International Transfers of Second-Hand Major Conventional Weapons
Patterns, Determinants and Consequences

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"A finished dissertation is a good dissertation." Anonymous (04.07.2022)

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List of Abbreviations

FTP	**F**oreign **T**roop **P**resence
GLM	**G**eneralized **L**inear **M**odel
IAT	**I**nternational **A**rms **T**ransfers
IISS	**I**nternational **I**nstitute for **S**trategic **S**tudies
IV	**I**nstrumental **V**ariable
MCW	**M**ajor **C**onventional **W**eapons
SHT	**S**econd-**H**and Arms **T**ransfers
SIPRI	**S**tockholm **I**nternational **P**eace **R**esearch **I**nstitute
TIV	**T**rend **I**ndicator **V**alue

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Zusammenfassung

Der russische Angriffskrieg gegen die Ukraine am 24. Februar 2022 hat eine neue Ära in der internationalen Politik eingeläutet. Die Anzahl der Opfer und das Ausmaß der Zerstörung sind immens. Der Krieg und die daraus resultierende "Zeitenwende", wie Bundeskanzler Olaf Scholz es nannte, werden weitreichende und lang anhaltende Folgen auf verschiedenen Ebenen haben (Kostolnik, 2022). Eine akute Folge dieses immer noch andauernden Krieges ist, dass das Thema Aufrüstung und Waffentransfer in den Vordergrund gerückt ist. Die Ukraine fordert die internationale Gemeinschaft, insbesondere die NATO und die EU auf, mehr Waffen zu liefern (BBC (2022), Schipani and Pop (2022)). Präsident Zelensky bezeichnet "die Lieferung von schweren [Hervorhebung der Verfasserin] Waffen an die Ukraine" als "die beste Investition in die Aufrechterhaltung der Stabilität in der Welt" (Zelensky, 2022). Sein Aufruf, demokratische Werte durch militärische Aufrüstung zu verteidigen, hat bisher zum Export von rund 5000 schweren Waffen in die Ukraine geführt (Antezza et al., 2022).

Die beobachteten Waffentransfers in die Ukraine haben eines gemeinsam: Es handelt sich überwiegend um funktionsfähige Waffen aus vorhandenen Beständen, insbesondere schwere Waffen, wie z.B. Panzer und Artillerie. Der Hauptgrund für die Lieferung von diesen, im Folgenden "Gebrauchtwaffen" genannten, Bestandswaffen ist die lange Vorlaufzeit, welche die Herstellung neuer Waffen erfordert. Derzeit liegt die Produktion z. B. der Abrams-Panzer in den USA bei etwa 15 Einheiten pro Monat, aber diese Zahl hängt stark von den Kapazitäten der Zulieferer und der Verfügbarkeit von Rohstoffen und Vorprodukten ab (Judson, 2022). Daher können unter bestimmten Bedingungen auch gebrauchte Waffen, die gegebenenfalls Instand

gesetzt werden müssen, eine praktikable Option gegenüber neu produzierten Waffen sein. Im Zusammenhang mit dem Ukraine-Krieg hat der deutsche Rüstungskonzern Rheinmetall angeboten, 50 alte Leopard-1-Panzer aus seinen Beständen zu modernisieren. Eine Lieferung wäre innerhalb von sechs Wochen möglich (Tagesschau, 2022).

Darüber hinaus ist die technologische Kompatibilität ein wichtiger Aspekt für die ukrainische Armee, wenn sie sich für gebrauchte Waffen im Vergleich zu neuen entscheidet. Alte sowjetische Ausrüstung wird daher in einigen Fällen modernen Waffen vorgezogen, für deren Einsatz oft eine zeitintensive Ausbildung erforderlich wäre. Aus diesem Grund erfolgte die Verlegung von rund 240 sowjetischen T-72-Panzern aus Polen in die Ukraine sofort, während der Einsatz von moderneren deutschen Gepard-Panzern mindestens zwei bis fünf Monate Ausbildung voraussetzt (Hinshaw and Ojewska (2022), Müller (2022)).

Der russische Angriffskrieg gegen die Ukraine ist in seiner internationalen Tragweite außergewöhnlich – nicht nur weil zwischenstaatliche Kriege viel seltener sind als innerstaatliche Auseinandersetzungen (Gleditsch et al., 2002). Allerdings sind Transfers von gebrauchten Großwaffen zwischen Regierungen etwas, das regelmäßig vorkommt. Diese Transfers haben ein erhebliches Ausmaß: Gebrauchtwaffentransfers stellen rund 20% aller beobachteten Transfers dar. Die Definition von Gebrauchtwaffen lautet, dass die Waffe nicht neu für den Transfer hergestellt wird. Nach dem Zweiten Weltkrieg ist der Anteil der Gebrauchtwaffen am Gesamtwaffentransfer ausgehend von rund 50% stetig bis auf einen Anteil von 10% am Ende des Kalten Kriegs gesunken. Da die Nachfolgestaaten der Sowjetunion den Markt mit alten Waffen wieder haben ansteigen lassen, bewegt sich das Transferlevel seitdem bei 20%.

