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**Beyond Restrictions: Analyzing the Impact of Arms
Embargoes on Arms Exports**

Master's Thesis

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Abstract

Recent deteriorations in global security have reignited discussion on arms trade and its regulation. Notably, arms embargoes restricting the trade of weapons with specific actors have become a frequent sanctioning tool, that is nevertheless often perceived as ineffective. This thesis analyzes the impact of mandatory multilateral arms embargoes imposed by the UN and the EU on arms exports of the top 25 arms supplying states from 2000 to 2022. It aims to contribute to the ongoing academic debate, which features both proponents and skeptics of arms embargoes and their effectiveness. Using a fixed effects model on collected panel data, the study examines the relationship between the share of embargoed market and the volume of exported arms. Contrary to the initial hypothesis that embargoes would reduce arms exports, the results reveal a significant positive effect of arms embargoes on arms exports. Additionally, EU membership seems to negatively affect arms exports when compared to non-EU members. These findings indicate that the largest arms exporters appear to be economically resilient and adaptable to the increasing number of imposed arms embargoes. This raises questions about the effectiveness of arms embargoes as a tool for reducing flow of arms and highlights the need for robust implementation and monitoring of embargoes, along with further empirical investigation.

Abstrakt

Nedávné zhoršení globální bezpečnostní situace znovu otevřelo diskusi o obchodu se zbraněmi a jeho regulaci. Zejména zbrojní embarga, která zakazují obchod se zbraněmi s konkrétními aktéry, se stala častým sankčním nástrojem, který je nicméně často vnímán jako neúčinný. Tato diplomová práce analyzuje dopad závazných multilaterálních zbrojních embarg uvalených OSN a EU na export zbraní 25 největších zbrojních dodavatelů v letech 2000 až 2022. Cílem je přispět k probíhající akademické debatě, která zahrnuje jak zastánce, tak skeptiky ohledně zbrojních embarg a jejich účinnosti. Pomocí modelů využívajících fixní efekty zkoumá studie na sesbíraných panelových datech vztah mezi podílem embarg na trhu a objemem exportovaných zbraní. Na rozdíl od původní hypotézy, tvrdící že embarga sníží vývoz zbraní, výsledky odhalují signifikantní pozitivní efekt zbrojních embarg na export zbraní. Dále analýza zjišťuje, že členství v EU má zřejmě negativní vliv na export zbraní v porovnání s nečlenskými státy. Tato zjištění naznačují, že největší dodavatelé zbraní se zdají být ekonomicky odolní a přizpůsobiví

vůči rostoucímu počtu uvalených zbrojních embarg ve světě. To vyvolává otázky o účinnosti zbrojních embarg jako nástroje pro omezení oběhu zbraní a zdůrazňuje potřebu důsledné implementace a monitorování embarg spolu s dalším empirickým výzkumem.

Keywords

Arms export, arms embargoes, largest arms suppliers, major conventional weapons, United Nations, European Union, SIPRI, fixed effects

Klíčová slova

Export zbraní, zbrojní embarga, největší dodavatelé zbraní, konvenční zbraně, Organizace spojených národů, Evropská unie, SIPRI, fixní efekty

Title

Beyond Restrictions: Analyzing the Impact of Arms Embargoes on Arms Exports

Název práce

Nad rámec omezení: Analýza dopadu zbrojních embarg na vývoz zbraní

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Introduction

The deterioration of global security situation with major active armed conflicts in Ukraine or Gaza has brought the topic of arms trade back in the spotlight. The export of major conventional weapons (MCW) and the restrictions on such transfers have again become a major political topic influencing the security and defense policies of virtually all countries in the world. Notably, the year 2023 has recorded the highest level of global military spending since the Stockholm International Peace Research Institute (SIPRI) began tracking this data in 1949. The potential of arms trade to fuel international and intrastate conflict is a concern relevant to all nations. This applies to countries involved in the export or import of arms, those serving as transit or trans-shipment points, as well as those experiencing the consequences of the arms trade, such as the engagement in conflicts, proximity to conflict zones or the influx of refugees.

Global arms trade is a unique and specific sector of the world economy that holds significant importance in the foreign policy of national governments. On the supply side, states have various economic and political motives to export weapons to other actors. Economic transfers benefit the state and its defense industry, while strategic and political transfers serve as a tool of foreign policy to support military capabilities among allies, build security partnerships with other nations or exert influence over the importer (Catrina, 1988; Comola, 2012; Johnson, 2021). Efforts to regulate the arms trade, both internationally and unilaterally, are intrinsically linked to the industry. These regulations are crucial in stopping illegal transfers of weapons that could escalate ongoing conflicts, fuel destabilizing arms build-ups, or be employed in human rights abuses and violations of international humanitarian law.

When punishing states for offensive behavior through sanctions, arms supplies are often the first to be targeted. In particular, arms embargoes, aimed at restricting the trade of weapons with a specific actor, have become increasingly popular since the end of the Cold War. They are considered a smart type of sanction, targeting only the arms sector and thus less likely to harm the general population as opposed to comprehensive economic sanctions (DellaVigna & La Ferrara, 2010; Knight, 1998). Arms embargo represents a popular norm enforcement tool that is among the most frequently used types of sanctions by reputable international organizations such as the United Nations (UN) and

the European Union (EU) (Kranz, 2016; Kreutz, 2005).

The apparent popularity of using arms embargoes contrasts with a critical assessment of their effectiveness by the academic community. Numerous empirical studies find that arms embargoes are routinely violated and highlight the lack of international enforcement, claiming that they represent an inefficient tool (Johnson & Willardson, 2018; Kuo & Spindel, 2022; Moore, 2010; Yanik, 2006). At the same time, empirical research by Brzoska and Lopez (2009), Erickson (2013) or Klomp (2024a) suggests that, contrary to the popular belief, states comply with the agreed arms embargoes and restrain their arms transfers to the embargoed actors. Accordingly, the academic community is divided between proponents and skeptics regarding the use of arms embargoes and their effectiveness.

The ongoing academic discourse on arms embargoes presents a compelling research gap warranting further investigation. This thesis seeks to contribute additional evidence to the contentious discussion surrounding the regulation of arms (Levine & Smith, 2003). The premise of this study is analyzing the effects of arms embargoes on the largest 25 arms exporters between years 2000 and 2022. Using a quantitative approach, this study will analyze the collected panel data, employing fixed effects model to examine the relationship between the share of embargoed markets and the volume of arms exports. The focus will be on mandatory multilateral embargoes imposed by the UN and the EU, which are arguably the most efficient and influential (Brzoska & Lopez, 2009). By looking at the arms export patterns of these suppliers when exposed to an increased share of the market restricted by embargoes, this study aims to indicate whether arms embargoes reduce the volume of exported arms or whether exporters remain resilient to this measure. Focusing on the potential reduction in arms flow as an intermediate factor of arms embargo, the results might reveal the true effect of this tool. Additionally, the analysis will account for factors such as the level of democracy, military spending, EU membership and transparency of arms exports.

The thesis will proceed as follows: comprehensive literature review will provide an overview of the relevant research on arms trade and arms embargoes. Based on this debate, research opportunities are identified, and hypotheses formed. Next section details the key variables and their data sources, followed by the outline of quantitative

methodology, specifically the fixed effects model, and discusses the rationale behind this choice. The results section begins with descriptive statistics, offering initial insights into the data and then presents the main empirical findings. Final section discusses the results, acknowledging the limitations and providing interpretation, followed by a conclusion summarizing key findings.

1. Literature review

This section will begin by reviewing the literature concerned with arms trade and the complex dynamics and motivations behind it, particularly focusing on the export of arms. It addresses the lack of a unified theory explaining why states export arms, the economic and security costs involved, and the political implications of arms trade relationships. Next, it introduces the literature on trade restrictions, with a primary emphasis on arms embargoes, which are the central focus of this analysis. It examines the ongoing academic debate on the effectiveness of arms embargoes. Finally, the literature review features the normative debate of upholding or breaching arms embargoes and the tradeoff between normative obligations and national interests.

1.1 Arms trade

The uniqueness of the international arms trade lies in the amount of attention it receives, which is economically unmatched given its relatively small size. The reason for this is obvious as international arms trade has not only economic consequences, but also profound effects on the distribution of military capabilities, the structure of international relations as well as questions of war and peace (Pamp et al., 2021). It has the potential to exacerbate interstate conflict, civil wars or facilitate repressive political regimes (Johnson, 2021). This section will introduce the academic perspective on international arms trade, its underlying dynamics and incentives, with an individual section devoted to arms exports, the motivation to export and associated challenges.

Turner et al. (2019, p. 1737) define arms trade as “a dynamic global network, that is influenced by both economic forces and geopolitical power dynamics”. However, the transfer of weapons differs substantially from the trade in other goods. Krause (1990, p. 715), notes that the international arms market has seldom, if ever, operated as the market for other products does. Even during the height of the laissez-faire era, arms transfers were directed by individual countries. Developing nations, historically, have pursued arms production capabilities with strategic intent rather than purely economic motives. While market forces play a role in shaping the global distribution of arms, political considerations often override purely economic incentives. Apparently, the international arms trade seems immune to economic crises and it manages to continuously prosper over

time. Particularly since the end of the Cold War, the market has become more globalized, fostering increased interdependence and cooperation. In fact, according to SIPRI, the volume of international transfers of MCW was constantly rising since the beginning of the twenty-first century and only started to slow down around the year 2018 (Wezeman et al., 2023). Therefore, the international arms trade remains a critical component of global economic and political landscape.

Johnson and Willardson (2018) highlight the fact that there is a lack of a unified theory regarding arms trade, which would explain why governments voluntarily provide other states with potentially threatening capabilities that might be used against their own interests. The transfer of arms can be defined as the “observable commodities that are traded in the international system for the purpose of enhancing the military power or political power of the recipient nation” (Laurance, 1992). Establishing an arms trade relationship is costly and comes with a variety of economic, security and political costs. Economic costs arise from the need to facilitate transactions, such as market research, negotiation, contract formation, and monitoring, as well as potential concessions, like granting favorable access to domestic markets for other goods. Furthermore, there are risks associated with payment defaults, property rights issues or unauthorized resale of arms. Security costs are significant due to the transfer of military capabilities, thereby bolstering the military strength of the buyer. While this may pose fewer challenges with close allies, the disparity in foreign policy alignment between two states increases potential security costs. Finally, establishing links with other states could entail political costs, both domestic and foreign. Trading arms with certain countries might antagonize others, leading to further economic and security costs. Creating trade links with certain states may also prove unpopular domestically, thus affecting government’s electoral prospects (Pamp et al., 2021).

Looking at the advantageous side of arms trade, the sale of weapons and military equipment has the potential to generate significant revenue for a state, stimulate technological innovation and create employment opportunities. Previous research explaining arms transfers has highlighted the importance of economic incentives (Hartley & Martin, 2003; Levine et al., 2000; Levine & Smith, 2003), sociological motives (Suchman & Eyre, 1992) and also strategic considerations, such as the affinity of buyers

and sellers (Harkavy, 1994; Krause, 1995). Since the early 20th century, arms have not only been tradable goods but also vital policy instruments. For instance, Bove et al. (2018) find that the transfer of arms remains an effective foreign policy tool to securing and maintaining access to oil. In general, political factors significantly influence the arms trade through various channels - national sovereignty governs regulation, export licenses are exclusively issued by governmental agencies, a significant share of the defense industry is owned by the state, and the arms manufacturing sector benefits from subsidies and other protective measures to support national interests (Comola, 2012).

Nevertheless, the role of arms trade as a potent instrument in foreign policy has come under academic scrutiny, emphasizing the fact that economic interests increasingly overshadow this role. Bondi (2004) argues that the international trade of arms shifted from being primarily driven by foreign policy objectives to becoming a “government-backed commercial endeavor aimed at securing profitable market positions abroad”. According to the author, little regard is shown for the potential negative consequences, including its impact on regions affected by persistent political instability, human rights abuses, stagnant economic development, or widespread corruption. Yanik (2006) identifies this transition toward profit-oriented motivation as originating at the end of the Cold War. This geopolitical transition was marked by a notable decline in domestic military spending, accompanied by a diminishing emphasis on strategic priorities. In response to this and with the aim of capitalizing on economic gains, some supplier countries and manufacturers have started to pursue more aggressive policies in their international sales, sometimes overlooking the ethical considerations of their buyers, potentially ignoring human rights abuses and indirectly exacerbating armed conflicts. These economic, strategic and also ethical considerations are intrinsically linked to the decisions of countries on whether to export arms and in what quantities.

1.1.1 Arms export

The export of major conventional weapons occupies a unique part within the arms trade, that is dominantly overseen and controlled by major world powers. According to SIPRI (Wezeman et al., 2023), the five largest arms exporters – United States, Russia, France, China and Germany – accounted for over three quarters of all arms exports in the years 2018–2022. Major arms exporters operate in an imperfect competition and prefer not to

export large quantities of weapons to their recipients, to maintain their dominant power (Martínez-Zarzoso & Johannsen, 2019). This creates an international structure with strong oligopolistic tendencies, where major exporters exert influence over the worldwide arms trade (Wang et al., 2023). The academic focus on the general motives of states to export military capabilities stems primarily from the economics framework, augmented by contributions from the field of international relations. Smith et al. (1985) summarize the overarching causes for states to export weapons as: strategic reasons, political leverage and economic benefits. Up to this point, these fundamental motivations for arms transfers have remained unchanged. First, strategic benefits of a domestic arms production include the independence of supply, the ability to have the latest military technology, and the ability to control the design of weapons system. Next, arms transfers grant the supplier significant political leverage over the importer by creating a dependency on weaponry, maintenance, and spare parts. Should the supplier choose to, for instance, withhold these essential components, the importer's weapon systems would gradually lose effectiveness, ultimately becoming useless. Besides, arms exports are used to consolidate global or regional influence, strengthen the capabilities of allies and partners, balance against rivals, or seek to influence the policy choices of recipients (Perlo-Freeman, 2021; Yarhi-Milo et al., 2016). The third reason to export arms is economic benefit. These benefits include the spread of the high capital and research and development (R&D) costs but also the advantages derived from economies of scale within an international market, meaning the cost advantage gained from increased production of military goods (Brzoska, 2008). Additionally, there are indirect benefits stemming from arms research and production, such as technological and scientific cooperation with other sectors, job creation, and economic stimulus. While arms production typically makes up a minor share of the overall economy, major deals have the potential to support a large number of jobs concentrated in particular areas, creating strong lobbies in the favor of arms sector (Perlo-Freeman, 2021).

Research on arms exports has garnered larger academic attention in recent years (e.g. Akerman & Seim, 2014; Beardsley et al., 2020; Blum, 2019; Brzoska, 2008; Harkavy, 1994; Kinsella, 2011; Krause, 1995; Lebacher et al., 2020; Martínez-Zarzoso & Johannsen, 2019; Pamp et al., 2021; Stohl & Grillot, 2009; Thurner et al., 2019; Wang et al., 2023), but there is surprisingly little quantitative research. Various authors employ

the approach of a case study and focus on export behavior of individual countries (Anthony, 1998; Blanton, 2000, 2005; Hartley & Belin, 2019; Perkins & Neumayer, 2010; Schulze et al., 2017). Another strand of research proposes that the international arms trade should be conceived of as a complex network (Pamp et al., 2021; Thurner et al., 2019). Several seminal studies deserve mentioning: Blanton (2000, 2005) investigates how human rights and democratic governance affect a country's eligibility to receive weapons from the United States. Smith and Tasiran (2005, 2010) investigate the factors influencing the elasticity of arms imports in relation to military expenditure. Comola (2012) examines political cycles in arms exports and finds that right-wing incumbents tend to increase arms exports, suggesting a general right-wing tendency to support national industry and deregulate heavy industry exports. Akerman and Seim (2014) find a negative relationship between differences in the level of polity and the likelihood of the arms trade during the Cold War. Bove et al. (2018) investigate the impact of oil dependence on the arms trade, revealing that global reliance on oil drives increased arms exports to oil-rich nations.

Beyond analyzing the mechanisms behind arms exports, various studies provide evidence of tangible benefits for the exporting countries. Thurner et al. (2019) confirm the benefits from the transfer of arms for exporters: stimulation of domestic military industry, and support of foreign allied countries and governments. Additionally, arms exports have a positive impact on national industrial base, contributing to innovation and manufacturing (Ruttan, 2006), and can also be a source of hard currency and employment (Hammond et al., 1983). Analysis by Callado Muñoz et al. (2023) shows that shocks arising from military exports have a clear spillover to US labor productivity and real economic growth, denoting that the shocks always go from military exports to economic growth and not in the opposite direction. According to Bove et al. (2018), the export of arms can function as a form of foreign aid, helping to counter local threats and reduce the risk of political instability. Moreover, many countries also receive military aid to buy weapons and equipment from the donor country (Bapat, 2011). Recently, in majority of confrontations between the state and violent non-state military actors, imported arms have played a fundamental role in determining the success of the combatants. Foreign arms can provide advanced capabilities and effectiveness to the government powers and shift the balance of power.

However, the export of arms also entails the repercussion of a potential proliferation of arms into unauthorized hands. The strand of literature exploring the impact of arms export on the onset of civil and ethnic wars yields inconclusive assumptions. Analysis by Suzuki (2007) revealed that significant arms imports did not exhibit a notable effect on either civil or ethnic conflict outbreaks. Moore (2010) partially corroborates this finding, indicating no significant effect of MCW imports on the intensity of civil conflicts. Fauconnet et al. (2019) discover that French MCW exports do not exacerbate intrastate conflicts. On the other hand, Magesan and Swee (2013) reveal that U.S. arms exports tended to diminish the likelihood of political repression in recipient countries while increasing the probability of civil conflict onset.

Based on the associated risks and since the export of arms is a tool of foreign policy, states usually try to monitor and control it. The effectiveness of the relevant laws, which delineate the conditions for granting an export license, ultimately depends on the monitoring and control of the actual export of weapons. Broad monitoring and regulation are essential for the state to exert its authority effectively and ensure the accuracy of official data concerning arms transfers (Catrina, 1994). Traditionally, arms trade has been heavily regulated with export controls, including embargoes, and export subsidies. These measures sometimes pursue conflicting objectives, such as promoting domestic industry while simultaneously restricting arms exports to safeguard national security (Callado Muñoz et al., 2023). As remarked by Perlo-Freeman (2021, p. 20): “Arms sales largely follow the demand and are often dependent on established relationships between buyer and seller which sellers are typically reluctant to abandon, regardless of concerns over the potential impact on conflict.” For these reasons, there are many skeptics in academic circles regarding the effectiveness of arms export restrictions. The next chapter introduces the complexities of trade restrictions, particularly focusing on the criticism they face.

1.2 Trade restrictions

Within the field of international relations, there is no authoritative definition of the term “sanction”. One commonly used definition is the “deliberate, government-inspired withdrawal or threat of withdrawal of customary trade or financial relations” (Hufbauer et al. 2019, p. 3). The objectives of imposed sanctions can vary but the overarching purpose can broadly be to exert coercive pressure on the targeted entity to comply with

the demands of the sender. The overall use of sanctions has increased since the end of the Cold War, as the UN Security Council deadlock broke, and the EU acquired greater foreign policymaking powers through the implementation of the Maastricht treaty (Erickson, 2020). The fact that the role of the international organizations has become more important, increased the potential scope of non-violent approaches to conflict resolution, such as the use of multilateral sanctions (Van Bergeijk, 1995). This chapter explores the use of sanctions in international relations and addresses the academic debate on their effectiveness and the importance of proper implementation.

For situations necessitating reinforcement of internationally accepted standards and rules of behavior, Erickson (2020) identifies three main tools available to international actors for norm enforcement: social sanctions, economic sanctions and military action. In this nexus of possibilities, economic sanctions come out as the pragmatic choice in terms of material costs both to senders and to targets. On one hand, social sanctions typically involve punishments that rely on social or moral leverage, the removal of social status, and targets' embarrassment and concern for a social status, ultimately encouraging a change in behavior. Perhaps most commonly, *naming and shaming* draws public attention to norm violators. Meernik et al (2012) describe it as "the principal weapon of choice among many international organizations and governments". Due to its low material costs for imposing actors, this form of enforcement is especially favored by those without substantial material resources. Although the direct material costs to the targets are minimal, the social costs and potential indirect material costs resulting from social stigmatization can motivate behavioral change.

