings Inc	USA	899	SIC
8	Arotech Corp	USA	4015	SIC
9	Aryt Industries Ltd	Israel	3567	SIC
10	Asahi-Seiki Manufacturing Co Ltd	Japan	3881	SIC
11	Aselsan A.S.	Turkey	4035	SIPRI
12	Austal Limited	Australia	4207	SIPRI
13	B/E Aerospace Inc	USA	3343	SIC
14	Babcock International Group PLC	Great Britain	4296	SIPRI
15	BAE Systems PLC	Great Britain	4296	SIPRI
16	Ball Corp	USA	4191	SIPRI
17	Biafo Industries Ltd	Pakistan	373	SIC
18	Boeing Co	USA	4194	SIPRI
19	Booz Allen Hamilton Holding Corp	USA	2462	SIPRI
20	BWX Technologies Inc	USA	2553	SIC, SIPRI
21	CACI International Inc	USA	4194	SIPRI
22	CAE Inc.	Canada	4185	SIPRI
23	Cobham PLC	Great Britain	4136	SIPRI
24	COM DEV International Ltd	Canada	3040	SIC
25	Conrad Industries Inc	USA	4194	SIC
26	Cubic Corp	USA	4194	SIPRI
27	Curtiss-Wright Corp	USA	4193	SIPRI
28	Dassault Aviation SA	France	4258	SIPRI
29	Delta Tucker Holdings Inc	USA	1049	SIPRI
30	Dyno Nobel Ltd	Australia	540	SIC
31	Elbit Systems Ltd	Israel	3957	SIC, SIPRI
32	Electromed Inc	USA	2526	SIC
33	Engineered Support Systems Inc	USA	523	SIC
34	EnPro Industries Inc.	USA	4194	SIC
35	Firstec Co Ltd	South Korea	4084	SIC
36	Fluor Corp	USA	4192	SIPRI
37	Fujitsu Ltd	Japan	4076	SIPRI
38	General Dynamics Corp	USA	4193	SIC, SIPRI
39	General Electric Co	USA	4194	SIPRI
40	GKN PLC	Great Britain	3706	SIPRI
41	Goodrich Corp	USA	2157	SIC
42	Gradlink (Israel) Ltd	Israel	1079	SIC
43	Hanwha Aerospace Co Ltd	South Korea	4091	SIPRI
44	Hi-Shear Technology Corp	USA	1483	SIC
45	Hindustan Aeronautics Limited	India	592	SIPRI
46	Honeywell International Inc	USA	4194	SIC, SIPRI
47	Hosoya Pyro-Engineering Co	Japan	3583	SIC
48	Huaibei Mining Holdings Co Ltd	China	500	SIC
49	Hunan Nanling Industry Explosive Material Co Ltd	China	3303	SIC
50	Huntington Ingalls Industries Inc	USA	2377	SIC, SIPRI
51	IHI Corp	Japan	4076	SIPRI
52	Incitec Pivot Ltd	Australia	4199	SIC
53	Jacobs Engineering Group Inc.	USA	4193	SIPRI