Die Evidenz zeigt, dass sich gebrauchte Waffen qualitativ von neuen Waffen unterscheiden und dass ihr Anteil an Gebrauchtwaffentransfers groß ist. Daher ist es

überraschend, dass die Forschung über Waffenhandel diesen Aspekt bisher weitgehend vernachlässigt hat. Wissenschaftliche Untersuchungen haben Muster aufgedeckt, die nachzeichnen, inwiefern wirtschaftliche, sicherheits oder politische Überlegungen, die Entscheidungen über Waffentransfers beeinflussen (siehe zum Beispiel Brzoska (2004), Krause (1995), Blanton (2005)). Zusätzlich haben Studien Determinanten von Transfers analysiert, z.B. Ressourcenabhängigkeiten (e.g. Bove et al. (2018)) oder Allianzzwänge (e.g. Martinez-Zarzoso and Johannsen (2017)). Auch Untersuchungen zu den Konsequenzen von Waffentransfers gibt es wie z. B., dass sie Konflikte auslösen können. Allerdings haben diese Studien bisher nicht zwischen neuen und gebrauchten Waffentransfers unterschieden.

Bisher wurde in der Forschung über Waffentransfers implizit davon ausgegangen, dass die zugrundeliegenden treibenden Kräfte für den Transfer von neu produzierten Waffen und von Waffen aus zweiter Hand dieselben sind. Die einleitende Bestandsaufnahme hat jedoch gezeigt, dass es sinnvoll ist anzunehmen, dass sich die Erklärungen für den Transfer von Gebraucht- und Neuwaffen unterscheiden. In der Literatur zu internationalen Waffentransfers finden sich zwar verschiedene Erkenntnisse, die tiefe Einblicke in die Transferströme gewähren, aber diese gelten womöglich nicht vollumfänglich für die Kategorie der Gebrauchtwaffen. Daher soll in dieser Dissertation herausgearbeitet werden, dass Gebrauchtwaffentransfers ihre eigenen Erklärungen benötigen und ihre eigenen normativen Implikationen haben.

Die Untersuchung der Dynamik von Gebrauchtwaffentransfers kann die bestehenden Theorien durch eine differenzierte Sichtweise verbessern. Wenn der Handel von Gebrauchtwaffen anders ist, muss die Rüstungstransferpolitik möglicherweise neu bewertet werden und künftige politische Maßnahmen sollten diesem Aspekt Rechnung tragen. Angesichts der jüngsten globalen Entwicklungen ist es daher von entscheidender Bedeutung, Gebrauchtwaffentransfers sowohl aus akademischer als auch aus angewandter Sicht zu verstehen. Sobald die wichtigsten Muster, Determinanten und Konsequenzen der Gebrauchtwaffentransfers bekannt sind, können sie

berücksichtigt werden. Der Hauptbeitrag meiner Dissertation besteht darin, den Transfer von Gebrauchtwaffen als eigenständige Kategorie einzuführen und einen Einblick in verschiedene Aspekte durch theoretische und empirische Perspektiven im Kontext der Waffenhandelsliteratur zu geben.

Um dieses Ziel zu erreichen und in dieser Dissertation einen möglichst umfassenden Einblick in den Transfer gebrauchter Waffen zu geben, werde ich mich dem Thema mit drei Fragen nähern, die in drei eigenständigen Papern (genannt Paper A, B und C) untersucht werden. Die erste Frage ergibt sich aus der Feststellung, dass die Waffenhandelsliteratur bisher sehr begrenzt Gebrauchtwaffentransfers untersucht hat. Zur empirischen Untermauerung des theoretischen Arguments, dass die Transfers von neuen und gebrauchten Waffen unterschiedliche Erklärungen erfordern, werden in Paper A die Muster von Gebrauchtwaffentransfers im Vergleich zu Transfers von neuen Waffen untersucht. Die Frage des Papers A ist, inwieweit die in der Literatur traditionell verwendeten Indikatoren für die beiden Kategorien unterschiedlich funktionieren. Es zeigt sich, dass gebrauchte Waffen in der Tat anders zu beurteilen sind und daher gesondert untersucht werden müssen, was in den Papers B und C erfolgt.