On the other hand, military action represents a rare tool of norm enforcement that comes with high material costs. Erickson (2020) ascribes the scarce use of military actions to two reasons. First, they necessitate a significant consideration of proportionality, making them an inappropriate punishment in most of the situations. Second, they impose greater costs on norm enforcers, in terms of organizing and executing the punishment, as well as causing severe disruption to the target-sender relationship. Military tools need not be used in isolation, as military action is usually considered a last resort, often following lower-cost punishments that highlight the target's norm violations. Cameron (2021) adds that military force and sanctions cannot always be separated, as they can be part of a policy

of containment or combined military/economic response. Additionally, it may be part of a prelude to military intervention to persuade domestic and international public opinion that all possible measures have been exhausted.

Therefore, economic sanctions generally fall in between the social sanctions and military action and come out as the pragmatic option to coerce norm violating actors to change their behavior. They may be imposed unilaterally by individual countries or multilaterally, by groups of states through international institutions. Sanctions may be comprehensive, prohibiting all economic activity with a target, or targeted/smart, prohibiting economic activity in certain sectors or with certain actors in a target. Arms embargoes, the primary focus of this analysis, represent targeted (or smart) economic sanctions that seek to prevent arms sales to governments or other actors within a targeted state.

Over time, targeted sanctions have gained widespread acceptance as the preferred tool for norm enforcement, offering proportional responses to a broader range of violations and creating lower aggregate costs for the senders. Peksen (2019, p. 639) observes that the transition from traditional comprehensive sanctions, which were favored in the 20th century, to targeted sanctions occurred partly due to the belief that targeted sanctions would be more effective. This effectiveness stems from their ability to exert direct pressure on key actors and their support networks. Additionally, because targeted sanctions focus on specific individuals or economic sectors, they were expected to minimize negative humanitarian effects on civilians. Also, targeted sanctions elicit responses from individuals and group entities rather than from states and national authorities (Giumelli, 2011). Nevertheless, critical review of the effectiveness of sanctions literature by Peksen (2019) reveals there is no strong evidence of targeted sanctions being more successful than conventional ones (Cortright & Lopez, 2002; Drezner, 1999; Eriksson, 2011). Additionally, some studies show that targeted sanctions could also have substantial negative effects, particularly increases in political repression, deterioration of humanitarian conditions, corruption in the government, and poor governance (Early & Schulzke, 2019; Gordon, 2011).

Therefore, despite being a popular norm enforcement tool, economic sanctions and their efficiency is subject to extensive academic debate. Skeptics (Early, 2015; Galtung, 1967;

Pape, 1997) argue that sanctions are unlikely to provide sufficient incentives for targets to comply with the will of the senders. Furthermore, third-party states can choose to engage in sanctions busting, that is, exploit trade opportunities created by the restrictions, or provide the target with foreign aid to compensate for some of the losses resulting from trade restrictions (Early, 2015). At the same time, advocates (Brooks, 2002; Hufbauer et al., 2019; Kirshner, 1997; Pattison, 2018) claim that sanctions can effectively encourage behavioral change when appropriately designed. Consequently, the true impact and success of sanctions remain a contentious topic within the field of international relations.

However, an essential aspect to consider when assessing compliance with sanctions and their subsequent effectiveness, is whether the sanctioning states follow through on their commitment to cut the supply of sanctioned goods to the target. This view is particularly relevant for this analysis. Once senders adopt a sanction on paper, it must be properly implemented to have any chance of achieving its goals. Effectiveness depends greatly on swift comprehensive implementation and rigorous enforcement (Cortright & Lopez, 2002, p. 113). Failure to implement sanctions properly can lead to sender nations avoiding the costs associated with enforcement, thus diminishing the pressure on targets to change their behavior (Wallensteen et al., 2003, p. 9). Moreover, poor implementation may also undermine attempts to signal disapproval to targets or other involved parties. Multilateral sanctions typically lack direct enforcement mechanisms and rely on sender nations to enact them domestically (Gowlland-Debbas, 2001; Staibano & Wallensteen, 2005). Similarly, unilateral sanctions heavily depend on the sender's willingness to implement them, which may be weak when imposed merely as a favor to an ally or to appease domestic interest groups. Factors such as political pressures, security considerations, or economic interests can provide strong incentives for states to circumvent their legal or political obligations. From this perspective, poor implementation significantly contributes to the mediocre performance of sanctions. Among targeted sanctions, arms embargoes are often cited as having the worst track record in terms of implementation and effectiveness, despite being frequently employed. They are the primary focus of this study and will be closely scrutinized in the subsequent chapter.

1.3 Arms embargoes

Arms embargoes have become an important and popular foreign policy tool to coercively

punish violent states and non-state actors. In contrast to most other types of sanctions, arms embargoes are not imposed to inflict economic pain on the target, but to deny the access to certain product – arms (Kreutz, 2005). They are usually used in cases of war, human rights violations, support for terrorism or the development of nuclear arsenal in order to punish the target for their behavior, send a message about the unacceptability of this behavior to other actors, and lessen the target's repressive and warlike ability (Giumelli, 2011). In recent years, arms embargoes have been a primary tool in the international responses to Russia's aggression in Ukraine or the nuclear development programs of Iran and North Korea. This chapter is concerned with arms embargoes and arms control regimes in general. It explores the increased popularity of arms embargoes as a policy tool, their objectives and further delves into the academic debate on their effectiveness.

Arms embargoes have gained popularity since the end of the Cold War, because they represent a smart type of sanction, targeting only the arms sector, therefore less likely harming the general population, unlike comprehensive economic sanctions used throughout the 20th century (DellaVigna & La Ferrara, 2010; Knight, 1998). They are one of the most frequently used type of sanction by the United Nations (Kreutz, 2005) and the European Union (Kranz, 2016), on their own or in conjunction with more comprehensive sanctions packages (Cortright & Lopez, 2002). When targeting military capabilities, arms embargoes can reduce the target's ability to wage war, develop weapons programs, or repress their populations. Arms embargoes are also less likely to be inhibited by humanitarian controversy than extensive sanctions packages that target the economy more broadly (Erickson, 2020).

Arms embargoes represent a key part of the international arms control framework. This normative framework aims to control the international movement of military-strategic goods and dual-use items that might fall into hands of violent states or non-state actors and consequently exacerbate an ongoing conflict, contribute to destabilizing weapons build-ups, or be used in violations of human rights. Additionally, it seeks to maintain the technological superiority of arms-producing nations' military capabilities and prevent unauthorized replication (Klomp, 2022). Key element of the regulatory framework are multilateral treaties and export control regimes designed to regulate the trade of weapons.

Some treaties ban the trade and use of specific types of weapons considered particularly dangerous or inhumane, while others target the illicit trade and manufacturing of arms. Before delving into the debate about arms embargoes' effectiveness, it is considered crucial to briefly mention existing attempts to restrict the arms market, which include considerably effective efforts, such as export control regimes in the fields of nuclear, biological and chemical weapons (Krause, 1995).

Currently, the main multilateral instrument of the arms control framework is the Arms Trade Treaty (ATT) established in 2013, with stated objectives to “establish the highest possible common international standards for regulating or improving the regulation of the international trade in conventional arms”, “prevent and eradicate the illicit trade in conventional arms and prevent their diversion”, and to “[reduce] human suffering” (The Arms Trade Treaty, 2013). As of July 2024, 115 states have ratified or acceded to the ATT including major arms producers like Germany, France, the United Kingdom or China, but with the notable exemption of the United States, that have not yet ratified the treaty. Nevertheless, ATT represents the first legally binding international agreement to establish standards for regulating international trade in conventional arms (Wang et al., 2023). There are also non-binding multilateral export control frameworks, the most extensive of which is the Wassenaar Arrangement. It aims to promote transparency and responsibility in the trade of conventional arms and dual-use goods and technologies but lacks any enforcement mechanisms. Besides, the existence of other multinational bodies underscores the commitment of states to regulate the trade with arms. These include the Treaty on the Non-Proliferation of Nuclear Weapons, Nuclear Suppliers Group, or the Zangger Committee, that aim to prevent nuclear proliferation by harmonizing export controls and monitoring the export and re-transfer of materials and technology that can be used to produce nuclear weapons; the Australia Group established to prevent the proliferation of chemical and biological weapons through the harmonization of export controls among countries; or the Missile Technology Control Regime that aims to limit the spread of missile technology capable of delivering weapons of mass destruction.

To better understand the ongoing academic debate on effectiveness of arms embargoes, it is important to consider which factors determine a country's effort to control arms trade. Klomp (2022) provides a review of existing literature that builds on various theoretical

perspectives regarding arms trade control and its stringency. The following part introduces these perspectives to illustrate the complexity of state's motivation to abide by the arms control laws.

First, the *military interest theory* suggests that the enforcement of arms trade laws is influenced by the global distribution of military power, with superpowers resisting the measures that limit their offensive capabilities to maintain their supreme position and bargaining power. Consequently, powerful states implement rigorous arms trade controls to prevent other nations from enhancing their military capabilities, thereby preserving their own dominance (Kroenig, 2009; Sanjian, 1988). Next, according to the *economic interest theory*, implementing arms trade legislation is more burdensome for wealthier nations, which often both produce and purchase weapons. Restrictive trade measures can be costly and may limit trading opportunities, leading senders to implement only those measures that are the least costly to them (Beck & Gahlaut, 2003). Further, the *external pressure theory* posits that major powers enforce strict arms trade controls to demonstrate their responsibility in the global community and respect for the international law, often imposing their norms on less powerful states. Thus, the decision to implement stringent trade controls and adhere to arms trade standards is driven more by external pressure to combat proliferation than by the state's own preferences (Goldsmith & Posner, 2005). According to the *collective action theory*, the competitiveness of arms market creates a weak link phenomenon, meaning that the country that downplays enforcement of trade controls might be able to gain significant economic advantage. This view highlights the collective action problem of arms trade control, where governments are likely to prioritize their national arms industries over strict strategic trade controls. This dynamic is reinforced by the close relationship between politicians and the defense industry, also referred to as the military-industrial complex (Eisenhower, 1961). Alternatively, the *security risk theory* implies trade control efforts largely depend on the current security situation of a country. States facing significant security risks might potentially be reluctant to restrict arms imports or exports, since it would restrain their ability to acquire equipment for self-defense purposes (Stinnett et al., 2011). Finally, *state capacity theory* underlines that variations in countries' compliance with arms trade controls stem from their ability to enforce rules, often hindered by technical and bureaucratic limitations. While states may have the political will to comply with obligations, deficiencies in

regulatory capacity or effective enforcement mechanisms can impede their ability to implement and enforce export control policies (Fuhrmann, 2007). To conclude, country's determination to enforce arms control policies, such as arms embargoes, is affected by its economic and political power, its position in the international system, its security situation and also its legal and regulatory capacity. It can be seen that a wide range of factors influences a country's decision to comply with an embargo, therefore affecting its potential subsequent effectiveness. The question of effectiveness of arms embargoes remains a contentious scientific question and the following part will introduce this debate.

1.3.1 Debate on effectiveness

As already indicated in the preceding debate, the apparent popularity of using arms embargoes contrasts with the highly critical assessment of their effectiveness. This section will introduce the academic literature on the effectiveness of arms embargoes, detailing both critical and advocative perspectives. It will conclude by examining the debate over the potential sources of these conflicting findings. Then it proceeds to the overview of the normative strand of literature highlighting the moral obligations of states in upholding international norms, before continuing to the Hypotheses section.

Historically, arms embargoes have been imposed for four main purposes: expressing disapproval of a particular actor's behavior, restricting an actor's capacity to commit violence, diminishing a country's military capabilities before a foreign intervention, or maintaining neutrality in ongoing conflicts (Brzoska & Lopez, 2009). In majority of cases, the primary aim is to achieve a change in policy within the targeted state by prohibiting the export of military-strategic items to specific countries, regions and entities. These items have the potential to be utilized for military purposes that could disrupt peace processes, destabilize regimes or regions, or violate human rights. (Bondi, 2002; Brzoska & Lopez, 2009; Giumelli, 2011).

Nevertheless, achieving a change in policy of the targeted state through an arms embargo is a difficult objective that is often hard to accomplish. As stated by Klomp (2024a, p. 3): "even when arms flows are effectively halted, there may be no change in the policy of the targeted state as arms imports are substituted by domestic production or arms imports from states that do not support the embargo." Thus, the analysis of arms embargoes'

effectiveness in academic literature has recently shifted towards a focus on intermediate factors, particularly the extent to which arms deliveries from the sender state to the target are halted. Thus, stopping the arms flow can be considered as an objective of arms embargo in itself. Evaluating effectiveness based on the reduction of arms transfers to the target state is also less dependent on the behavior of the target state (Brzoska, 2008). The effectiveness of an arms embargo is hence primarily influenced by the imposition and enforcement by the exporting country and by its embargo-busting practices.

The debate about arms embargoes and their effectiveness is built upon several major arguments. First, the effectiveness of an arms embargo depends on the determination of individual sender states to impose them, on their subsequent integration into domestic legislation, and on their enforcement and oversight by authorities (Klomp, 2024a). However, as pointed out by Erickson (2013, p. 160): “Policy adoption does not ensure policy implementation.” Failure to implement arms embargoes significantly hinders their effectiveness. This is reinforced in situations where non-compliance costs remain low and national governments lack the incentive to invest in effective trade restrictions. Additionally, as mentioned by Pamp et al. (2021), adherence to arms embargo is further influenced by the cost of severing an established trade link. Ending an arms trade relationship can lead to economic and security repercussions for both parties. For instance, if an exporter halts weapon deliveries, the importing country must seek new suppliers, potentially leading to a change in international security environment. The exporter may also need to redirect the already manufactured products to other countries.

Next, controlling the export of arms requires an effective bureaucracy immune to corruption, a robust border control, and a legal framework that ensures efficient punishment in case of violations (Brzoska, 2008; DellaVigna & La Ferrara, 2010). One of the major consequences of technical and bureaucratic deficiencies is the phenomenon of arms leaking across porous borders (Bove & Böhmelt, 2021). Moreover, enforcing an arms embargo presents a challenge due to the non-exclusive and unevenly distributed security advantages of compliance. Even states not actively adhering to an embargo may reap some of its benefits. This vision of “free riding” allows states to pursue strategic objectives or preserve export markets while shifting the responsibility of addressing global security onto others (Klomp, 2024a; Moore, 2010). Additionally, arms producing

firms in embargo-sending states may seek to bypass arms embargoes by utilizing intermediary countries for the transit of military goods or licensing arms production technology to third-party nations (Bove & Böhmelt, 2021; Moore, 2010). Finally, in many arms exporting countries, significant role is played by the military-industrial complex. Arms embargoes might negatively impact the economic performance of defense companies; therefore their representatives might oppose the introduction of embargoes and advance their interests through lobbying in order to influence the government in their favor (Klomp, 2024b; Smith & Dunne, 2018).

In addition to evaluating the effectiveness of arms embargoes by looking at the “minimum” objective of stopping the flow of arms to the target, there remains the critical question of their impact on the target’s policies. Arms embargoes are expected to change the behavior of a target, for instance to stop it from continuing a war which the sender wants to end (Brzoska, 2008). Nevertheless, analyzing and evaluating policy changes in the target requires significant qualitative interpretation, which is challenging to standardize across different cases. Consequently, this type of analysis is more prevalent in case study literature focusing on the effectiveness of individual cases of embargoes (e.g., Bogers et al., 2022), rather than in broad examinations of arms embargoes’ overall effectiveness. As observed by Brzoska (2008, p. 23), the link between arms supplies and policy changes in the target is weak. Targets typically adapt their military strategies and resources to the available level of arms and ammunition. Furthermore, embargoes are often introduced too late, suggesting that swifter reactions might increase the potential effectiveness of sanctions in influencing policy change. This highlights the complex nature of arms embargoes in achieving their broader objectives, that is often criticized in academic works. The criticism is described in the following sub-part.

1.3.1.1 Ineffectiveness of arms embargoes

The popularity of arms embargoes as an attractive instrument of foreign policy, especially by international organizations, has already been described in the preceding parts of this work. Nevertheless, this popularity stands in stark contrast to the critical evaluations of the effectiveness of arms embargoes. Part of the academic literature questions the effectiveness, arguing that these measures have minimal impact both on the flow of arms and on the behavior of targeted entities. This part describes the academic literature

empirically rejecting arms embargoes and labelling them as an ineffective policy tool. It introduces the main arguments against arms embargoes and studies the discussion of possible factors influencing low levels of compliance and embargo effectiveness.

Violations of embargoes by the sending states combined with a lack of international enforcement are believed to significantly undermine embargo success (Brzoska & Lopez, 2009; Bondi, 2002; Moore, 2010; Tierney, 2005). Additionally, academic community stresses the humanitarian consequences of embargo violations, when the delivery of arms to conflict zones and to actors with a record of human rights violations continues (Bondi, 2002; Johnson & Willardson, 2018; Yanik, 2006). As noted by the UN Human Rights Office (Office of the United Nations High Commissioner for Human Rights [OHCHR], 2022), arms continue being exported to human right violators, who are often subject to arms embargo, because of the confluence of several factors: a lack of accountability for states that ignore human rights provisions in arms control laws for national security or commercial interests; a regulatory framework that allows states to interpret human rights conditions leniently; a culture of secrecy and non-transparency surrounding arms exports; corruption in the arms sector; and a lack of human rights due diligence conducted by the arms producers, coupled with a failure of states to mandate this.

Empirical works by various authors largely confirm the bad reputation of arms embargoes and their ineffectiveness. Previous studies on arms embargoes against South Africa or countries in the Middle East report numerous violations and criticize poor implementation (Harkavy, 1975; Landgren, 1989; Wulf, 1993). More recent analyses of arms embargoes have reached similarly discouraging conclusions (Bondi, 2002; Boucher & Holt, 2009; Cortright & Lopez, 2002; Durch, 2000; Escribà -Folch, 2010; Fruchart et al., 2007; Gordon, 2011; Hufbauer et al., 2019; Kaempfer & Lowenberg, 2007; Kuo & Spindel, 2022; Moore, 2010; Staibano & Wallenstein, 2005; Tierney, 2005; Vines, 2007; Wang et al., 2022). Tierney (2005) criticizes the weak enforcement of arms embargoes and that they are unlikely to bring about political change, they criminalize target societies, they benefit arms suppliers intending to violate them and they ultimately undermine the credibility of the UN. Durch (2000) points out that arms embargoes have rarely been militarily effective, or morally sustainable. Gordon (2011) concludes arms embargoes do not reduce the flow of weapons but also create illegal market with potentially higher profit

than legal arms market; and Escribà-Folch (2010) suggests arms embargoes may actually be counterproductive by lowering the likelihood of a negotiated settlement of a conflict. Extensive study done by SIPRI concludes that nearly every UN arms embargo has been systematically violated (Fruchart et al., 2007). Recently, the important role of intermediary arms suppliers has been confirmed as a significant factor in evading embargoes (Kuo & Spindel, 2022). Bove and Böhmelt (2021) discover that arms embargoes efficiently reduce the direct flow of arms into the target, but arms exporters shift the flow of arms to neighbors of the embargoed state and take advantage of the porous borders to keep delivering weapons.

Sanction busting is often cited as one of the main reasons for low effectiveness of arms embargoes (Peksen, 2019; Van Bergeijk et al., 2019). It is the practice of the sending states to evade the arms embargo directly or with the involvement of a third party (Early, 2015). In the international arena, embargoed countries often have allies willing to covertly continue shipping arms or to act as a transshipment state. Transshipments entail rerouting arms through intermediary ports or countries to obscure their origin, destination, or the parties involved. It may be effectively used to bypass the restrictions imposed by embargo and to continue trading (Fantozzi & Naldi, 2023). Besides, governments rarely acknowledge violations of arms embargoes, while they also anticipate minimal to no repercussions from the initiating and supervising authorities. Violations are also likely to originate from countries with strong economic pressure on arms export, since there might be less emphasis on enforcement of embargoes (Brzoska & Lopez, 2009). In domestic politics, export control is only effective to the extent government is willing to enforce. This will can be weakened by the existence of military-industrial complex, where domestic arms companies are generally interwoven into the state's economic, security and political setting. These companies build national military capacity, wield significant economic power and can exert pressure on political elites to approve lucrative international arms transfers (OHCHR, 2022). Additionally, arms embargoes present a relatively cheap measure for the actors to distance themselves from the target and avoid complicity. As a consequence, terminating export of weapons to the embargoed actor may be more about dissociating from the target's actions and signaling this to the international community than actively seeking a shift in target's behavior (Brzoska, 2008).