54	Kawasaki Heavy Industries Ltd	Japan	4076	SIPRI
55	KBR Inc	USA	3469	SIPRI
56	Keltech Energies	India	1993	SIC
57	Korea Aerospace Industries Ltd	South Korea	2246	SIPRI
58	Kovrov Mechanical Plant JSC	Russia	2661	SIC
59	L3 Technologies Inc	USA	3898	SIPRI
60	Leidos Holdings Inc	USA	3492	SIPRI
61	Leonardo SPA	Italy	4232	SIPRI
62	LIG Nex1 Co Ltd	South Korea	1198	SIPRI
63	Lockheed Martin Corp	USA	4194	SIC, SIPRI
64	Manroy PLC	Great Britain	192	SIC
65	ManTech International Corp	USA	4194	SIPRI
66	Meggitt PLC	Great Britain	4296	SIPRI
67	Melrose Industries PLC	Great Britain	4053	SIPRI
68	Miroku Corp	Japan	3862	SIC
69	Mitsubishi Electric Corp	Japan	4077	SIPRI
70	Mitsubishi Heavy Industries Ltd	Japan	4075	SIPRI
71	Moog Inc.	USA	4194	SIPRI
72	Nec Corp	Japan	4076	SIPRI
73	Nevada Chemicals Inc	USA	1210	SIC
74	Noble Explochem Ltd	India	4054	SIC
75	Northrop Grumman Corp	USA	4193	SIPRI
76	Orbital ATK Inc	USA	3630	SIC
77	Orbital Sciences Corp	USA	2794	SIC
78	Orica Ltd	Australia	4204	SIC
79	Oshkosh Corp	USA	4193	SIPRI
80	Perspecta Inc	USA	571	SIPRI
81	Poly Union Chemical Holding Group Co Ltd	China	3849	SIC
82	Premier Explosives Ltd	India	3467	SIC
83	Qinetiq Group	Great Britain	3763	SIPRI
84	QLogic Corp	USA	3176	SIC
85	Raytheon Co.	USA	4090	SIPRI
86	Rheinmetall AG, Duesseldorf	Germany	4227	SIPRI
87	Rockwell Collins Inc	USA	3751	SIPRI
88	Rolls Royce Holdings PLC	Great Britain	4296	SIPRI
89	RSC Energia	Russia	2742	SIC
90	Saab AB	Sweden	2949	SIPRI
91	Safran SA	France	4260	SIC, SIPRI
92	Science Applications International Corp	USA	1752	SIPRI
93	Serco Group PLC	Great Britain	4296	SIPRI
94	Shanxi Tond Chemical Co Ltd	China	2549	SIC
95	Sichuan Yahua Industrial Group Co Ltd	China	2383	SIC
96	Singapore Technologies Engineering Ltd	Singapore	4179	SIPRI
97	Ste D'Explosifs & De Produits Chimiques	France	3698	SIC
98	Sturm Ruger & Co Inc.	USA	4194	SIC
99	Teledyne Technologies Inc.	USA	4194	SIPRI
100	Textron Inc	USA	4192	SIPRI
101	Thales	France	4261	SIC, SIPRI
102	Thyssenkrupp AG, Duisburg/Essen	Germany	4227	SIPRI
103	TransDigm Group Inc	USA	3641	SIPRI
104	TRL Electronics PLC	Great Britain	456	SIC
105	United Defense Industries Inc.	USA	372	SIC
106	Vectrus Inc	USA	1499	SIPRI
107	Verney-Carron S.A	France	2949	SIC
108	ViaSat Inc.	USA	4194	SIPRI

Notes. Company is the name of the arms company included in the thesis. Country is the country where the company is headquartered. Obs. is the number of observations for the specific company in the sample. Source denotes whether we retrieved the company from the SIPRI list and/or based on SIC code.

A.2 List of market indices

Country	Market Index
Australia	S&P ASX 200 Index
Canada	S&P TSX
China	Shanghai SE Composite Index
France	CAC 40
Germany	Deutscher Aktienindex
India	S&P BSE Sensex
Israel	Tel Aviv 35 Index
Italy	FTSE Milano Italia Borsa Index
Japan	Nikkei 225
Netherlands	Amsterdam Exchange Index
Pakistan	FTSE Pakistan Index
Russia	Russian Trading System Index
Singapore	FTSE Straits Times Index
South Korea	Korea Composite Stock Price Index
Sweden	OMX Stockholm 30 Index
Turkey	Borsa Istanbul 100 Index
Great Britain	FTSE 100 Index
USA	S&P 500

Notes. Country refers to the headquarter country of the company. Market index represents the respective market index for each country.