As it can be seen, the decision to continue supplying weapons to an embargoed state is influenced by economic as well as political and strategic factors. From an economic point of view, arms embargo implies that reduced supply of arms will lead to a higher price and a reduction in the quantities exchanged. This opportunity also attracts arms suppliers to profit through illicit deliveries enabled by the arms embargoes. This creates a weak link phenomenon, where the overall success of an embargo is determined by the state with the lowest compliance. In this situation, a state that sends arms to the embargoed target can gain significant economic and strategic advantages (Russett & Sullivan, 1971). Regardless of the presence of an arms embargo, Brender (2016) discovers most deals concerning conventional weapons are eventually fulfilled. As observed by Kuo and Spindel (2022), embargoed countries are still able to obtain heavy combat systems, including fighter aircraft and tanks, and they generally obtain the same distribution of weapon systems as non-embargoed countries.

Adding to the motivation of profit, Moore (2010, p. 609) discovers that economic motives alone cannot explain why state violate embargoes. According to the author, the decision to transfer arms to an embargoed target is ultimately political and this position may create greater incentive to violate the embargo. If an embargo threatens to establish a new regional balance of power that disadvantages the exporting country, that country will have a unique incentive to violate the embargo (Moore, 2010). Additionally, a state might consider the political backing for the regime through arms transfers, as these transfers serve as a symbol of political support, even more meaningful in the event of embargo (Catrina, 1988).

At last, the political will preceding the decision to impose an arms embargo ultimately curbs its effectiveness. Especially on the part of the permanent members of the UN Security Council, high potential costs and the condition of relationships between the permanent members, can render the decisions to impose arms embargo contentious. In cases such as the Syrian civil war or Israeli-Palestinian conflicts, the Security Council was unable to overcome internal divisions to impose arms embargoes. The Council even avoids discussing sanctions entirely, when a permanent member's veto seems inevitable (Erickson, 2020). Subsequently, violations of arms embargoes can partly be attributed to imperfections in the way international legislation concerning trade restrictions is

translated into national laws, creating significant leeway for supplier countries to interpret these laws to their advantage (Yanik, 2006). This also occurs in the environment, where non-governmental bodies investigating the violations have limited authority and depend on voluntary cooperation from national governments. As a result, there is a lack of systematic and quantitative evidence of arms embargoes violations (Bondi, 2004; DellaVigna & La Ferrara, 2010).

When discussing the ineffectiveness of arms embargoes, it is also crucial to consider the response by the embargoed actors. Especially the presence of domestic arms production poses a challenge, since embargoes, by making imported arms more expensive, encourage countries to produce their own weapons (Levine et al., 2000). This is likely the case of Russia and China, who are targets of the EU arms embargoes, but they can probably mitigate it through their domestic arms production. Additionally, there are high costs to switching suppliers particularly after a state has invested in a specific block's arms (Kinsella 1998; Thurner et al. 2019). However, states under embargo might mitigate through three potential strategies: domestically producing substitutes for the lost weapons; finding alternative sources for the same systems, often through intermediary suppliers; or replacing the arms by sourcing a complete substitute from a different block of foreign arms suppliers (Kuo & Spindel, 2022). Other authors also emphasize the effect of a weak domestic acceptance of the embargo contributing to its ineffectiveness. This can be seen particularly in the cases of UN arms embargoes imposed on African countries, that have not stopped weapons reaching their targets. The effectiveness of embargoes is constrained by some states' limited capacity and resources to enforce them, and by a lack of political will in others. In Africa, UN sanctions are often perceived merely as punitive diplomatic gestures (Vines, 2007). This perception is additionally exacerbated by several factors: a disconnect between UN sanctions-monitoring committees and the governments of target states, poor coordination among national and regional law enforcement agencies, and the porous international borders (Alusala, 2016).

To conclude, the widespread use of arms embargoes as a foreign policy tool by international organizations stands in stark contrast to their soberingly limited effectiveness. Empirical evidence often indicates arms embargoes fail to achieve their intended goals. Violations by sending states, weak international enforcement

mechanisms, and target's quick adaptation to the often late arriving sanctions undermine their success. The persistence of arms flows to conflict zones and human rights violators, the economic and strategic incentives for embargo violations, and the insufficient domestic implementation of embargoes contribute to their minimal effect on changing target's behavior. While arms embargoes serve as a signal of disapproval and a tool for distancing from violent actors, their real impact on both the sender and the target regimes remains questionable. Nevertheless, the academic debate is further formed by a number of authors, who report significant negative effect of arms embargoes on the flow of arms and accentuate their potential for being a valid and effective foreign policy tool.

1.3.1.2 Effective arms embargoes

There is an influential strand in the scientific community of proponents of arms embargoes, who advocate their effectiveness. According to them, complying with arms embargoes can yield both material and non-material benefits despite the economic and strategic incentives to violate them. Adherence presents opportunities for new multilateral cooperation and enhances international reputation, legitimacy, and influence, potentially boosting military power or economic gains (Erickson, 2015; Mercer, 1996). Conversely, violations can provoke the international community, leading to naming and shaming which damages legitimacy and government reputation also among constituents (Erickson, 2015, 2020). This section introduces the empirical works presenting arms embargoes as a valid and effective tool. The most notable results and arguments contributing to embargo's effectiveness are presented.

Most notably, academic research done by J. Erickson (2013) empirically confirms, contrary to popular expectations, that arms embargoes on average restrain sending states' arms exports, despite strong economic incentives to do otherwise. Additionally, meta-regression analysis of studies examining the effectiveness of arms embargoes in stopping arms transfers to target states conducted by Klomp (2024a) suggests that there is a weak, yet statistically significant, negative impact of arms embargoes on arms transfers to target states. Brzoska (2008) finds that multilateral arms embargoes reduce a target state's arms imports by more than one third. Other findings suggest too that arms embargoes are effective in constraining arms exports (Baronchelli et al., 2022; Baronchelli & Caruso, 2023; Comola, 2012; Craft, 1999, DellaVigna & La Ferrara, 2010; Martinez-Zarzoso &

Johannsen, 2019; Pamp et al., 2021; Schulze et al., 2017). Some of the works also test for the instances of sanctions-busting and find no evidence of trade diversion through countries neighboring the embargoed state (Baronchelli et al., 2022; Baronchelli & Caruso, 2023). These findings offer optimism for adherence to international commitments. Especially major arms exporters overall seem to enforce sanctions despite significant economic incentives to disregard them and the absence of formal accountability measures. Instead, compliance may be motivated by normative pressures and accountability in international and domestic or by security concerns (Erickson, 2013).

Brzoska and Lopez (2009, p. 224) argue that although no arms embargo has been one hundred percent effective, the majority of arms embargoes induce at least some reduction in arms imports to the target. According to the authors, this fact is often overlooked in many case studies on arms embargoes, where an excessively high benchmark for success, such as the complete halt of all arms and ammunition imports, is set. Pattison (2018) further adds that arms embargoes are indeed successful when the appropriate measure of effectiveness is adopted. These may first be a reduction in the conflict intensity and battlefield deaths and, second, a decrease in the number of arms circulating within the state. Furthermore, the structural design of arms embargo has a significant influence over the effectiveness. This includes whether the embargo is multilateral and imposed by reputable international organizations such as the UN or the EU, or unilateral, which may be simpler to evade due to the accessibility of alternative suppliers. Scope of an embargo also determines its effectiveness, as voluntary embargoes often possess only symbolical value and are easily violated. Brzoska (2008) adds, that arms embargoes as a solitary tool will rarely affect target policies, but when utilized as a consistent element of larger policy packages, they evince the biggest effectiveness.

Overall, while the effectiveness of arms embargoes is often debated, there exists a significant body of research advocating their efficiency. Proponents argue that adherence to arms embargoes can bring substantial material and non-material benefits, including enhanced international cooperation and reputation. The number of empirical works demonstrating that arms embargoes do restrain arms exports to the targets and affirming them as a potentially effective tool underscores the conflicting nature of this topic and contributes to the ongoing academic debate.

1.3.1.3 Lack of consensus

Why is the ongoing academic debate on the effectiveness of arms embargoes polarized? This phenomenon mirrors the continuing larger debate about economic sanctions. Despite decades of empirical research, no consensus has yet emerged on the sign and significance of key variables theoretically determining the success of economic sanctions. Van Bergeijk et al. (2019) explore reasons for the heterogeneity of findings in the literature but conclude that their chosen key variables do not show a significant impact on success or failure of economic sanctions. Similarly, a meta-analysis by Klomp (2024a) on the effect of arms embargoes on weapon transfers reveals the absence of a consistently significant relationship between embargoes and arms flows to target states, demonstrating that the impact of embargoes is rather heterogeneous.

Klomp (2024a) also studies the potential for a publication bias, which occurs when published results disproportionately reflect significant effects due to a tendency to withhold non-significant findings. Publication bias is a consequence of selecting research findings or results that satisfy prior beliefs or theoretical expectations or selecting based on the statistical significance (Demena, 2017). However, the research suggests the absence of selection bias, as both positive and negative findings are being reported and published. The lack of consensus and the ongoing divided nature of the academic debate highlight the need for continued research and provide opportunity for further studies, such as this one.

1.3.2 Normative debate

So far, the economic, strategic and political incentives behind restraining one country's arms export have been debated. But the moral incentives to uphold an arms embargo or to restrict the flow of arms into a country with ongoing conflicts represent another significant part of the academic literature on arms trade restrictions. As noted by Schulze et al. (2017, p. 529): "the arms trade provides a perfect area for studying the trade-off between, on the one hand, normative obligations and, on the other hand, military and economic interests." In line with their ethical commitments, many Western governments have pledged to consider human rights and, to a lesser extent, democratic conditions when deciding whether to sanction their weapons exports (Perkins & Neumayer, 2010). Major

democratic arms suppliers claim that they take into account the human rights records of both existing and potential purchasing states (Johnson & Willardson, 2018). However, fulfilling these moral obligations to protect universal rights at the international level can often conflict with national interests driven by economic and security concerns. According to Schulze et al. (2017), the most effective way to identify earlier instances of shared international norms is to examine multilateral arms embargoes. They reflect a collective commitment to prevent or resolve domestic or international conflicts and to sanction countries for severe human rights violations. This section will present scientific literature concerned with the issue of normative values and arms export, analyzing the trade-off between them and focusing primarily on democratic countries.

When we look at arms exporters with democratic governments, such as EU members or the United States, they have all adopted positions on human rights designed to constrain arms sales to states with poor human rights record and to generally prevent conflicts (Johnson & Willardson, 2018; Stavrianakis, 2023a). Moreover, officials from major powers frequently emphasize that they implement strict arms trade controls to demonstrate their status as responsible members of the international community (Stinnett et al., 2011). The objectives of arms embargoes greatly overlap with the human rights protection rhetoric of democratic governments. But does this rhetoric match the records of arms sales?

Non-governmental organizations as well as academic authors have long criticized the “organized hypocrisy” of democratic nations, arguing that their arms trade policies are largely symbolic. Critics contend that these countries show reluctance to sacrifice national economic and security interests in favor of protecting human rights (Perkins & Neumayer, 2010). Scholars remain skeptical regarding the ethical principles guiding countries’ decisions to export weapons and empirical research reveals consistent trends of disregarding these ethical considerations. A number of case studies have documented the transfer of weapons from Western states to countries with dubious human rights and democratic practices (Amnesty International, 2006; Cooper, 2006; Gaskarth, 2006). Berrigan et al. (2005) report that 13 of the top 25 recipients of US arms transfers in 2003 were defined as “undemocratic” by the country’s State Department. Yanik (2006) reports that between 1999 and 2003, France, Germany, the UK, and the US exported weapons to

numerous countries labelled as “undemocratic” or “partially democratic” by the Freedom House. Dunne and Freeman (2003) note that one fifth of all arms exports from the UK in 2001 went to “highly sensitive” countries with undemocratic regimes and serious human rights abuses. Johnson and Willardson (2018) show that major democratic suppliers generally do not account for human rights violations in the importing state; and Martínez-Zarzoso and Johannsen (2019) find that the arms importer’s level of democracy is not influential in determining arms deals. Perlo-Freeman (2021) finds that conflict does not significantly restrain arms exports. Weapons deliveries are instead driven by demand factors, with all major arms exporters supplying substantial volumes of arms to various wars, regardless of their stated policies. Among major democratic arms exporters, minimal restraint regarding the exports to zones of conflict is further corroborated by Erickson (2023), Soubrier (2023) or Stavrianakis (2023b). Analyses of German arms export policies reveal that they often fail to comply with standards that prohibit exports to countries involved in military conflicts and in general do not discriminate against human rights-violating countries (Platte & Leuffen, 2016; Schulze et al., 2017). Additionally, DellaVigna and La Ferrara (2010), discover a positive relationship between high level of corruption in the country and an increase in arms sales. Klomp (2024b) finds that arms embargoes have no effect on the business performance of arms producing firms located in countries with a weak rule of law or high level of corruption.

The irresponsible arms export practices of democratic states are frequently enabled by domestic and international laws that contain significant ambiguities, allowing for extensive maneuvers. This issue is exacerbated by opaque and highly secretive decision-making processes that lack parliamentary oversight, as it is often the case with policies of arms export (Schulze et al., 2017). Stavrianakis (2023a) summarizes the criticisms of arms export and control policies of major democratic producers by highlighting several key themes in the literature. First, conflict is not a consistent restrictive factor for granting arms export licenses. Instead, licensing decisions primarily promote economic and security objectives. Additionally, there is minimal legislative and public oversight over the executive’s licensing decisions. Lastly, states tend to adhere to the letter of the law rather than its spirit, leading to weak control measures. As declared by Perlo-Freeman (2021, p. 20) these criticisms are not a call to abandon attempts at regulating arms sales. Instead, they emphasize that while getting states to agree to stricter export controls is

a significant step, ensuring their implementation in practice requires considerably more effort.

On the other hand, a certain degree of restraint of arms transfers, especially in the period after Cold War, was found by several authors. Akerman and Seim (2014) conclude that democracies are 60 percent less likely to trade with a state at the bottom of the Polity scale than at the top. Blanton (2000, 2005) finds that countries with poor human rights records are less likely to receive US arms transfers, whereas more democratic countries are more likely to qualify for such transfers. Schulze et al. (2017) confirm, despite Germany's poor record of arms exports to warring countries, that it fully complied with multilateral arms embargoes after 1990. These findings suggest that, over time, democratic nations are becoming more serious about aligning their arms export policies with their ethical and legal commitments. This provides a positive outlook on countries' normative responsibility in arms transfers.

The literature review has outlined the economic, strategic, political and normative factors behind arms exports and restrictions imposed on them, with primary focus on arms embargoes. On one hand, proponents of arms embargoes argue that they effectively restrict arms transfers, preventing the escalation of conflicts. On the other hand, critics contend that embargoes can be ineffective, easily circumvented due to minimal international oversight and that economic incentives to breach them outweigh the benefits of upholding them. The divided nature of the debate on arms embargoes as an effective tool provides space for further research. The next section builds on the discussed literature and proposes a series of hypotheses.

2. Hypotheses

The main focus of this work is on the impact of exposure to arms embargoes on the biggest arms exporters in the twenty-first century. This era is epitomized by the post-Cold War characteristics, such as the end to deadlocks in the UN Security Council, the implementation of the Maastricht Treaty defined by the increased foreign policy powers of the EU and a general desire to enforce international norms through non-military means (Erickson, 2013, p.165). The arms market has become more globalized, with increasing interdependence and cooperation (Bove et al., 2018) and with bigger role of commercial

motivation in exporters' considerations (Thurner et al., 2019). At the same time, the end of the Cold War led to new arms export laws and regimes, driven by emerging human security concerns in the international community. This paved the path for an increased use of multilateral arms embargoes, that became increasingly possible and necessary, and that sent more credible threats to the targets (Bapat & Morgan, 2009). Since the end of the Cold War, there has been a substantial rise in the total number of arms embargoes worldwide (see Figure 1).

As already outlined in the section concerned with the effectiveness of arms embargoes, many researchers anticipate and subsequently confirm a low level of compliance with arms embargoes from the senders. This is due to a number of economic, strategic and political factors. Essentially, profits from selling arms to the embargoed target can be significant and sending arms can represent a symbol of support for a specific group.

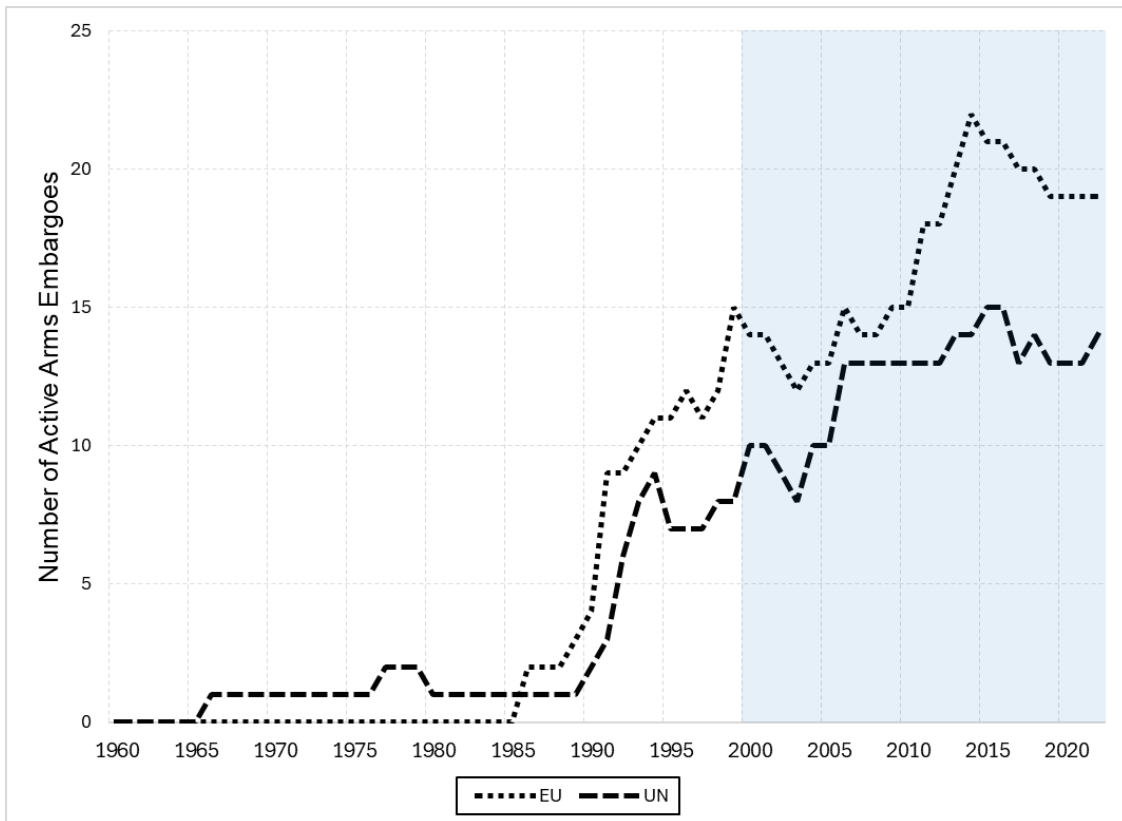


Figure 1. Number of mandatory arms embargoes, 1960–2022. The graph shows the number of mandatory arms embargoes in force authorized by international organizations. Analyzed timespan highlighted in blue. Source: SIPRI, Author's calculation.

This perspective emerges from an understanding of the challenges associated with international enforcement mechanisms and the pragmatic considerations countries face in maintaining the profitability and competitiveness of their arms industry. The view that embargoes are frequently bypassed and consequently have minimal impact on exporters (Radford, 2013) essentially forms a baseline null hypothesis, indicating that arms embargoes will have no significant effect on arms exports. At the same time, despite the economic incentives to keep exporting arms to an embargoed target, a number of empirical studies (e.g. Baronchelli & Caruso, 2023; Erickson, 2013; Klomp, 2024a) find that major exporters in fact implement the embargoes and reduce the flow of weapons. Based on this literature, the hypothesis can be formulated as:

Hypothesis 1: Arms embargoes will have negative effect on sending states' arms exports.

As can be seen from the current academic literature, arms trade dynamics and the decisions behind the export of weapons cannot be separated from domestic and international politics (Fuhrmann, 2007). The compliance with an arms embargo may stem from security concerns of the senders and/or international and domestic normative pressures. Generally, normative concerns are relatable to democratic countries, rather than non-democratic ones. For democracies, adherence to multilateral arms embargoes serves as a demonstration of their commitment to legal agreements and global norms, potentially strengthening their credibility in the international arena. Senders of multilateral arms embargoes typically involve a coalition of primarily democratic countries, which generally advocate for a functioning international order, have an interest in maintaining the operation of international organizations and in ensuring their effectiveness. Democratic countries, as opposed to non-democracies, also often face significant pressure from domestic civil society organizations, the media, and the public to act in accordance with human rights principles and therefore adhere to sanctions prohibiting the transfer of weapons to human rights violators (Efrat & Yair, 2023). As a matter of fact, democracies have historically been less likely to be targeted by an arms embargo for violations of human rights or unauthorized development of nuclear arsenal. In other words, democracies are more likely to comply with international rules and norms (Simmons, 1998, 2010). Following the research by Platte and Leuffen (2016) and based on the normative motivation for democracies to uphold arms embargoes, the second

hypothesis is formed:

Hypothesis 2: Democracies will be negatively affected by arms embargoes in terms of their arms export quantities.

Turning now to further important factors influencing arms exports, additional hypotheses are formed based on the other employed control variables. Looking at a country's military burden, defined as the share of its annual GDP allocated to military expenditures, it is expected to have a positive effect on arms exports even when the exporter is exposed to an increased amount of arms embargo. An increase in military spending may signify an enhancement in the national manufacture of arms and a potential increase in arms export (Pamp & Thurner, 2017; Smith & Tasiran, 2005, 2010). Additionally, countries with a substantial military budget wield a considerable influence over the arms market, which can be leveraged to maintain or increase arms export.

Hypothesis 3: Increased military burden will positively influence arms exports, notwithstanding the exposure to an arms embargo.

This work explores the impact of compulsory multilateral embargoes imposed by the UN and the EU. Given that the EU implements all UN arms embargoes and further imposes additional measures, the arms exporters in EU are subject to a significantly more embargoed market than non-EU based exporters (see Figure 1). Moreover, 21st century has been characterized by low military spending in Western Europe, reducing the production capabilities to a minimum and effectively weakening the arms industrial capacity (Vojenské zpravodajství, 2024). Building on recent literature that underscores the potentially harmful effects of arms embargoes on EU arms producers (Klomp, 2024b; Seyoum, 2017), the hypothesis is formulated as follows:

Hypothesis 4: EU Membership will have negative effect on arms export due to the increased exposure to arms embargoes mandated by both the UN and the EU.

Lastly, the analysis looks at the transparency of reporting arms exports by individual countries. High transparency is generally valuable for accountability in the arms trade. Nevertheless, highly transparent arms exporters are more likely to adhere to international arms embargoes in order to maintain their reputation (DellaVigna & La Ferrara, 2010).

By aligning with multilateral arms embargoes, arms exports are likely to be constrained.

Hypothesis 5: High transparency in reporting arms exports will have negative effect on exports of arms in the context of increased presence of arms embargoes.

This analysis specifically aims to discover whether arms embargoes have an impact on the volume of arms exports of major arms suppliers, or whether arms embargoes remain a popular yet vain norm enforcement tool with no real effect on the global arms trade. It should be addressed that assessing the *effectiveness* of arms embargoes is beyond the scope of this work, as this introduces the problem of multiple measures evaluating their effectiveness, ranging from reducing or stopping the flow of weapons to changing the target's behavior. Nevertheless, reflecting the academic debate focusing on the intermediate factors of arms embargoes (Klomp, 2024a), in particular to what extent is the volume of exported arms limited by the presence of an embargo, the results of this analysis may indicate the true impact of arms embargoes on arms exporters.

3. Methodology

This chapter first describes the variables and respective data sources used in the analysis. It will outline the dependent and independent variables and the covariates. Second, it will introduce the employed research design, specifying the model and explaining the use of fixed effects to test the hypotheses. It also presents the tests conducted to examine the nature of the collected panel data.

3.1 Key variables and data sources

This analysis examines the relationship between arms exports and arms embargoes. The dataset incorporates a novel approach to measuring arms embargoes (similar to Klomp, 2024b) and tracks arms exports by the 25 largest suppliers (similar to Erickson, 2013). The largest twenty-five arms exporters are chosen based on the data from SIPRI's arms transfers database¹. Given the research question, that is, whether states' arms exports are curtailed by the exposure to arms embargoes, the focus is on the national states as a main

¹ These are the selected countries, arranged in order according to their ranking on the chart of the world's largest arms suppliers, starting from the biggest: the United States, Russia, France, Germany, China, the United Kingdom, Italy, Israel, Spain, the Netherlands, Ukraine, Sweden, South Korea, Switzerland, Canada, Türkiye, Belarus, South Africa, Norway, Australia, Poland, Belgium, Czechia, the United Arab Emirates, Brazil.

unit of analysis. This study is novel due to its extensive timeframe, covering the period from 2000 to 2022, whereas previous research has focused primarily on earlier periods. Also, it stands out in its scope by considering arms embargoes imposed by both the UN and the EU, while various other authors choose to include only arms embargoes mandated by the UN (Fruchart et al., 2007; Moore, 2010). This section will introduce the examined dependent and independent variables and controls.

The *dependent variable* of the analysis captures a country's arms export as defined by the SIPRI, from whose database the data is drawn. Therefore, it focuses on the supply of military weapons through sales, aid, gifts, and production under manufacturing licenses. SIPRI uses standardized trend-indicator values (TIVs) expressed in million constant (1990) US\$, in order to facilitate cross-national comparisons over time and accommodate the variety of modes of gift and payment (SIPRI, 2024b). TIV measures the weapon's core price and value as military resources, instead of actual paid price. The benefit of using TIVs rather than financial values lies in their immunity to the various economic and political factors and technological changes that generally impact weapon systems prices. As a result, TIVs are easily comparable across different countries and time periods. Sanjian (1998) notes that SIPRI data accurately reflect the yearly intensity of states' arms transfer activities.

Kinsella (2011, p. 224) labels SIPRI as “the most authoritative source of both quantitative and qualitative information on the arms trade”. Vast majority of scholars concerned with the study of arms trade relies on this data source and employs it in their analyses. Accordingly, a number of variables employed in this analysis are sourced from SIPRI. An important alternative source is the World Military Expenditures and Arms Transfers (WMEAT) dataset produced by the Bureau of Verification and Compliance of the U.S. Department of State. It is less extensively utilized, since it suffers from several shortcomings – the country coverage is smaller than SIPRI (Brender, 2016) and since 2021, new data ceased to be published (WMEAT, 2021). Applied combination of both databases in research is explored by Smith and Tasiran (2005, 2010). In principle, SIPRI measures the volume of transfers of major weapons systems while WMEAT measures the value. Given the nature of this study, data on the volume of transferred military resources is required rather than the financial value or contracted prices, therefore the

data from SIPRI is preferred. As noted by Moore (2010, p. 599), data from SIPRI represent open-source information on official arms transfers from state to state. Inferences can therefore be made only on the official records, which makes this an analysis of public transfers rather than covert state activities. Accordingly, the data availability from less transparent arms exporters is limited. Nevertheless, coverage of the majority of analyzed countries remains significant, lending credibility to SIPRI as a reliable data source.

The main focus is on the export of major conventional weapons such as aircrafts, armored vehicles, missiles or air defense systems, which are covered in TIVs. Accordingly, these figures neither include illegal transfers of MCW nor the trade of small arms and light weapons (SALW) such as machine guns and rifles. The restricted scope of this work on MCW as opposed to SALW is for several reasons, mainly because small arms are more problematic to track. National states are also significantly more invested in the transfer of major weapons systems (Johnson & Willardson, 2018). Additionally, the evaluation of SALW market is constrained by the influence of transfers occurring on the illegal market. In contrast, the illicit market of MCW is significantly smaller, because such transfers are more difficult to mask.

The main *independent variable* of interest are mandatory multilateral arms embargoes imposed by the UN and the EU. Brzoska and Lopez (2009, p. 225) confirm that multilateralization of an embargo increases the chances of significant changes in the target's arms import patterns and raises hopes for a change in policy. Greater participation enhances embargo effectiveness, reducing arms transfers and strengthening the signal of dissociation (Brzoska, 2008). Moreover, disparities in effectiveness between mandatory and voluntary embargoes were observed (Brzoska & Lopez, 2009). Voluntary embargoes are often argued to hold merely symbolic value and usually precede the implementation of a mandatory embargo (Klomp, 2024a) and are therefore expected to have generally low effectiveness and undermine overall effect of embargoes on arms exports. Therefore, the focus here is only on mandatory multilateral arms embargoes imposed by reputable international organizations, in this case the UN and the EU.

The data on arms embargoes are sourced from SIPRI's arms embargoes archive (SIPRI, 2022). The analysis specifically focuses on national states under embargo, excluding non-

state actors such as Al Qaeda or ISIL. Since arms transfer data are recorded annually, embargoes are coded only from the first full year and ending in the last full year a state is embargoed. This is because partial years allow for some legal exports to occur, which annual data cannot distinguish from exports violating the embargo (Erickson, 2013). The independent variable is quantified by calculating the proportion of the GDP of countries subject to arms embargoes to the total world GDP for a given year (similarly Klomp, 2024b). This ratio represents the exposure of a sender to a legally inaccessible part of the market. For this calculation we use GDP in constant 2015 US\$ provided by World Bank, that represent a reliable measure of economic performance by removing the distorting effects of inflation. For the purposes of this analysis, the ratio is log-transformed. This approach provides a comprehensive and novel representation of the arms market, convenient for a standardized and comparable analysis across different countries. This variable will be crucial for testing all formulated hypotheses.

Turning to the *control variables*, both political and economic factors are included, as they play a significant role in explaining arms trade (Klomp, 2022). Importantly, only controls with potentially confounding effects on both the export of weapons and compliance with arms embargoes are selected (Erickson, 2013). The controls include polity score, GDP per capita, military burden, membership in the EU and the transparency of arms exports.

First, the variable measuring the polity score of a sender is included. As noted by Simmons (1998), democratic states are more inclined to adhere to international regulations and norms. Additionally, democracy can have a positive effect on arms transfers (Blanton, 2005). The polity2 indicator from the Polity5 Project (Marshall & Gurr, 2020) hosted by the Center of Systemic Peace is applied for this analysis. This indicator captures the regime characteristics on a scale ranging from +10 (strongly democratic) to -10 (strongly autocratic). Due to the absence of data for the most recent years in the Polity5 dataset, an additional key indicator of democracy is incorporated to supplement it – the v2x polyarchy index hosted by V-Dem Institute (Coppedge et al., 2024). It measures the electoral democracy index and is included due to its improved temporal coverage of the analyzed countries. These measures are used to test the Hypothesis 2 and the impact of democratic regime on arms export in the context of increasing exposure to arms embargoes.

Real GDP per capita is included as an approximate measure of wealth, as wealthier states are better positioned to mitigate the lost profit resulting from arms embargoes. This variable is closely related to both the economic and institutional capacity of the state (Brender, 2016) and labelled as having “the largest consensus on its robustness among scholars” (Klomp, 2022, p. 664). It is incorporated as a standard control variable, given its consistent impact in various studies. Data is sourced from the World Development Indicators of the World Bank and is reported in constant 2015 US\$.

Next, the military burden represents country’s annual military spending as a share of its GDP. It is included as an increased share of national military spending may signify an enhancement in the national manufacture of arms and a potential increase in arms export (Pamp & Thurner, 2017; Smith & Tasiran, 2005, 2010). This type of data is acquired from the SIPRI Military Expenditure Database (SIPRI, 2024a) This variable serves to test Hypothesis 3 and the impact of military spending on arms exports.

Furthermore, membership in the European Union is an important indicator of compliance with the arms embargoes imposed by this institution. In theory, embargoes by a homogeneous group of countries, like the EU, can be more effective than those by a diverse group, such as the UN. This is because smaller, homogeneous groups can reach agreements more easily and implement measures more effectively (Mueller, 2003). Thus, the EU can be viewed more credible in its trade policies. Empirically, this is not confirmed as some studies report a larger decrease in arms exports under EU arms embargoes compared to the UN ones (Baronchelli et al., 2022), while others argue that UN embargoes are the most effective (Brzoska, 2008; Kuo & Spindel, 2022). The answer to the Hypothesis 4 will possibly answer the question, whether EU arms exporters are more negatively affected by arms embargoes. This variable is coded as a dummy according to the country’s membership in EU in the given year.

Finally, the Small Arms Trade Transparency Barometer produced by the Small Arms Survey (SAS) is employed. This index measures a country’s transparency in reporting the exports of small arms, drawing on export reports by individual countries as well as international customs data. The index ranges from 0 to 25 representing the lowest to highest transparency. It evaluates the timeliness, access, clarity, and comprehensiveness of the information provided by countries on their exports of small arms. Additionally, it

verifies the data on granted and denied licenses, as well as actual deliveries (Small Arms Survey [SAS], 2023). Although this analysis focuses on MCW rather than small arms, the transparency scores provide insight into the overall transparency of individual states and their governments. Employing this variable is novel (see DellaVigna & La Ferrara, 2010), but it can yield interesting insights into the interplay among arms exports, arms embargoes and a country's transparency. This measure serves to test the Hypothesis 5.

3.2 Model specification

The compiled panel data provides multiple observations over the years 2000–2022 (T=23) for this period's 25 largest arms exporting countries (N=25). To test the hypotheses, which seek to analyze the impact of arms embargoes on arms exports over time, a panel linear model with fixed effects for countries and years is employed. In this context, when the units of analysis are countries, the fixed effects approach appears to be the most appropriate (Verbeek, 2000). The country fixed effects control for unobserved, time-invariant unit-specific influences, such as the size of the arms trade industry and the available technology. Meanwhile, year fixed effects capture the unobservable time-varying characteristics and address concerns that arms exports may be driven by common trends affecting all actors in the system, such as a general market growth or an outbreak of a war. The decision to include both country and year fixed effects is based on the significant result of the Breusch-Pagan Lagrange multiplier test to determine the significance of time effects (see Appendix), as well as on the literature concerned with the same topic (Bove & Böhmelt, 2021; Erickson, 2011). This framework allows to control for endogeneity issues arising from the potential omitted variable bias and also minimizes the risk of sample selection bias (Smith & Tasiran, 2010). Therefore, the fixed effects model is likely to enhance the robustness of the analysis.

In order to rule out different estimation methods, several tests were conducted and the results are presented here. First, the very low p-value ($< 2.2e-16$) of F test for individual effects indicates fixed effects model is a better choice than simple OLS (for details see Appendix). Additionally, a random effects model is also used for handling unobserved heterogeneity and making more precise inferences in panel data analysis. The choice between fixed and random effects models involves the Hausman test, which tests whether the unique errors (random effects) are correlated with independent variables. Based on

the low p-value (0.0423) of Hausman test, we can reject the null hypothesis and opt for a fixed effects model (see Appendix). This is also supported by the nature of the data. The differences between countries are constant, with each country having its own unique, unobservable characteristics that do not vary randomly over time. The preference for fixed effects over random effects also aligns with the literature (see review by Klomp, 2024a).

To evaluate the reliability of the panel data, several robustness tests were conducted. First, the Breusch-Godfrey/Wooldridge test for serial correlation in panel models resulted in a low p-value (see Appendix), suggesting the presence of serial correlation in the data. This violates the assumption of independence of errors, potentially leading to biased results. Second, heteroskedasticity was examined using the studentized Breusch-Pagan test. The resulting low p-value (see Appendix) indicates that heteroskedasticity cannot be dismissed, as errors are not constant across observations. To address these issues, robust standard errors are incorporated into the results of the models. Specifically, the method proposed by Arellano (1987), implemented using the `vcovHC.plm` function in R by Croissant & Millo (2008), is chosen to estimate clustered robust standard errors for the fixed effects panel models. The Arellano method for robust covariance matrix estimation is generally considered suitable for fixed effects models, correcting for heteroskedasticity as well as serial and cross-sectional correlation. Alternatively, two different formulas for calculating robust standard errors are considered: Beck & Katz (1995) and Driscoll & Kraay (1998). Method by Beck & Katz (1995) for estimating Panel Corrected Standard Errors (PCSE) is a popular choice that assumes either a large number of cross-sectional units or time periods, which does not fully align with the moderate sample size present in this analysis. The method by Driscoll & Kraay (1998) also accounts for serial and cross-sectional correlation but is preferred in settings with a large number of time periods. The results of models using these different estimators are reported in the Appendix. In the end, clustered standard errors using the Arellano estimating method is chosen as the main approach. This method offers a conservative approach that performs well even with shorter panel datasets, effectively addressing heteroskedasticity and serial correlation.

This methodological approach provides the foundation for empirically analyzing how the exposure of major arms senders to arms embargoes impacts their arms exports. We

consider various political and economic factors potentially influencing both the export of weapons and compliance with arms embargoes. After outlining the variables, data sources and the analytical approach using the panel linear model with fixed effects, we now move to the empirical results of this study.

4. Empirical results

This section starts off with a comprehensive overview of the dataset, presenting descriptive statistics to outline key characteristics of the variables. Next, the results of the fixed effects models will be presented. All calculations and visualizations are computed using the RStudio, employing mainly the `plm` package (Croissant & Millo, 2008), `stargazer` (Hlaváč, 2022) for the presentation of results and `ggplot2` (Wickham, 2016) for graphical displays.

4.1 Descriptive statistics

This section provides descriptive statistics of the compiled dataset. Table 1 shows the summary statistics of all variables. Arms exports, the dependent variable, is expressed in trend-indicator values in million US dollars. A few values are missing since SIPRI has identified no deliveries that year. Figure 2 illustrates the dominance of six major players in the 21st-century arms export market: the United States, Russia, France, Germany, China, and the United Kingdom, collectively accounting for over 80 % of the overall trade during the analyzed period. The top 25 exporters represent nearly 98 % of global arms exports in the 21st century (SIPRI, 2024b). Figure 3 shows the arms exports of each analyzed country over the time period of interest. In major exporting countries like the United States, Germany, France or the UK, exports remain relatively stable or exhibit a slight increase over the years. In contrast, smaller emerging exporters such as South Korea and Türkiye show a rising trend. Notably, in the most recent period, Russian arms exports have considerably decreased, while France's exports have increased by almost 50 %, potentially positioning France as the second-largest exporter of MCW in the future.

Regarding the main independent variable, Figure 4 depicts the exposure of exporters to arms embargoes, expressed as the share of the market that is inaccessible to each country. EU members, as shown, face a significantly higher number of embargoes. During recent years, nearly 20 % of the total world market was legally inaccessible for arms exports

Table 1. Summary statistics

Variable	N	Mean	St. Dev.	Min	Max	Units
Arms exports	565	1,011.4	2,037.8	0	15,592	TIV (million US\$)
Embargoed market	575	0.1	0.1	0.001	0.2	0 to 1
v2x_polyarchy	575	0.7	0.3	0.02	0.9	0 to 1
Polity2	477	6.9	5.6	-8	10	-10 to 10
GDP per capita	575	31,854.2	21,767.0	1,420.1	90,057.0	US\$
SAS transparency barometer	456	12.3	5.0	0.0	22.0	0 to 25
EU membership	575	0.4	0.5	0	1	Dummy
Military burden	567	0.02	0.02	0.01	0.3	0 to 1

originating in the EU. This is primarily due to EU-imposed arms embargoes on China in 1989 and Russia in 2014, both significant world economies. Based on this data, EU arms exporters are expected to be more impacted by arms embargoes compared to those only subject to UN embargoes, supporting Hypothesis 4.

Next, Figure 5 shows the distribution of polity2 scores throughout the sample. Notably, several observations for the most recent years are missing. This deficiency is supplemented by the v-dem polyarchy index with more extensive temporal coverage, measuring electoral democracy (Figure 6). It can be seen that the majority of the sample consists of democratic countries. Only Belarus, China, and the United Arab Emirates fall into the category of “Autocracies” with a polity score of -6 and lower, as specified by the Polity project. A comparatively similar distribution is observed in the index of electoral democracy. Additionally, it is important to note that while the data is not normally distributed across the entire sample, it remains stable within individual states. This stability within states warrants that the analysis can still produce meaningful results.