A.3 List of events

Central African Republic (embargo imposed 12/05/2013)				
Event ID	Event date	Type of event	Hostility effect	Source example
1	12/05/2013	Clashes	↑	ACLED, NY Times, The Guardian
2	01/31/2014	Clashes	↑	ACLED, BBC
3	04/09/2014	Clashes	↑	ACLED, BBC
4	05/28/2014	Church attack	↑	ACLED, BBC
5	06/24/2014	Clashes	↑	ACLED, BBC
6	09/28/2015	Prison attack	↑	ACLED, BBC, The Guardian
7	11/24/2016	Clashes	↑	ACLED, The Guardian
8	06/20/2017	Clashes	↑	ACLED, BBC
9	05/01/2018	Church attack	↑	ACLED, BBC
10	02/02/2019	Peace agreement	↓	ACLED, BBC, NY Times
Libya (embargo imposed 02/26/2011)				
Event ID	Event date	Type of event	Hostility effect	Source example
11	11/15/2013	Attacks on civilians	↑	ACLED, BBC
12	05/16/2014	Second civil war breaks out	↑	ACLED, BBC
13	02/20/2015	Bombing	↑	ACLED, BBC
14	12/17/2015	Peace agreement	↓	CNN, The Guardian
15	05/19/2017	Airbase attack	↑	ACLED, BBC
16	05/27/2017	Clashes	↑	ACLED, CNN
17	09/03/2018	Clashes and prison break	↑	ACLED, BBC
18	04/04/2019	Declaration of war	↑	ACLED, CNN
19	07/03/2019	Airstrike	↑	ACLED, Daily Mail
20	01/05/2020	Airstrike	↑	ACLED, The Guardian
Yemen (embargo imposed 04/14/2015)				
Event ID	Event date	Type of event	Hostility effect	Source example
21	06/30/2015	Prison break	↑	ACLED, BBC
22	09/04/2015	Clashes	↑	NY Times
23	12/06/2015	Governor killed	↑	ACLED. BBC
24	08/29/2016	Bombing	↑	ACLED, BBC
25	10/08/2016	Airstrike	↑	ACLED. BBC
26	12/04/2017	Former president killed	↑	ACLED, BBC, NY Times
27	04/23/2018	Political leader killed	↑	ACLED, BBC, CNN
28	12/13/2018	Peace agreement	↓	CNN, The Guardian
29	09/30/2019	Rebels release detainees	↓	BBC
30	01/18/2020	Missile attack	↑	ACLED, BBC, CNN

Democratic Republic of Congo (embargo imposed 07/28/2003)				
Event ID	Event date	Type of event	Hostility effect	Source example
31	02/02/2007	Clashes	↑	ACLED, BBC
32	01/23/2008	Peace agreement	↓	BBC
33	12/29/2008	Church attack	↑	ACLED, Fox News, BBC
34	01/23/2009	Rebel leader arrested	↓	BBC
35	02/27/2011	Attempted coup	↑	ACLED, BBC
36	07/06/2012	Clashes	↑	ACLED, BBC
37	11/20/2012	Rebels gain territory	↑	ACLED, BBC, CNN
38	03/18/2013	Rebel leader arrested	↓	BBC, CNN
39	11/05/2013	Peace agreement	↓	ACLED, CNN, Washington Post
40	09/20/2016	Clashes	↑	ACLED, The Guardian
Somalia (embargo imposed 01/23/1992)				
Event ID	Event date	Type of event	Hostility effect	Source example
41	02/24/2005	End of government exile	↓	BBC, The Guardian
42	06/09/2008	Peace agreement	↓	BBC
43	06/18/2009	Minister killed	↑	ACLED, CNN, NY Times
44	02/09/2012	Rebels merge with terror organization	↑	BBC, CNN
45	06/09/2016	Bombing	↑	ACLED, BBC, The Guardian
46	08/21/2016	Bombings	↑	ACLED, CNN
47	10/14/2017	Bombings	↑	ACLED, NY Times, The Guardian
48	07/23/2018	Clashes	↑	ACLED, BBC
49	12/28/2019	Bombing	↑	ACLED, BBC, NY Times
50	08/16/2020	Bombing and hostage attack	↑	BBC
Sudan, Darfur region (embargo imposed 07/30/2004)				
Event ID	Event date	Type of event	Hostility effect	Source example
51	05/05/2006	Peace agreement	↓	BBC
52	05/10/2008	Clashes	↑	ACLED, BBC, The Guardian
53	05/24/2009	Clashes	↑	ACLED, BBC
54	02/23/2010	Peace agreement	↓	BBC, CNN
55	12/25/2011	Founder of rebel group killed	↑	ACLED, BBC, Washington Post
56	09/08/2012	Clashes	↑	ACLED, BBC
57	08/21/2014	Clashes	↑	ACLED, BBC
58	04/11/2019	Coup	↓	ACLED, BBC, CNN
59	08/17/2019	Peace agreement	↓	Daily Mail
60	07/27/2020	Clashes	↑	BBC

Notes. The event ID is the unique ID for each event. The event date is the date of the incident. Hostility effect refers to the impact on conflict in the embargo, whereby upward arrow denotes conflict increase and downward arrow denotes conflict decrease. Source example is examples of sources that have covered the event. All news sources (except ACLED) are on the SimilarWeb's ranking of top websites measured by web traffic.