Figure 7 presents the distribution of states’ transparency in arms exports using the Small Arms Trade Transparency Barometer produced by SAS. The index theoretically ranges from 0 to 25 representing the lowest to highest transparency, with the score 22 being the highest documented in this dataset. In the collected sample, most observations fall

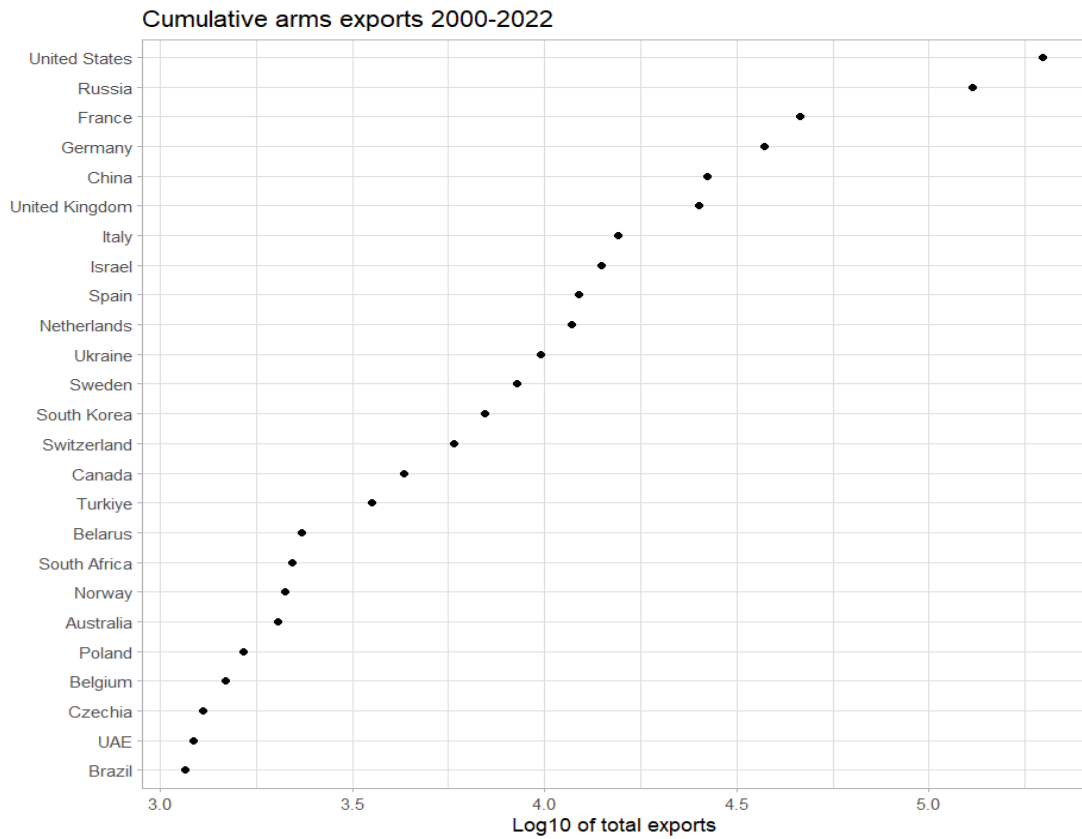


Figure 2. Cumulative arms exports per country for years 2000–2022, log10 transformed. *Source:* SIPRI, author’s calculation.

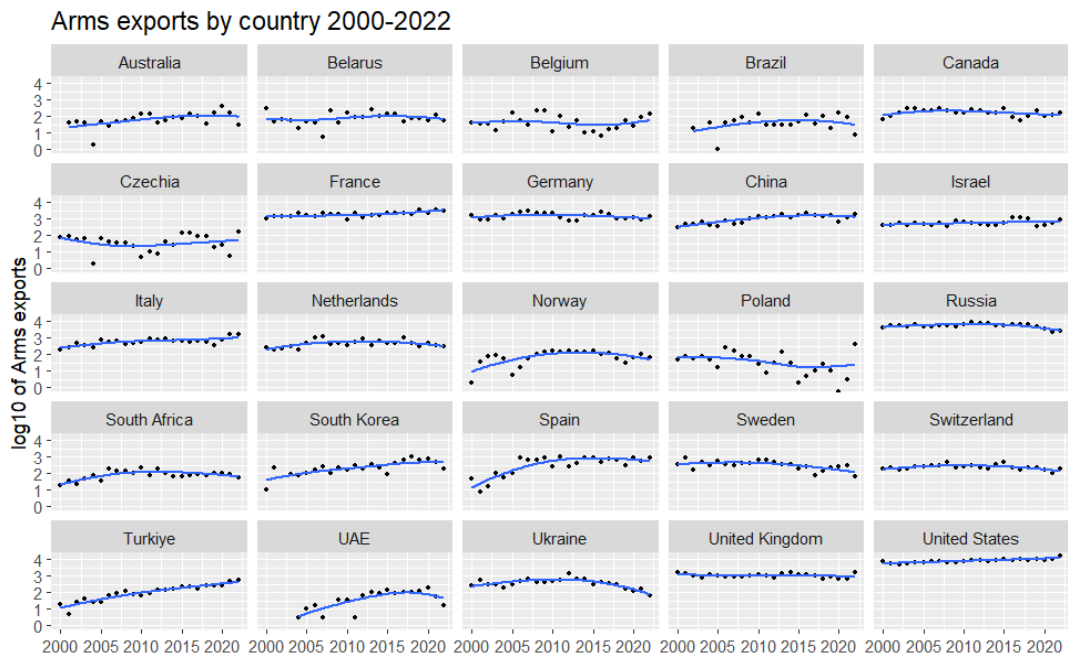


Figure 3. Arms exports per country for years 2000–2022, log10 transformed. *Source:* SIPRI, author’s calculation.

between scores 10 and 15, indicating moderate transparency in reporting arms exports, with some room for improvement. Notably, several states (Israel, South Africa, Ukraine and UAE) obtained repeatedly very low scores between 0 and 2. This signals that some countries classified as democracies still show zero transparency in the reports of their arms exports. This might signify that the level of democracy might not be sufficient in explaining the relationship between arms exports and exposure to arms embargoes. Additionally, values of this variable are missing for the most recent years and for Belarus.

Next, Figure 8 compares the distribution of arms exports between EU and non-EU exporters. Both distributions are similar, facilitating a feasible comparison of effect of arms embargoes on both groups. Notable outliers at the top of the Non-EU Members violin plot are the export values of United States and Russia, accounting together for nearly a half of the share of the arms exports market.

Figure 9 shows the military burden of the analyzed countries. The trend line indicates a slight decrease in military spending over the 21st century. Military expenditures range from around 1–2 % of GDP among states in Europe but also in Australia, Brazil, Canada or China; 3–5 % for the U.S. or Russia, up to around 6 % for Israel or UAE. Notably, several NATO members states have not fulfilled their commitment to dedicate at least 2 % of annual GDP to defense spending. This aligns with the 21st century trend of low military spending in Europe (Vojenské zpravodajství, 2024), which is likely to be reversed by the military conflict in Ukraine, but not yet reflected in this data. In fact, the year 2023 recorded the highest level of global military spending since SIPRI began tracking this data in 1949.

In summary, the descriptive statistics reveal several key insights. The arms export market is dominated by several major players, with the U.S. and Russia accounting for a significant share of it. EU exporters face greater exposure to arms embargoes compared to the non-EU members. Most countries in our sample are democracies, yet transparency in arms exports varies widely, with some democratic states exhibiting minimal transparency. The military burden of observed countries ranges between 1 % and 6 % of GDP, slightly decreasing over the analyzed timeframe. The analysis will now proceed to the results of fixed effects models to examine the impact of arms embargoes on arms exports and determine the validity of individual hypotheses.

Share of embargoed market 2000-2022

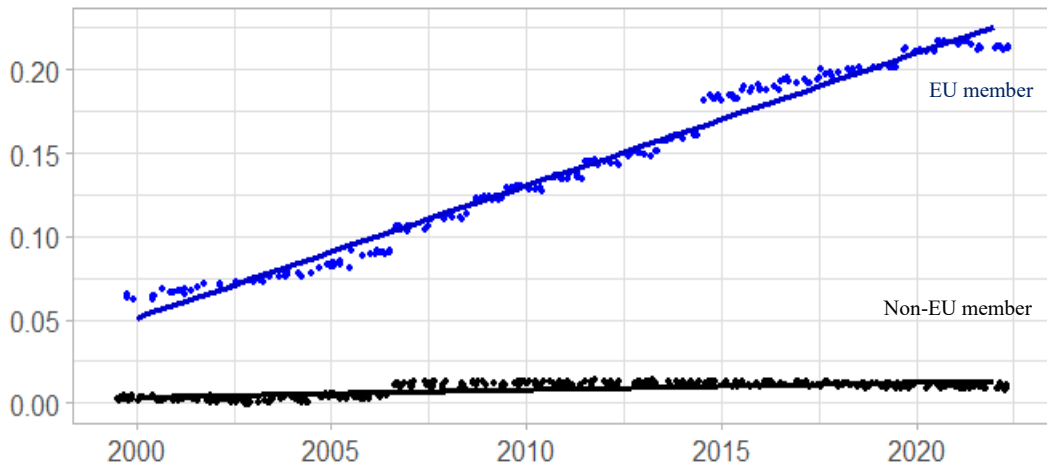


Figure 4. Graph illustrating the development of the share of the embargoed market for EU and non-EU member states. Plotted lines fit a linear model for each displayed group. Source: SIPRI, World Bank, author’s calculation.

Polity Score Distribution

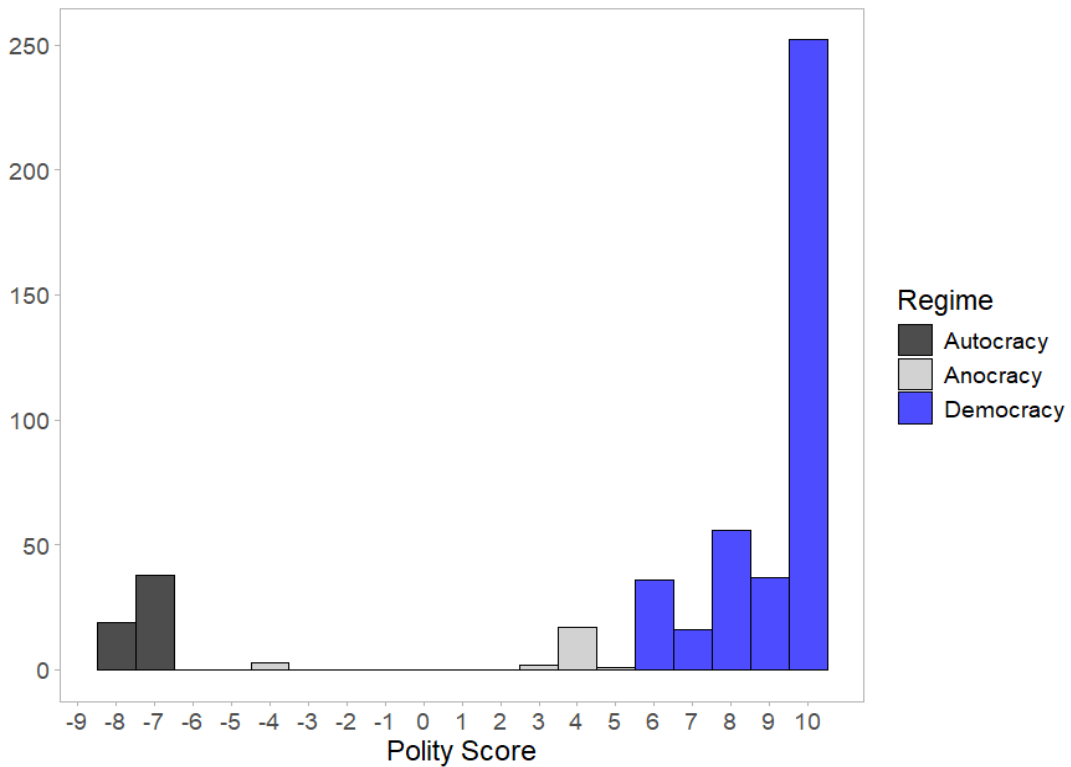


Figure 5. Histogram showing the distribution of Polity2 score in the sample, graphically distinguishing between regime types. Source: Polity 5 Project, Author’s calculation.

Electoral Democracy Distribution

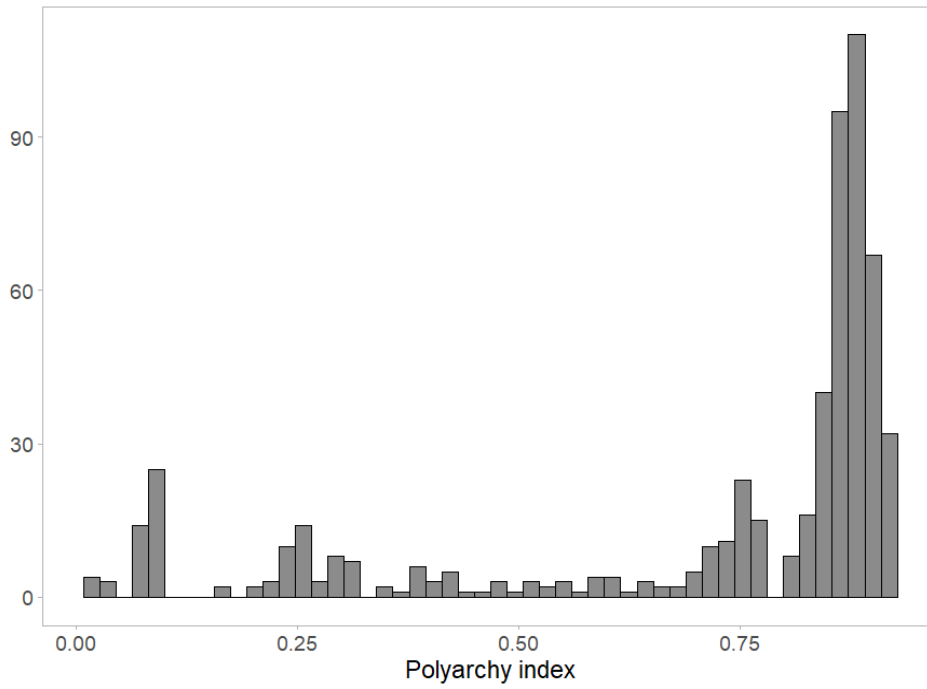


Figure 6. Histogram showing the distribution of Polyarchy index in the sample. Source: V-Dem, author's calculation.

Distribution: Transparency of Arms Exports

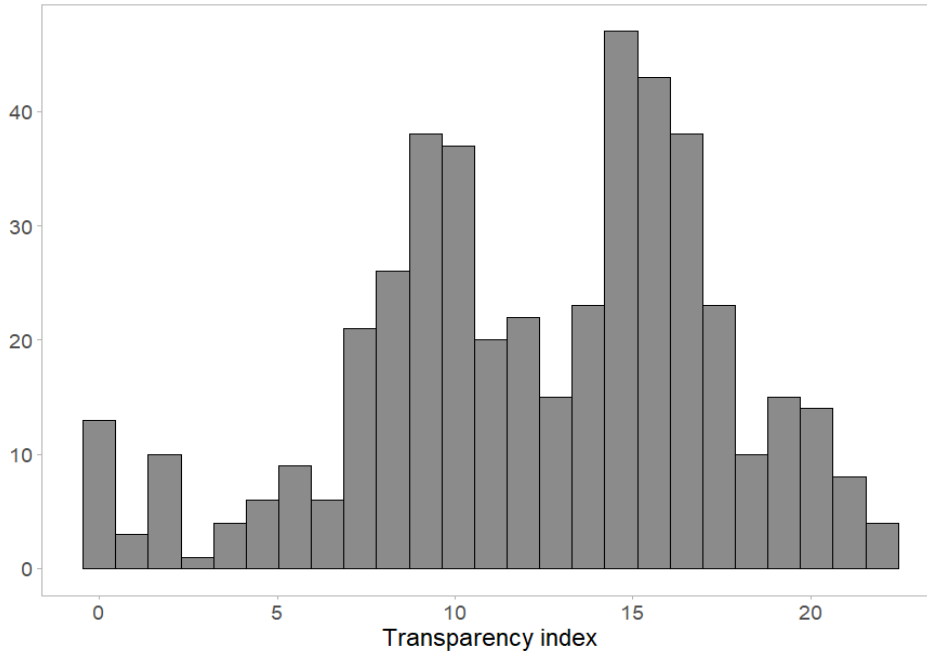


Figure 7. Histogram showing the distribution of arms exports transparency index as specified by SAS Transparency Barometer. Source: SAS, author's calculation.

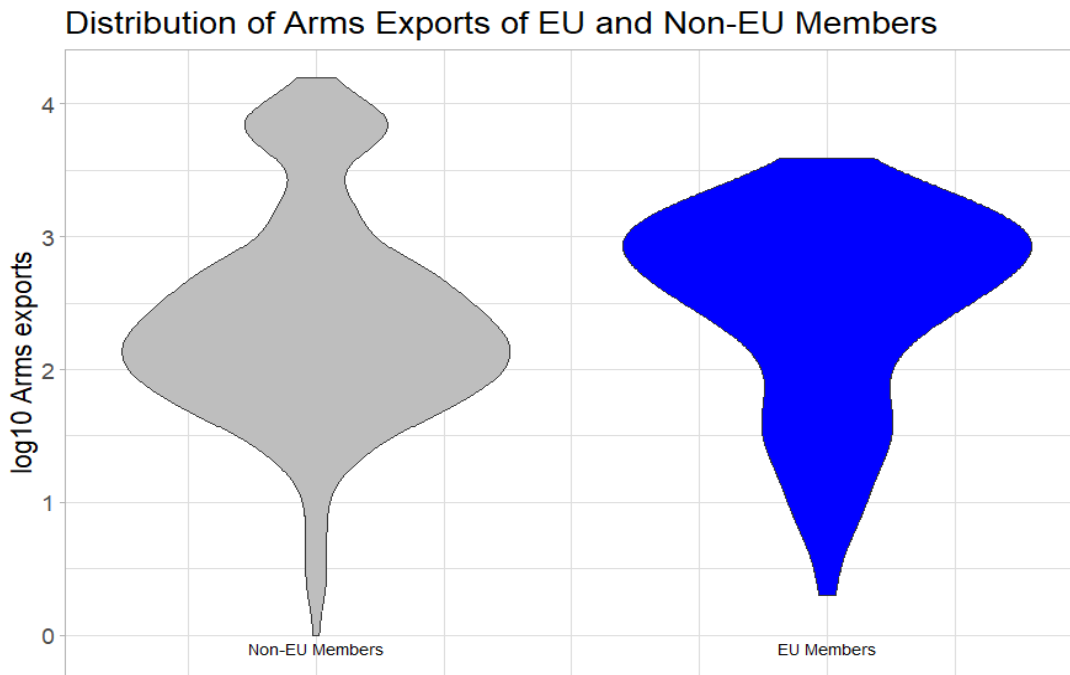


Figure 8. Violin plots showing the distributions of arms exports in the sample distinguishing between non-EU and EU members. Arms exports log10-transformed. Source: SIPRI, author's calculation.

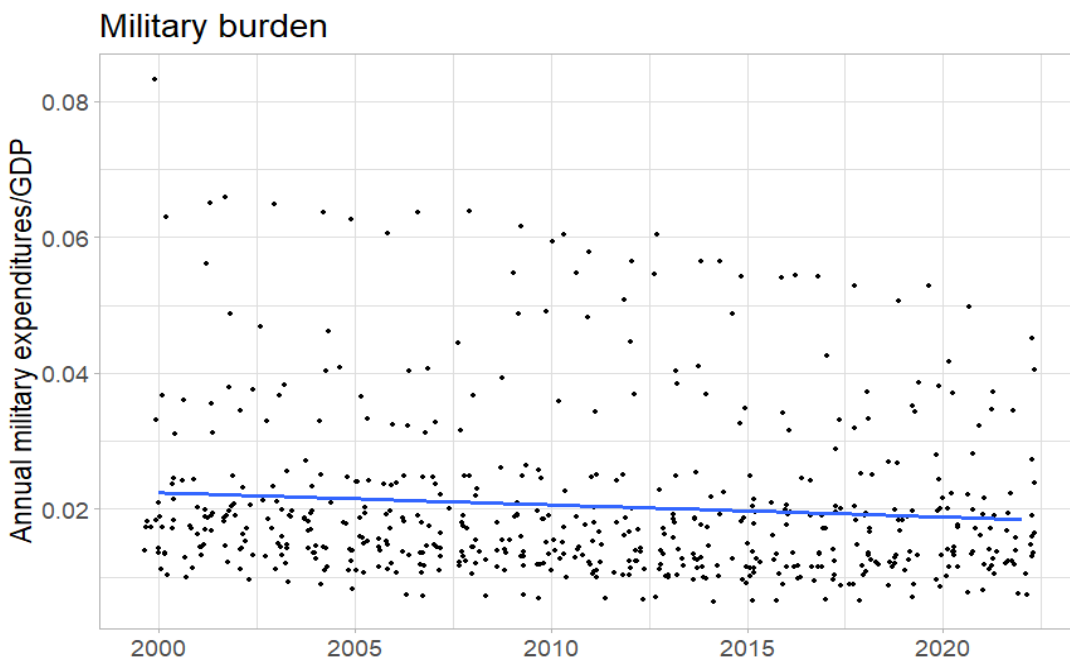


Figure 9. Scatterplot graph illustrating the development of annual military burden in the sample. Plotted line fits a linear model. Source: SIPRI, author's calculation².

² For the purpose of clarity, one observation was removed from the plot – the military burden of Ukraine in year 2022 equaling to 0.335 that significantly influenced the final form of the graph.

4.2 Results of models

The aim of this thesis was to analyze the effect of multilateral arms embargoes on the world's largest arms exporters. The results may indicate to what extent is the exported volume of arms curbed in the presence of an embargo. According to Klomp (2024a), focusing on such intermediate factors might reveal how effective an arms embargo is. To examine the relationship between arms exports, exposure of an exporter to arms embargoes and variables potentially confounding this relationship, a number of fixed effects models was employed. The subsequent part will introduce the outcomes of the models, robustness tests of the results, followed by a discussion and interpretation.

Table 2 provides the results of a simple model with country and year fixed effects, examining the relationship between arms exports, share of embargoed market and a set of the specified control variables. The fixed effects control for unobserved heterogeneity, safeguarding that the observed relationships are not confounded by these unmeasured variables. To address potential issues of heteroskedasticity and autocorrelation, all models employ clustered standard errors proposed by Arellano (1987), as described in the Methodology section. Column (1) gives an initial test of the impact of an exposure of a country to arms embargo on the volume of its arms exports. The estimated coefficient for the effect of arms embargoes is positive and significantly discernible from zero at the 1 % level. Columns (2) to (7) gradually introduce the specified controls in the model. The main coefficient of interest, the share of embargoed market, remains positive and its statistical significance ranges between the 1% and 10 % level, with the exception of model in column (5). The high and significant F-statistic value in all models indicates evidence against the null hypothesis, suggesting that the explanatory variables explain a significant portion of the variance in the dependent variable. It can be seen in all models that a raising share of embargoed market seems to increase the volume of arms exports.

First, the level of democracy in the exporting state does not seem to have any significantly discernible effect on arms exports. This is the case for both polity2 index as well as the v2x polyarchy index. Only the polity2 index is used in the later models due to its collinearity with the v2x polyarchy and since it was associated with a smaller error term. Next, in model (4) the membership in the EU is associated with a negative effect on arms exports, however, the coefficient is only significant at the 10 % level.

Table 2. Fixed effects models of arms exports and single combinations of covariates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Embargoed Market (ln)	150.554*** (35.238)	145.774* (74.205)	151.025*** (36.028)	244.979** (114.798)	74.662 (51.219)	149.443* (82.052)	174.622* (105.358)
Polity2		-71.544 (70.380)					
v2x_Polyarchy			37.233 (580.342)				
EU member				-885.640* (453.820)			
GDP p.c.					0.038 (0.033)		
Military Burden						-2,282.059*** (878.794)	
Exports Transparency							-9.878 (15.409)
Observations	565	467	565	565	565	557	449
R ²	0.033	0.081	0.033	0.052	0.060	0.035	0.056
Adjusted R ²	-0.012	0.027	-0.014	0.007	0.014	-0.012	0.001
F Statistic	18.254*** (df = 1; 539)	19.500*** (df = 2; 440)	9.112*** (df = 2; 538)	14.875*** (df = 2; 538)	17.099*** (df = 2; 538)	9.607*** (df = 2; 530)	12.628*** (df = 2; 423)

Note: Clustered robust standard errors in parentheses, ln = natural logarithm.

*p<0.1; **p<0.05; ***p<0.01

In model (5) real GDP per capita does not have any discernible effect on arms exports and simultaneously the inclusion of this covariate diminished the significance of arms embargoes variable. This finding is unexpected, as GDP per capita is generally a robust measure, reflecting the economic capacity for arms production and trade. Model (6) reveals a negative effect of military burden significant at the 1 % level. This indicates that higher military expenditure relative to GDP is associated with lower arms exports, suggesting that countries with greater internal military spending may have less capacity or need to export arms. Finally, in model (7), the coefficient for the share of the embargoed market remains positive and significant at the 10% level, while the transparency of a subject's arms exports indicates negative, yet insignificant effect. These

results provide preliminary evidence for supporting or disproving the stated hypotheses. However, further testing is required. The subsequent part will explore models with combinations of control variables to enhance robustness and the explanatory power.

Table 3 presents the results of six fixed effects models including different combinations of covariates. They show the estimates of regression of the arms exports of 25 largest exporters on a set of variables over the period 2000–2022. Similarly to the previous models, the high and significant F-statistic suggest the explanatory variables clarify a significant portion of the variance. This indicates that the models are robust and that the included predictors are meaningful in explaining the dependent variable. The relatively small values of adjusted R-squared signify that while the models explain some variation in arms exports, there are likely other factors not captured by this set of variables. Nevertheless, this does not necessarily undermine the significance of the modelled predictors. Additionally, the models give out a small Variance Inflation Factor (VIF), indicating that multicollinearity is not a significant issue in the models.

The results of all six models report a positive effect of the share of embargoed market on arms exports, significant at the 1 % level in four models and at 5 % level in two models. These coefficients allow us to reject the null hypothesis, that the observed relationship occurs by random. In fact, it can be concluded that arms embargoes do indeed have a significant effect on arms exports. At the same time, the models give support against the Hypothesis 1, stating that arms embargoes will have a negative effect on arms export. As a matter of fact, we observe a positive effect of the arms embargoes factor, meaning that exposure of an actor to an increasingly embargoed market results in increased number of exported arms by the same actor. Given the log-linearity of the model, where the share of the embargoed market is log-transformed, the interpretation of the coefficient is that we observe a proportional change in arms exports in response to a unit change in the logarithm of the share of the embargoed market. This arguably counterintuitive finding will be further elaborated in the Discussion. It implies that when countries face restrictions in certain markets due to arms embargoes, they potentially increase their arms exports to other markets to compensate for the potential loss.

All displayed models incorporate three covariates – polity2 index measuring the level of democracy/autocracy, GDP per capita and a dummy variable indicating the membership

of the exporter in the EU. According to the results, arms exports seem not to be significantly associated either with the real GDP per capita nor the level of democracy in the exporting country. The level of democracy is consistently an insignificant coefficient, leading to a possible rejection of the Hypothesis 2. It states that democracies will be negatively affected by the arms embargoes, in terms of their arms export quantities, but we observe no significant relationship between the variables.

At the same time, membership in the EU constantly holds as a negative predictor of arms exports in cases of increased exposure to arms embargoes across all models. The coefficient remains significant at the 1 % level (except model 5, where it is significant at the 5 % level). This gives support to the Hypothesis 4, stating that membership in the EU will have negative effect on export of arms. This finding is relatively expected, as the exposure of EU arms exporting countries to the embargoed market is significantly higher compared to exporters subject only to UN-mandated arms embargoes.

Models in columns (2), (3), (5) and (6) additionally incorporate the military burden variable, respectively its 1-year lagged form. The lagged form possibly corresponds to the production cycle, where higher military expenditure in one year may translate into increased production of defense companies in following years. First, a change in the direction of the coefficient can be observed as opposed to the model in Table 2. Second, inclusion of the variable in the models resulted in its loss of significance. Notably, the lagged version of the variable exhibited a significant effect, but this significance was mitigated when clustered standard errors were applied. Regarding the Hypothesis 3, stating that an increase in military burden will positively influence arms exports, notwithstanding the exposure to an arms embargo, we see a positive coefficient associated with military burden. However, the diminished significance does not let us accept the third Hypothesis.

Lastly, columns (4), (5) and (6) show the models including the transparency variable. It measures states' transparency in reporting the exports of arms based on export reports and international customs data and evaluates the access, clarity and comprehensiveness of provided information. Looking at the coefficient, higher transparency seems to be associated with reduced arms exports in situations of increased exposure to arms embargoes. Nevertheless, the high error term decreases significance of the coefficient.

Table 3. Fixed effects models of arms exports, embargoed market and covariates.

	(1)	(2)	(3)	(4)	(5)	(6)
Embargoed Market (ln)	190.022*** (67.479)	187.772*** (64.382)	188.157*** (67.244)	232.575** (97.804)	230.924** (94.813)	237.337*** (91.141)
Polity2	-54.667 (59.689)	-54.638 (59.560)	-58.900 (61.511)	-43.218 (49.407)	-43.107 (49.418)	-49.217 (51.929)
GDP p.c.	0.023 (0.020)	0.027 (0.022)	0.031 (0.026)	0.028 (0.024)	0.032 (0.028)	0.035 (0.029)
EU member	-892.266*** (327.488)	-878.223*** (309.986)	-890.671*** (325.854)	-1,015.790** (414.739)	-1,001.964** (396.102)	-1,013.020*** (379.090)
Military Burden		5,764.743 (8,511.478)			4,464.472 (8,874.476)	
Lag. Military Burden			17,207.400 (13,591.460)			18,004.850 (13,540.910)
Exports Transparency				-25.646 (24.398)	-27.325 (25.586)	-26.275 (24.119)
Observations	467	463	442	426	422	423
R ²	0.129	0.131	0.133	0.130	0.131	0.142
Adjusted R ²	0.074	0.072	0.072	0.069	0.067	0.078
F Statistic	16.281*** (df = 4; 438)	13.001*** (df = 5; 433)	12.633*** (df = 5; 412)	11.857*** (df = 5; 397)	9.873*** (df = 6; 392)	10.800*** (df = 6; 393)

Note: Clustered robust standard errors in parentheses, ln = natural logarithm.

*p<0.1; **p<0.05; ***p<0.01

This ultimately leads to a rejection of Hypothesis 5 stating that high transparency in reporting weapons transfers will have negative effect on exports of arms in the context of increased presence of arms embargoes.

In general, the fixed effects models provide interesting insights into the dynamics of arms exports in relation to exposure to embargoed markets. Specifically, the analysis reveals a significant positive effect of the exposure to the embargoed market on arms exports, leading to the rejection of the null hypothesis. At the same time, it counters the Hypothesis 1, which anticipated a negative effect on arms exports. This finding therefore does not let us accept Hypothesis 1. Additionally, the models show that level of democracy does not

significantly influence arms exports, which challenges Hypothesis 2. Similarly, the analysis shows that the variable of military burden does not yield significant results even in its 1 year lagged form. The lack of significance does not let us accept Hypothesis 3.

In contrast, EU membership variable consistently demonstrates a negative impact on arms exports when states are exposed to a larger share of embargoed markets, thereby supporting Hypothesis 4. Lastly, Hypothesis 5, which suggested a negative impact of transparency on arms exports in an increasingly embargoed market, is not supported due to high error terms and low significance of the coefficients.

Figure 10 illustrates the trend of arms exports in relation to exposure to an increasing share of the embargoed market. The data reveals a generally increasing trend in arms exports among the majority of the analyzed exporters. However, notable exceptions exist among EU member states, such as Belgium, Germany, and Sweden, which exhibit a decrease in arms exports as their exposure to embargoed markets grows. This aligns with the observed negative effect of EU membership on arms exports. At the same time, other EU major exporters like France or Italy show a gradually increasing trend in their arms exports. The world's largest arms exporters, the United States and Russia, appear largely unaffected by the embargoes, continuing to increase their arms exports. This economic resilience indicates that the increasing number of embargoed regimes in the world does not have a crippling effect on major arms senders in terms of their arms exports. This may be due to strategic diversification in their arms trade practices that safeguard against the impact of embargoes.

Trend in Arms Exports in Analysed Countries

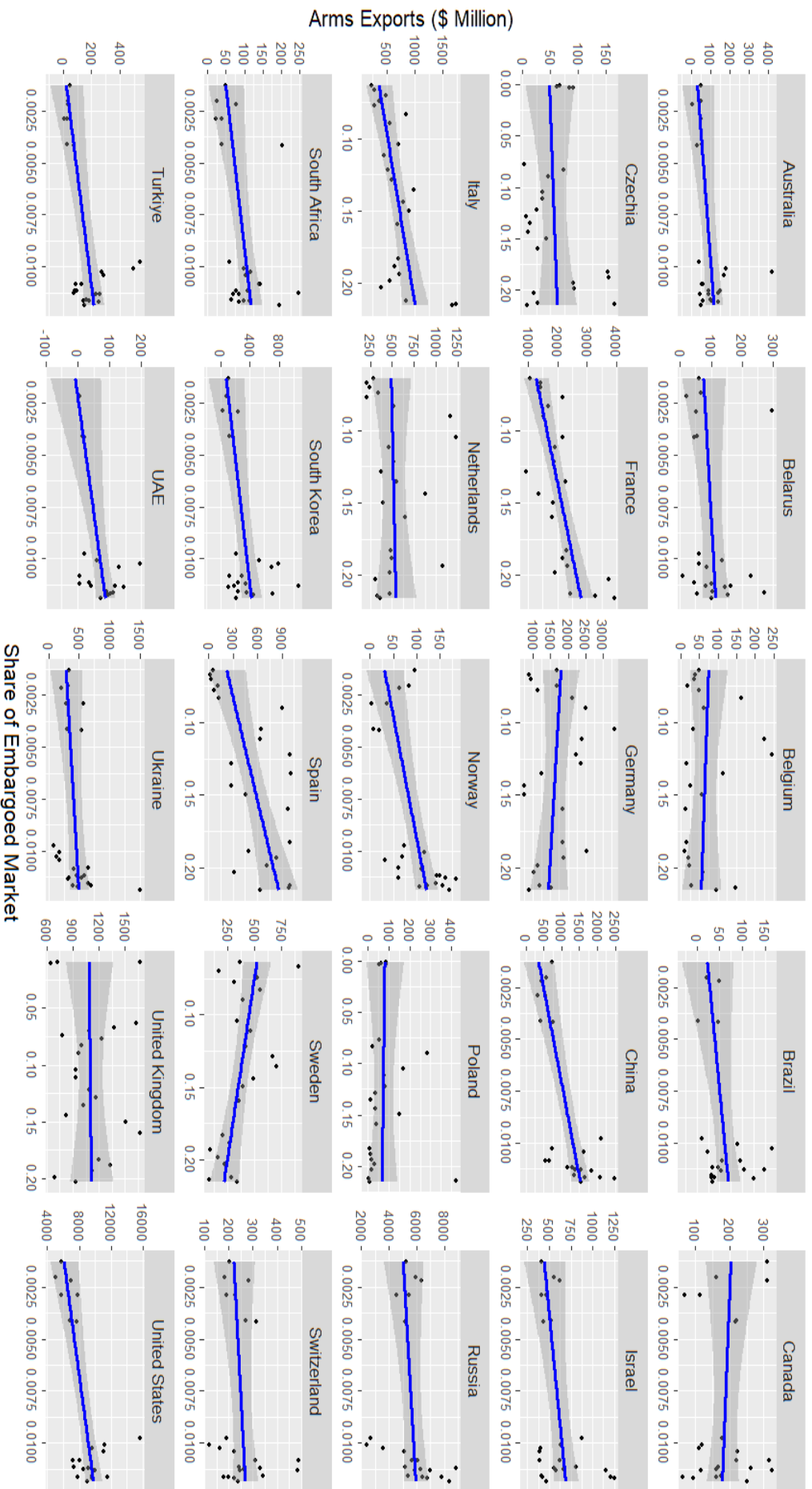


Figure 10. Faceted plot showing the trend in arms exports related to the share of embargoed market in 25 analyzed countries. Trend line represents fitted linear model of the two variables. Alphabetically sorted, axes shrank for clearer visualization. *Source:* SIPRI, author's calculation

To further corroborate the results, a series of interaction effects is conducted within the fixed effect models. The results can be found in Table 4. First column tests the interaction effect between the variable measuring embargoed market and the EU membership, the second column the interaction effect between the embargoed market and the lagged military burden and the third column the interaction between the embargoed market and the level of polity. The interaction term in column (1) is negative and statistically significant at the 5 % level. It suggests that for members of the EU, an increase in the share of the embargoed market is associated with a decrease in arms exports. Figure 11 visually depicts this effect³. EU membership seems to suppress the potential growth of arms exports, that is seen at the non-EU members. It should be noted the collected dataset records only few changes in the EU membership, lowering the possibility of causal interpretation of this control variable. This limitation is addressed by the use of the interaction effect, which further strengthens the findings from the models. Consequently, we can accept Hypothesis 4, suggesting that EU membership has a negative effect on arms exports.

Moving to the column (2), it examines the interaction between embargoed market and lagged military burden (both log-transformed). The interaction term is positive, statistically significant at the 10 % level. It suggests a positive interaction between the share of embargoed market and the amount of military expenditures. It means higher military expenditure might lead to increased arms exports in the cases of heavier share of the embargoed market. This gives limited support to the Hypothesis 3, however the reduced significance prevents full acceptance of this Hypothesis. Lastly, the column (3) shows interaction between the level of polity and embargoed market. The insignificant interaction term indicates high uncertainty and further supports the findings that the level of democracy does not significantly influence arms exports. This seems to hold true even in direct interaction with the varying shares of the embargoed market.

To further test the impact of arms embargoes on democratic countries, fixed effects models were applied to a subset of only democratic arms exporters. This included all observations with polity2 score 6 and higher, indicated by the Center of Systemic Peace

³As the coefficients in models (2) and (3) do not achieve statistical significance at the conventional 95% level, we have opted not to include them in the graphical representations.

as the benchmark for a country to be labelled as democracy. To further increase robustness of the subset, missing values of polity2 were supplemented by the polyarchy

Table 4. Interaction effects of chosen variables

	(1)	(2)	(3)
Embargoed Market	37,724.040** (14,993.590)		
Embargoed Market (ln)		1,478.693* (834.667)	204.159** (83.011)
Polity2	-53.769 (60.417)	-44.637 (54.773)	-66.783 (66.102)
GDP p.c.	0.026 (0.022)	0.038 (0.024)	0.025 (0.018)
EU member	-75.504 (152.757)	-579.546*** (187.101)	-844.493* (467.179)
Lag. Military Burden		28,293.860** (12,415.270)	
Lag. Military Burden (ln)		792.159 (782.435)	
Embargoed Market:EU member	-37,430.740** (15,554.590)		
Embargoed Market(ln):Lag. Military Burden (ln)		338.654* (205.025)	
Embargoed Market(ln):Polity2			-2.797 (13.951)

Note: Clustered robust standard errors in parentheses, ln = natural logarithm, colon indicates the interaction effect.

*p<0.1; **p<0.05; ***p<0.01

index, measuring electoral democracy and hosted by V-Dem. Where polity2 score is missing, observations with polyarchy index of 0,5 and higher were included, nevertheless in cases of contradictions, polity score was preferred. Notably, performing a test on non-democratic subset was not possible due to the sparse number of observations left. The results of the fixed effects models on the democratic subset are shown in Table 5. Generally, the subset shows remarkably similar results to the models performed on the whole dataset. The effect of embargoed market remains positive, although its statistical significance drops. Only model in column (3) shows coefficient significant at the 5 %

level, the rest (with exception of models 4 and 5) is significant at the 10 % level. We see a similar trend at the EU membership dummy variable, which keeps the negative direction but shows a decrease in significance. The remaining determinants result as not statistically significant. This is likely due to the decreased number of observations and the significance being mitigated by the clustered standard errors. Nevertheless, we see the same trend in the democratic subset, where the exposure to embargoed market seems to have positive effect on arms exports. Coming back to the Hypothesis 2, saying democracies will be negatively affected by arms embargoes in terms of their arms export quantities, we ultimately reject this hypothesis based on the findings from all models as well as the interaction effect.

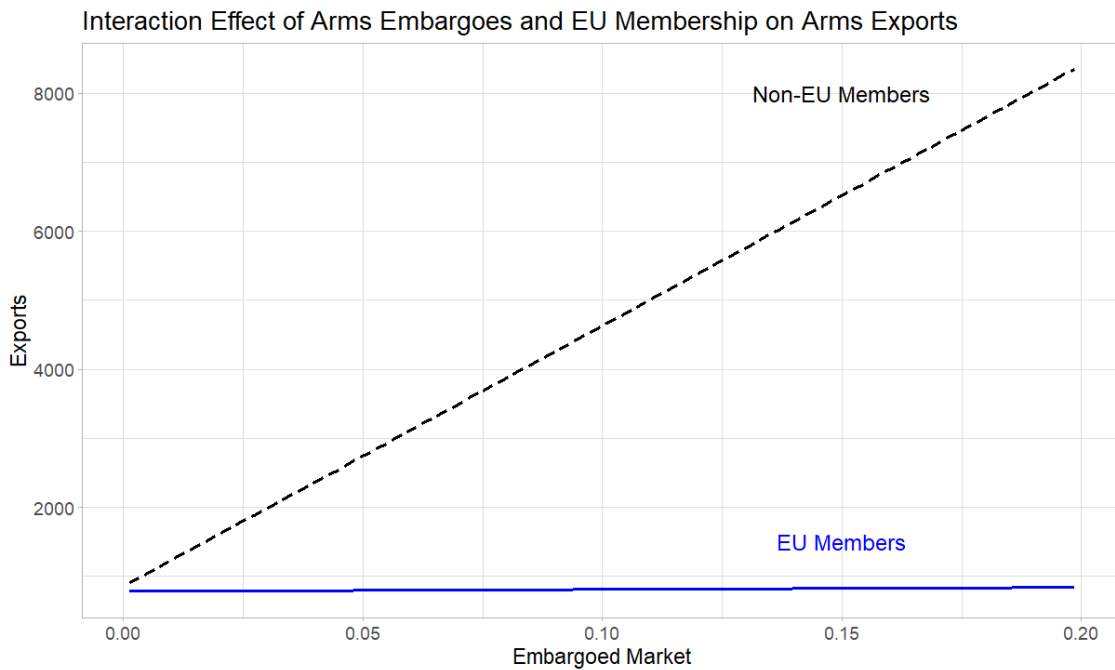


Figure 11. Graphical representation of the interaction effect of variables *embargoed market* and *EU membership* on *arms exports*. Blue solid line represents effect for EU members, black dashed line represents non-EU members.

Table 5. Fixed effects models on a subset of democratic states

	(1)	(2)	(3)	(4)	(5)	(6)
Embargoed Market (ln)	136.640*	145.509*	155.871**	169.315	181.320	186.875*
	(75.474)	(85.524)	(78.554)	(104.099)	(118.857)	(102.952)
Polity2	-269.076	-274.211	-294.970	-290.548	-300.013	-327.864
	(177.707)	(187.380)	(183.642)	(239.729)	(259.179)	(255.948)
GDP p.c.	0.024	0.025	0.023	0.031	0.033	0.035
	(0.022)	(0.024)	(0.027)	(0.028)	(0.031)	(0.035)
EU member	-713.662*	-733.646*	-797.677*	-817.956*	-846.004	-900.961*
	(396.896)	(413.869)	(429.712)	(489.446)	(516.889)	(506.016)
Military Burden		7,252.964			9,757.439	
		(14,055.700)			(18,476.330)	
Lag. Military Burden			13,098.110			18,516.460
			(22,672.850)			(25,095.470)
Exports Transparency				-28.021	-28.731	-31.336
				(28.522)	(29.313)	(29.541)
Observations	393	393	372	372	372	353
R ²	0.168	0.169	0.188	0.168	0.170	0.195
Adjusted R ²	0.111	0.110	0.127	0.106	0.105	0.129
F Statistic	18.517*** (df = 4; 367)	14.902*** (df = 5; 366)	15.967*** (df = 5; 345)	13.960*** (df = 5; 345)	11.766*** (df = 6; 344)	13.156*** (df = 6; 325)

Note: Clustered robust standard errors in parentheses, ln = natural logarithm.

*p<0.1; **p<0.05; ***p<0.01

4.2.1 Robustness checks

To further test the robustness of the models and increase confidence in the results, several alternative tests were conducted. All results can be found in the Appendix. First, we ran the Augmented Dickey-Fuller (ADF) test to determine stationarity of the data on arms exports and arms embargoes. In the case of the embargoed market, we can reject the null hypothesis and conclude that the variable is stationary. In the case of arms exports data, we fail to reject the null hypothesis and the values likely have a unit root. This is possibly due to the nature of the arms exports data, which are likely to fluctuate over the years. To

account for this, we transform the dependent variable and rerun the fixed effects models. Three different methods are used for transforming the data – expressing the arms exports of a state as a share of the world annual arms exports, expressing absolute annual change of TIV for a state and expressing this annual change of TIV relatively in percentages (see Appendix). Nevertheless, all models with a modified dependent variable yield inconsistent and insignificant coefficients, small R-squared values and insignificant F statistics. At the same time, it seems plausible that embargoed regimes in the world do not seem to significantly harm the export patterns of the largest arms exporters. Even though we tried to account for the non-stationary changes in dependent variable by employing the year fixed effects, this issue should further be addressed in future analyses. A possible way to counter fluctuations is expanding the analyzed timeframe and using a moving average of arms exports for e.g. 5-year time frame. This approach is employed in analyses published by SIPRI, however for the particular case of this work, the analyzed timeframe is considered too short. Alternatively, the Vector Autoregressive Moving Average (VARMA) method can be a valuable approach for analyzing arms exports over time, particularly when considering the interactions between multiple influencing factors (Düker et al., 2024).

Next, the fixed effects models are replicated excluding the United States from the sample (see Baronchelli & Caruso, 2023). As already indicated, the U.S. represent the biggest actor in the arms trade worldwide, accounting for 34 % of all arms exports in the analysis. To mitigate this leverage over the arms trade, US observations are excluded from the sample to avoid the estimates being driven by the US outliers. Results remain robust and can be found in the Appendix. Excluding the United States yields coefficients with similar magnitude and significance as the original models in Table 3. Particularly, the coefficients related to the effect of embargoed market and EU membership remain significant at the 1 % level. Even though the reduced number of observations disrupts the value of R-squared, we can conclude that the models remain robust and reasonably explain the variance in arms exports in relation to the share of the embargoed market and other covariates.

Additionally, we consider the fact that arms embargoes may become evident in the arms exports in the following years, mainly due to the fact that arms deals and deliveries are

usually arranged months or years in advance. Therefore, the independent variable representing the share of embargoed market is lagged by one year. The results remain robust, the coefficient of embargoed market being significant at the 5 % level in all models (see Appendix).

Lastly, we log transform two more relevant variables, GDP per capita and lagged military burden. This yielded less significant results for the embargoed market variable. Otherwise, the coefficients remain similar to the original models, enhancing their robustness (see Appendix). We also replace GDP per capita with logged real GDP in constant 2015 US\$, to capture wealth of the exporters in another way. This inclusion renders all coefficients except GDP insignificant, suggesting that this predictor captures a wide range of other factors (see Appendix). The observed effect of GDP overshadowing other variables confirms the capability of wealthier states to export more arms.

Overall, the robustness checks affirm the validity of the fixed effects models. The exclusion of the United States and the consideration of lagged effects and log transformations strengthen the findings. The next section will delve into the discussion of these findings, exploring the implications and limits.

5. Discussion

This section will give a summary of the results along with their interpretation and fit in the ongoing academic as well as political debate. It will also acknowledge the limitations of this study and present possibilities for a way forward.

To summarize the results, the fixed effects models consistently resulted in a significant positive effect of the increased exposure to the market restrained by arms embargoes on arms exports. This led to a plausible rejection of the null hypothesis, concluding that arms embargoes evince a significant effect on arms exports of the world's largest 25 senders of MCW. At the same time, we must reject the Hypothesis 1, which stated that arms embargoes will negatively affect the exports of arms. In fact, we consistently observed a *positive* coefficient related to the effect of arms embargoes, suggesting that the increase in the share of embargoed market raises the volume of exported arms. The results also reveal a consistently negative effect of EU membership on arms exports in the situation of increased share of the embargoed market. This provided support for the Hypothesis 4.

Furthermore, the results revealed no discernible effect of the level of democracy on arms exports. The coefficient remained insignificant in different versions of the fixed effects model and in the interaction term. Running the model on a democratic subset of exporters revealed remarkably similar results to the baseline models, suggesting that the positive effect of arms embargoes holds even in democratic countries. This provides evidence against the Hypothesis 2, thus concluding that the level of democracy does not have an effect on reducing arms exports in the situation of an amplified exposure to arms embargoes. Next, the effect of military burden revealed results with insufficient levels of significance. This does not let us accept the Hypothesis 3, since we cannot confirm a positive effect of increased military spending on arms exports in situation of increased exposure to arms embargoes. Lastly, a similar situation comes with the effect of arms export transparency. Insufficient level of significance associated with the coefficient means little support for the stated negative effect of transparency in arms transfers on the export of MCW in context of increasing share of embargoed market. Accordingly, we cannot accept the Hypothesis 5.

The finding of a positive effect of arms embargoes, in particular the exposure to increasing share of embargoed market, on arms exports is seemingly counterintuitive and fits into the strand of academic literature condemning arms embargoes as ineffective tools. It suggests major senders of arms remain resilient to the presence of multilateral arms embargoes and keep shipping the same or increasing amounts of MCW. Similarly, Gordon (2011) concludes that arms embargoes do not reduce the flow of arms, a view also supported by skeptics like Tierney (2005) or Vines (2007). This analysis in many ways follows the research by Bove and Böhmelt (2021) who discover that even though arms embargoes reduce the direct flow of arms into the target, arms exporters shift the arms trade to neighbors of embargoed state. Thus, the results partially align with their findings, indicating that overall arms exports do not decline over time. Consequently, the results of this work do not correspond with the findings of Erickson (2013), who concludes that arms embargoes restrain sending states' arms exports. However, it is important to note that this analysis measures the general effect of embargoes on arms exporters, not the direct flow of arms into embargoed states, as some other authors do.

The findings give space to several alternative explanations. First, it seems plausible that

major arms exporting countries strategically diversify their markets to avoid losing profits from arms trade, thereby protecting themselves from the effects of arms embargoes. Exporters might be shifting their focus to non-embargoed regions or increase sales to other states to compensate for the restricted markets. Notably, despite the various controls, the rise of arms exports introduces the possible issue of tautological relationship, where arms exports could be growing due to the overall growth of arms trade. Although we tried to account for this by using the year fixed effects and by running additional tests, it should be considered when interpreting the results.

Another important consideration is due to the fact that the demand for arms does not disappear with the introduction of arms embargoes, potentially giving rise to illicit trade. This phenomenon is documented in the academic literature: Radford (2013) finds that arms embargoes foster the growth of illicit arms markets and Tierney (2005) notes embargoes increase demand for arms from the actors at illicit market as well as from legal suppliers, which conforms with the results of this analysis. Erickson (2013) adds that illicit trade became increasingly relevant in the post-Cold War era, as for instance former Soviet arms made their way to the black market.

Another factor influencing the results might be that the states targeted by UN arms embargoes are often economically inefficient developing countries. As a result, restriction of arms trade with these states does not significantly impact the major exporters of arms. This is possibly the case of arms embargoes against Central African Republic, Eritrea or Somalia. In cases of arms embargoes against Iran or North Korea, we can hypothesize these states eventually find ways to circumvent embargoes by obtaining MCW from other actors who do not comply with the international restrictions. This can include illicit trade or friendly states and private arms dealers willing to bypass the embargoes for profit.

Conversely, arms embargoes imposed by the EU incorporate comparatively longer list of countries, also consisting of major world economies. This includes China, Russia or Egypt. This broader scope likely contributes to the negative coefficient of EU membership on arms exports, as the combined market share restricted by both UN and EU embargoes is significantly higher compared to those restricted only by UN embargoes. At the same time, we can expect the biggest actors like Russia and China to

be affected by arms embargoes only partially, since they can also offset the loss from restricted arms imports through their domestic arms manufacturing. In addition to that, several EU members including Germany and France continued arms trade with Russia despite the arms embargo, as revealed by investigative journalists (Maggiore et al., 2022). Significant portion of the trade with Russia also seems to be circumventing the sanctions via intermediates, such as China (International Working Group on Russian Sanctions, 2023).

Coming back to the acceptance of Hypothesis 4 stating the negative impact of membership in the EU on arms exports in light of increasing share of embargoed market, this adds to the debate of potentially negative economic impact on EU arms manufacturing sector. Even though EU member states are arguably a coherent pack with coordinated policies, the defense sector remains largely a national issue due to differences in member states' strategic cultures and the appeal to protect national defense industries (Giegerich & Sabatino, 2022). For instance, the aftermath following the murder of journalist Jamal Khashoggi at the Saudi Embassy in Türkiye in 2018 clearly illustrates the disputes among EU members over the imposition of arms embargoes. In this case, Germany decided to impose arms embargo on Saudi Arabia, provoking France and United Kingdom. This was because this action effectively prevented the sales of jointly produced Eurofighter Typhoon and Tornado fighter jets sold by the UK, reliant on German parts, but also impacted France's missiles sales similarly dependent on the parts from Germany (Noack, 2019). After several months, Germany agreed to some lenience in their sanctions and warranted the sale of weapons via France and the UK (Plevier, 2019). However, this episode illustrates that even close allies disagree on sanctioning behavior and that these sanctions often prove ineffective due to alternative channels of arms supply.

Moreover, majority of the 21st century was characterized by low military spending in Western European countries, reducing the production capabilities of defense companies to a minimum and effectively weakening their industrial capacity (Vojenské zpravodajství, 2024). The Russian invasion of Ukraine and subsequent increase of defense budgets across the EU brought several challenges to light – rising inflation, inefficient spending and a lack of collaboration (Giegerich & Sabatino, 2022).

Additionally, the results of this analysis partially support the notion that arms embargoes might have adverse effects on EU arms producers (Klomp, 2024b; Seyoum, 2017). At the same time, true economic impact of arms embargoes on arms producers in the EU requires additional testing and case study analyses. Nevertheless, the current situation presents opportunity for a critical debate on better design of EU arms embargoes, enhanced cooperation in defense sector and improved alignment with NATO.

Ultimately, the results indicating a positive effect of arms embargoes on arms exports, along with the other mentioned factors, undermine the reputation of arms embargoes as an effective international tool. The ability of major exporters to adapt to these restrictions and gradually increase the annual volume of exports underscores the significant economic incentive coming from arms trade and indicates their possible reluctance to forfeit such profits.

Regarding the Hypothesis 2 and its rejection, it reveals a surprising picture of the missing relationship between democracy and arms exports in embargoed markets. The findings indicate that the level of democracy does not significantly influence the volume of exported arms when faced with increasing embargo pressure. This result aligns partially with previous research, which highlights that weapon deliveries are driven mainly by demand factors, notwithstanding the level of democracy or moral obligations given by international norms (Martínez-Zarzoso & Johannsen, 2019). Perkins and Neumayer (2010) argue that democratic countries, despite being expected to adhere more to their moral obligations, often prioritize national economic and security interests over reducing arms trade. This analysis shows that the increase in arms exports is indistinguishable between democratic and non-democratic arms exporters, even as the exposure to arms embargoes rises. This finding challenges the assumption that democracies are more likely to comply with international arms embargoes. It suggests that the economic and strategic benefits of arms exports may outweigh other considerations across all polity types.

Furthermore, the mixed results regarding the effect of military burden on arms exports gave limited support to Hypothesis 3, leading to its rejection. The significant negative effect found in the baseline models aligns with some existing literature, such as Pamp & Thurner (2017), suggesting that increases in arms exports are followed by a reduction in military expenditures. At the same time, the interaction term between embargoed market

and military burden suggests that higher military expenditure might lead to increased arms exports in the cases of heavier share of the embargoed market. This indicates a complicated trade-off between domestic military spending and arms exports. The effect of military expenditure on arms exports remains a complicated issue in academic debate (Smith & Tasiran, 2005, 2010). The hypothesized positive effect of increased military spending on arms exports, notwithstanding the arms embargoes, is not confirmed in this analysis.

Additionally, the analysis looked at the transparency of reporting arms transfers by individual countries and its effect on MCW exports. Hypothesis 5 expected highly transparent arms exporters more likely to adhere to international arms embargoes, thus constraining their arms exports more than less transparent countries. Some models indicated a negative effect of increased transparency, however the associated error term hampered their significance. As a result, the Hypothesis 5 was not accepted. The inclusion of transparency as a variable in arms export analysis is relatively scarce in the academic literature, utilized for instance by DellaVigna and La Ferrara (2010). Future research could refine the measurement of transparency and explore its interaction with arms exports.

The empirical results reported here should be considered in the light of several limitations. To begin, the inferences made on the export data taken from SIPRI should be read with several conditions in mind. First, the data only covers arms trade flows that have been made officially known. Naturally, illicit and secret arms transfers are not reported and are not shown in the data. Second, the analysis covered only arms trade with major conventional weapons, not small arms, which are not monitored by SIPRI. Third, SIPRI data does not take into account MCW produced by several different countries. Some conventional weapons are manufactured by firms from different countries, such as the Eurofighter Typhoon fighter jet made by a consortium of Airbus, BAE Systems and Leonardo. This type of production and export is hardly assigned to a single country and this issue is not handled by SIPRI (Brender, 2016). Lastly, Smith and Tasiran (2010) bring attention to the fact that in arms industry, there are strong incentives, both on the exporting and importing side, to misreport weapon transfers. Also, problems arise with the imports of dual-use goods, that are both of civilian and military application and might

be reported misleadingly, complicating the accuracy of the data.

The nature of the data and measurement of the variables, along with the probability of model errors, presents possible endogeneity bias possibly introducing bias into the results. We believe the inclusion of fixed effects and a set of control variables addresses the problems of potential omitted variable bias and prevents sample selection bias (Smith & Tasiran, 2010). Also, including clustered standard errors as described by Arellano (1987), should address the issues of heterogeneity and serial correlation in the sample. Nevertheless, we cannot exclude reverse causality. It may be more difficult to impose an embargo on targets that are also significant buyers of arms. Conversely, countries may be more willing to cut the supply of MCW to partners whose imports are already low. To control for the issue of reversed causality, the method of matching may be used in future research, as indicated by Baronchelli et al. (2022). Also, Caruso (2003) proposes a counterfactual experiment to assess how much more exporters would have traded without the imposition of embargoes. The results of these experiments could offer deeper insights into the actual effects of arms embargoes and the overall size of the arms market.

Regarding the methodology, more nuanced techniques such as the generalized method of moments, two-stage or three-stage least squares models might yield more robust results and additional insights into the complex relationship among the variables. However, given the limitations of the data and the capacity and scope of this study, we opted for a fixed effects model, since this represented a pragmatic and appropriate choice. The restricted size of the panel data also limits the external validity of this study. Future studies could employ more sophisticated estimation techniques, improve the measurement of the embargo variable and focus more directly on the arms transfers between exporters and the embargoed states and potentially the intermediaries. Additionally, broadening the scope of analyzed countries, years and also other multilateral and unilateral embargoes might lead to more generalizable results. While the results suggest that arms embargoes can have significant positive effects on arms trade, the limitations of the data and methodology emphasize the need for further research. By continuing in this research area, deeper understanding of the complex relationship between arms embargoes and arms trade can be gained, ultimately informing more effective policy decisions.

Conclusion

This thesis analyzed the impact of mandatory multilateral arms embargoes on the world's largest arms exporters in the post-Cold War era. The study examined how the volume of exported arms is influenced by exposure to arms embargoes, expressed as the share of the arms market restricted by embargoes. The study applied fixed effects models on panel data from 25 countries over the years 2000 to 2022. Contrary to the main hypothesis, which anticipated a negative effect of arms embargoes on arms exports, the results revealed a consistently significant positive effect of an increasing share of the embargoed market on the volume of exported MCW. Additionally, membership in the EU was found to have a negative effect on arms exports. However, the study did not confirm any significant effect for the level of democracy, military expenditure, and transparency in arms exports.

Considering the limitations of the data and methodology used, it is important to interpret the results cautiously. Arms embargoes should not be directly associated with a causal positive effect on arms exports. Nevertheless, in the context of real-world settings, the findings show that embargoed regimes do not seem to have a crippling effect on the largest arms senders and their arms exports. The minimal effect of arms embargoes on major exporters of arms also raises doubts about their potential effectiveness. Poor implementation of arms embargoes might significantly hamper their success. This is especially pressing in cases of arms embargoes imposed on internationally significant actors, such as Russia, where compliance is crucial for their effectiveness. Notwithstanding, in the case of arms embargo against Russia, arms trade verifiably continued through legal loopholes even after the introduction of sanction packages by the EU. This prompts the question of whether sanctioning states are fully committed to halting the supply of arms to the targeted nations.

The results of this study fit into the critical strand of academic discourse on arms embargoes, with growing skepticism about their effectiveness. Critical perspectives argue that embargoes are often poorly implemented and easily evaded, leading to minimal impact on the target and also the sender, as demonstrated in this work. The findings contribute to the recent trend in literature that shifts focus towards intermediate factors of sanctions, such as the reduction in arms flows, as measures of arms embargo

effectiveness. Consequently, despite the fact that this study does not directly measure the effectiveness of arms embargoes, the observed positive effect on arms exports suggests the minimal impact embargoes have on exporters. Moreover, the collected dataset introduces a novel approach to measuring arms embargoes, encompassing those imposed by both the UN and the EU, and covering a novel and most recent time period.

The issue of the effects of arms embargoes on major exporters of arms remains relevant not only from an academic point of view but also as a policy issue. The resilience of arms exporters to embargoes highlights the potential future need for more robust implementation and monitoring. The academic community agrees there is a lack of strong enforcement mechanisms for arms embargoes, which allows for violations. This suggests establishing stricter oversight mechanisms to monitor compliance and punish violations. The findings of this study also underscore the importance of increasing transparency in the arms trade. Leveraging current technology for better reporting of arms exports, along with increased international accountability, could enhance the effectiveness of arms embargoes.

The described negative effects specifically on EU exporters indicate the economic costs of arms embargoes for member states. It gives room to the debate of the EU regulatory environment potentially putting exporters from the EU at a disadvantage in the global market. Additionally, reduced revenues from arms exports can limit the financial resources available for reinvestment in R&D and innovation within the defense sector. This can limit technological advancements and reduce the competitiveness of EU arms producers.

Finally, further studies should continue to analyze the effect of arms embargoes on arms exports, utilizing novel data and more sophisticated methodologies, focusing for instance directly on arms exports to embargoed countries in specific country pairs. The findings of this thesis might serve as a resource for further research on similar and associated topics. Expanding both theoretical and empirical understanding of arms embargoes and their impact on arms exports can provide valuable academic, economic, and political insights into the global arms market and the effectiveness of sanction regimes.

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Appendix

Table A1.1. List of mandatory UN arms embargoes used for the calculation of independent variable *embargoed market*. Provides target state, entry into force, end (if applicable), establishing document and full years of an embargo for the calculation. *Source*: SIPRI.

Mandatory UN arms embargoes					
	Target	Entry into force	Lifted	Establishing document	Full years
1	Afghanistan	19 December 2000	16 January 2002	UNSCR 1333	2001
2	Angola (UNITA)	15 September 1993	9 December 2002	UNSCR 864	2000–2001
3	Central African Rep.	5 December 2013		UNSCR 2127	2014–2022
4	Cote d'Ivoire	15 November 2004	28 April 2016	UNSCR 1572	2005–2015
5	DRC	28 July 2003		UNSCR 1493	2004–2022
6	Eritrea	23 December 2009	14 November 2018	UNSCR 1907	2010–2017
7	Iran	23 December 2006	18 October 2023	UNSCR 1737	2007–2022
8	Iraq	6 August 1990		UNSCR 661	2000–2022
9	Lebanon	11 August 2006		UNSCR 1701	2007–2022
10	Liberia	19 November 1992	26 May 2016	UNSCR 788	2000–2015
11	Libya	26 February 2011		UNSCR 1970	2012–2022
12	North Korea (DPRK)	14 October 2006		UNSCR 1718	2007–2022
13	Rwanda	17 May 1994	10 July 2008	UNSCR 918	2000–2007
14	Sierra Leone	8 October 1997	29 September 2010	UNSCR 1132	2000–2009
15	Somalia	23 January 1992		UNSCR 733	2000–2022
16	South Sudan	13 July 2018		UNSCR 2428	2019–2022
17	Sudan (Darfur region)	30 July 2004		UNSCR 1556	2005–2022
18	Yemen	14 April 2015		UNSCR 2216	2016–2022
19	Yugoslavia (FRY)	31 March 1998	10 September 2001	UNSCR 1160	2000

Table A1.2. List of mandatory EU arms embargoes used for the calculation of independent variable *embargoed market*. Provides target state, entry into force, end (if applicable), establishing document and full years of an embargo for the calculation. *Source*: SIPRI.

Mandatory EU arms embargoes					
	Target	Entry into force	Lifted	Est. document	Full years
1	Afghanistan	17 December 1996	26 February 2001	96/746/CFSP	2000
2	Belarus	20 June 2011		2011/357/CFSP	2012–2022
3	Bosnia and Herzegovina	5 July 1991	23 January 2006	EC declaration	2000–2005
4	Central African Republic	23 December 2013		2013/798/CFSP	2014–2022
5	China	27 June 1989		EC declaration	2000–2022
6	Cote d'Ivoire	15 November 2004	9 June 2016	2004/852/CFSP	2005–2015
7	DRC	7 April 1993		EC declaration	2000–2022
8	Egypt	21 August 2013		EU agreement	2014–2022
9	Eritrea	15 March 1999	31 May 2001	1999/206/CFSP	2000
10	Eritrea	1 March 2010	12 December 2018	2010/127/CFSP	2011–2017
11	Ethiopia	15 March 1999	31 May 2001	1999/206/CFSP	2000
12	Guinea	27 October 2009	14 April 2014	2009/788/CFSP	2010–2013
13	Iran	23 April 2007		2007/246/CFSP	2008–2022
14	Iraq	4 August 1990		EC declaration	2000–2022
15	Lebanon	15 September 2006		2006/625/CFSP	2007–2022
16	Liberia	7 May 2001	20 June 2016	2001/357/CFSP	2002–2015
17	Libya	27 January 1986	11 October 2004	EC declaration	2000–2003
18	Libya	28 February 2011		2011/137/CFSP	2012–2022
19	Myanmar	29 July 1991		EC declaration	2000–2022
20	North Korea	22 November 2006		2006/795/CFSP	2007–2022
21	Russia	31 July 2014		2014/512/CFSP	2015–2022
22	Sierra Leone	5 June 1998	29 October 2010	98/409/CFSP	2000–2009
23	Somalia	10 December 2002		2002/960/CFSP	2003–2022
24	South Sudan	18 July 2011		2011/423/CFSP	2012–2022
25	Sudan	15 March 1994		94/165/CFSP	2000–2022
26	Syria	9 May 2011		2011/273/CFSP	2012–2022
27	Uzbekistan	14 November 2005	31 October 2009	2005/792/CFSP	2006–2008
28	Venezuela	13 November 2017		EU 2017/2063	2018–2022
29	Yemen	8 June 2015		EU 2015/878	2016–2022
30	Yugoslavia (FRY)	5 July 1991	8 October 2001	EC declaration	2000
31	Zimbabwe	18 February 2002		2002/145/CFSP	2003–2022

Table A.2. Results of Breusch-Pagan Lagrange multiplier test determining the significance of time effects.

Lagrange Multiplier Test - time effects (Breusch-Pagan)

data: exports ~ log(embargoed_market)

Chi-squared	DF	p-value
6.9786	1	0.008249

alternative hypothesis: significant effects

Table A.3. Results of F test for individual effects to test fixed effects and simple OLS models.

F test for individual effects

data: exports ~ log(embargoed_market)

F	DF1	DF2	p-value
220.66	24	539	< 2.2e-16

alternative hypothesis: significant effects

Table A.4. Results of Hausman test to test fixed effects and random effects models.

Hausman Test

data: exports ~ log(embargoed_market) + polity2 + gdppc + EU_member + ...

Chi-squared	DF	p-value
13.047	6	0.0423

alternative hypothesis: one model is inconsistent

Table A.5. Results of Breusch-Godfrey/Wooldridge test for serial correlation.

Breusch-Godfrey/Wooldridge test for serial correlation in panel models

data: exports ~ log(embargoed_market) + polity2 + gdppc + EU_member + ...

Chi-squared	DF	p-value
150.12	11	< 2.2e-16

alternative hypothesis: serial correlation in idiosyncratic errors

Table A.6. Results of studentized Breusch-Pagan test for heteroskedasticity.

studentized Breusch-Pagan test

data: exports ~ log(embargoed_market) + polity2 + gdppc + EU_member + ...

BP	DF	p-value
136.66	6	< 2.2e-16

Table A.7. Coefficients of fixed effects models employing alternative robust covariance matrix estimators.

	(1)	(2)	(3)	(4)
Embargoed Market (ln)	237.337*** (45.599)	237.337*** (43.319)	188.157*** (42.252)	188.157*** (38.564)
Polity2	-49.217* (28.422)	-49.217** (22.329)	-58.900** (27.770)	-58.900* (32.746)
GDP p.c.	0.035*** (0.010)	0.035*** (0.010)	0.031*** (0.010)	0.031*** (0.010)
EU member	-1,013.020*** (295.745)	-1,013.020*** (159.561)	-890.671*** (292.975)	-890.671*** (145.135)
Exports Transparency	-26.275** (11.736)	-26.275*** (8.903)		
Lag. Military Burden	180.048** (82.517)	180.048 (173.903)	172.074** (80.880)	172.074 (177.642)
PCSE (Beck & Katz, 1995)	Y		Y	
Driscoll & Kraay (1998)		Y		Y

Note: Robust standard errors in brackets.

* p<0.1; ** p<0.05; *** p<0.01

Table A.8.1. Results of ADF Test for stationarity of the arms exports data.

Augmented Dickey-Fuller Test

data: Panel.set\$exports

Dickey-Fuller	Lag order	p-value
0.4725	1	0.99

alternative hypothesis: stationary

Table A.8.2. Results of ADF Test for stationarity of the arms embargoes data.

Augmented Dickey-Fuller Test

data: Panel.set\$embargoed_market

Dickey-Fuller	Lag order	p-value
-4.8508	2	0.01

alternative hypothesis: stationary

Table A.9. Results of fixed effects models employing different transformations of dependent variable.

	Exports share		Absolute TIV annual change		Relative TIV annual change	
	(1)	(2)	(3)	(4)	(5)	(6)
Embargoed Market	-0.063*	-0.072**				
	(0.034)	(0.037)				
Embargoed Market (ln)			4.611	-3.045	-0.585	-0.316
			(14.938)	(6.952)	(0.406)	(0.369)
Polity2	0.0002	0.00005	-5.625	9.776	-0.044	-0.045
	(0.001)	(0.001)	(7.063)	(13.381)	(0.068)	(0.065)
GDP p.c.	0.00000	0.00000	0.006	0.003	-0.0001**	-0.0001*
	(0.00000)	(0.00000)	(0.008)	(0.007)	(0.0001)	(0.0001)
EU member	0.006	0.006	13.784	23.229	4.716***	3.814**
	(0.005)	(0.005)	(40.604)	(39.573)	(1.722)	(1.701)
Exports Transparency	-0.0003		-11.177		0.055	
	(0.0004)		(10.963)		(0.074)	
Lag. Military Burden	-0.006	-0.006	82.347	89.856	0.087	0.405
	(0.004)	(0.004)	(74.540)	(79.962)	(0.335)	(0.433)
Observations	423	442	423	442	417	436
R ²	0.026	0.025	0.006	0.005	0.030	0.021
Adjusted R ²	-0.046	-0.044	-0.067	-0.065	-0.043	-0.049
F Statistic	1.714 (df = 6; 393)	2.089* (df = 5; 412)	0.426 (df = 6; 393)	0.425 (df = 5; 412)	2.001* (df = 6; 387)	1.713 (df = 5; 406)

Note: Clustered robust standard errors in parentheses, ln = natural logarithm.

* p<0.1; ** p<0.05; *** p<0.01

Table A.10. Results of fixed effects models excluding U.S. observations

	(1)	(2)	(3)	(4)	(5)	(6)
Embargoed Market (ln)	143.472*** (46.054)	142.971*** (46.575)	133.551*** (45.586)	140.650*** (45.264)	139.919*** (46.198)	143.540*** (49.541)
Polity2	-14.848 (20.667)	-14.815 (20.289)	-13.477 (18.113)	-12.081 (16.239)	-12.386 (16.165)	-12.932 (17.545)
GDP p.c.	0.005 (0.006)	0.005 (0.008)	0.006 (0.007)	0.005 (0.007)	0.004 (0.009)	0.006 (0.008)
EU member	-624.012*** (197.113)	-622.062*** (194.539)	-593.078*** (190.780)	-623.039*** (196.035)	-622.813*** (196.961)	-629.629*** (204.980)
Military Burden		390.699 (8,259.923)			-2,255.185 (7,007.197)	
Lag. Military Burden			3,207.535 (9,557.192)			3,612.383 (9,665.765)
Exports Transparency				-0.923 (8.978)	-0.995 (9.323)	-1.275 (9.257)
Observations	446	442	422	407	403	404
R ²	0.076	0.076	0.066	0.067	0.067	0.067
Adjusted R ²	0.017	0.014	-0.001	0.0002	-0.003	-0.002
F Statistic	8.639*** (df = 4; 418)	6.810*** (df = 5; 413)	5.511*** (df = 5; 393)	5.418*** (df = 5; 379)	4.462*** (df = 6; 374)	4.517*** (df = 6; 375)

Note: Clustered robust standard errors in parentheses, ln = natural logarithm.

* p<0.1; **p<0.05; ***p<0.01

Table A.11.1. Results of fixed effects models employing lagged version of the *embargoed market* variable.

	(1)	(2)	(3)	(4)	(5)	(6)
Lag. Embargoed Market (ln)	136.920** (59.214)	135.158** (57.309)	139.612** (57.041)	165.473** (77.053)	163.349** (74.261)	168.078** (72.770)
Polity2	-52.841 (58.478)	-52.727 (58.433)	-58.748 (62.087)	-43.463 (50.205)	-43.449 (50.215)	-49.299 (53.081)
GDP p.c.	0.030 (0.024)	0.032 (0.027)	0.036 (0.028)	0.034 (0.027)	0.037 (0.031)	0.040 (0.032)
EU member	-631.068** (265.463)	-622.648** (252.654)	-621.312** (245.257)	-669.244** (288.514)	-656.205** (272.190)	-657.890** (264.824)
Military Burden		3,102.923 (8,917.680)			3,721.007 (8,799.587)	
Lag. Military Burden			16,855.860 (14,119.000)			17,373.350 (14,131.970)
Exports Transparency				-21.329 (22.911)	-22.739 (24.120)	-21.699 (22.813)
Observations	445	441	442	426	422	423
R ²	0.115	0.115	0.124	0.117	0.118	0.128
Adjusted R ²	0.055	0.052	0.063	0.054	0.052	0.063
F Statistic	13.450*** (df = 4; 416)	10.664*** (df = 5; 411)	11.699*** (df = 5; 412)	10.497*** (df = 5; 397)	8.720*** (df = 6; 392)	9.573*** (df = 6; 393)

Note: Clustered robust standard errors in parentheses, ln = natural logarithm.

* p<0.1; ** p<0.05; *** p<0.01

Table A.11.2. Comparison of models with *embargoed market* and lagged version of the variable.

	(1)	(2)	(3)	(4)
Embargoed Market (ln)	237.337*** (48.139)	188.157*** (44.033)		
Lag. Embargoed Market (ln)			168.078** (72.770)	139.612*** (37.268)
Polity2	-49.217** (24.393)	-58.900** (23.649)	-49.299 (53.081)	-58.748** (23.807)
GDP p.c.	0.035*** (0.010)	0.031*** (0.010)	0.040 (0.032)	0.036*** (0.010)
EU member	-1,013.020*** (282.962)	-890.671*** (275.318)	-657.890** (264.824)	-621.312** (249.762)
Exports Transparency	-26.275** (11.938)		-21.699 (22.813)	
Lag. Military Burden	180.048** (79.014)	172.074** (77.888)	173.734** (141.320)	168.559** (78.254)
Observations	423	442	423	442
R ²	0.142	0.133	0.128	0.124
Adjusted R ²	0.078	0.072	0.063	0.063
F Statistic	10.800*** (df = 6; 393)	12.633*** (df = 5; 412)	9.573*** (df = 6; 393)	11.699*** (df = 5; 412)

Note: Clustered robust standard errors in parentheses, ln = natural logarithm.

* p<0.1; ** p<0.05; *** p<0.01

Table A.12. Results of fixed effects models with log-transformed variables *GDP per capita* and *lagged military burden*

	(1)	(2)	(3)	(4)
Embargoed Market (ln)	205.130 (150.905)	209.620 (145.366)	209.883** (84.930)	254.716** (107.021)
Polity2	-35.990 (56.204)	-40.488 (58.127)	-59.616 (61.751)	-49.448 (52.242)
GDP p.c. (ln)	636.458** (248.116)	712.389*** (208.865)		
GDP p.c.			0.031 (0.026)	0.033 (0.028)
EU member	-1,011.378* (536.941)	-1,019.584** (515.787)	-932.459** (360.349)	-1,049.684** (413.025)
Exports Transparency	-20.164 (18.821)	-19.234 (18.162)		-22.902 (22.087)
Lag. Military Burden		14,586.190 (9,497.849)		
Lag. Military Burden (ln)			493.935 (456.751)	475.095 (428.070)
Observations	426	423	442	423
R ²	0.130	0.138	0.136	0.142
Adjusted R ²	0.069	0.074	0.075	0.079
F Statistic	11.866*** (df = 5; 397)	10.480*** (df = 6; 393)	12.928*** (df = 5; 412)	10.826*** (df = 6; 393)

Note: Clustered robust standard errors in parentheses, *ln* = natural logarithm.

* p<0.1; ** p<0.05; *** p<0.01

Table A.13. Results of fixed effects models replacing variable *GDP per capita* with *GDP*.

	(1)	(2)	(3)	(4)	(5)	(6)
Embargoed Market (ln)	127.062 (131.685)	125.337 (131.430)	128.405 (129.378)	158.917 (157.488)	159.891 (158.955)	158.354 (151.360)
Polity2	-47.695 (68.108)	-47.327 (68.118)	-50.846 (69.870)	-33.243 (56.942)	-32.450 (57.401)	-37.118 (58.890)
GDP (ln)	561.647* (304.168)	579.178* (314.614)	625.336** (269.050)	655.929*** (232.224)	688.717*** (224.754)	726.398*** (195.313)
EU member	-728.812 (482.785)	-724.225 (484.594)	-732.784 (489.797)	-834.112 (567.038)	-828.825 (566.003)	-825.271 (540.997)
Military Burden		1,071.167 (6,913.404)				
Lag. Military Burden			13,040.980 (10,017.570)			13,935.300 (10,678.560)
Exports transparency				-18.629 (19.269)	-17.105 (19.670)	-16.677 (18.775)
Military Burden (ln)					118.034 (213.014)	
Observations	467	463	442	426	422	423
R ²	0.133	0.133	0.129	0.131	0.132	0.138
Adjusted R ²	0.077	0.075	0.068	0.069	0.067	0.075
F Statistic	16.755*** (df = 4; 438)	13.290*** (df = 5; 433)	12.230*** (df = 5; 412)	11.943*** (df = 5; 397)	9.897*** (df = 6; 392)	10.498*** (df = 6; 393)

Note: Clustered robust standard errors in parentheses, ln = natural logarithm.

* p<0.1; ** p<0.05; *** p<0.01