Paper B geht der Frage nach, was den Transfer von Gebrauchtwaffen bestimmt und fragt, wann Exporteure beschließen, ihre Waffenbestände zu verringern und Gebrauchtwaffen zu exportieren. Da Sicherheitserwägungen bei der Reduktion von Waffenbeständen eine wichtige Rolle spielen sollten, wird das Konzept der externen Sicherheitsgarantien eingeführt. Wenn die nationale Sicherheit durch andere Optionen auf dem gleichen Niveau gehalten werden kann, könnte dies den Export von Gebrauchtwaffen determinieren. Das Paper B zeigt, dass Waffenbestände durch externe Sicherheitsgarantien z. B. in Form von ausländischer Truppenpräsenz ersetzt werden können und ergänzt die bestehende Literatur durch die Einführung einer neuen Perspektive auf die Determinanten von Waffentransferströmen. Es wird gezeigt, dass Waffenbestände eine relevante Kategorie für die Untersuchung von

Transferströmen sind und dass die Veränderung von Waffenbeständen mit einer Substitution von sicherheitsrelevanten Gütern verbunden sein kann.

Paper C beschäftigt sich mit der Frage, welche Folgen es hat, wenn ein Land gebrauchte Waffen importiert. Während einige Studien darauf hinweisen, dass Waffenimporte das Risiko des Ausbruchs von Konflikten erhöhen, bleibt die Debatte über dieses Thema ungeklärt. Das Paper C zielt darauf ab, die Studienlage über den Ausbruch von Konflikten und Waffentransfers zu erweitern und die Beziehung zwischen dem Import gebrauchter Waffen und dem Risiko des Ausbruchs von Konflikten zu entschlüsseln. Paper C stützt sich auf einen Erklärungsrahmen, der auf drei verschiedenen Merkmalen gebrauchter Waffen beruht. Obwohl es schwierig ist nachzuvollziehen, in welche Richtung die Kausalität geht, deuten die Ergebnisse darauf hin, dass Importe gebrauchter Waffen bei der Erklärung des Ausbruchs von Konflikten eine größere Rolle spielen als die Importe neuer Waffen.

Diese kumulative Dissertationsschrift ist wie folgt strukturiert. Ein Übersichtsartikel (framing paper) führt in das Thema ein und verknüpft die drei Paper. Paper A (Chapter 2) zeigt die Muster von Gebrauchtwaffentransfers auf und inwiefern diese sich von Neuwaffentransfers unterscheiden. Paper B (Chapter 3) widmet sich der Frage, was Gebrauchtwaffentransfers determiniert. Paper C (Chapter 4) zeigt auf, dass die Konsequenzen von Gebrauchtwaffenimporten im Vergleich zu Neuwaffenimporten im Hinblick auf Konflikte unterschiedlich sind.

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Chapter 1

Framing Paper

Abstract

In my thesis, I examine the topic of international transfers of second-hand major conventional weapons by analyzing the patterns, determinants, and consequences, based on three papers. This framing paper gives an systematic overview of the field in general and presents the three papers in this context. In the beginning I introduce the topic and motivate why research on transfers of second-hand major conventional weapons is needed. To achieve this I will present descriptive relationships as well as discuss the relevant literature that connects to the topic. This exercise will identify the research gaps that exist in the literature and which are tackled in the three papers. The goal of the framing paper is then to connect the the main findings and contributions of the three papers and embedded them coherently in the larger debates that link to them. Finally, the framing paper discusses future research avenues.

1.1 Introduction

Russia's war of aggression against Ukraine on February 24, 2022, ushered in a new era in international politics. The loss of human life and the scale of destruction is immense, and the war and the resulting "Zeitenwende" as Bundeskanzler Olaf Scholz has called it, will have far-reaching and long-lasting consequences on various levels (Kostolnik, 2022). One acute consequence of the ongoing war is that the topic of armament and the transfer of weapons has come to the fore. Ukraine is calling on the international community and particularly NATO and the EU, to transfer more weapons (BBC (2022), Schipani and Pop (2022)). President Zelensky links the "the supply of *heavy* [emphasis added] weapons to Ukraine" to be "the best investment in maintaining stability in the world" (Zelensky, 2022). So far, his call to defend democratic values through military gear has resulted in the export of around 5000 heavy weapons to Ukraine (Antezza et al., 2022).

The observed arms transfers to Ukraine have one thing in common: they consist mainly of already existing weapons, especially in the case of heavy weapons, e.g., tanks and artillery. This is due to several reasons. The main one is time pressure because the production of new heavy weapons is time intensive, and production cannot be scaled up quickly. Currently, the production for, e.g., the Abrams tanks in the US is around 15 units per month, but this number depends on the industrial base that supplies the plant (Judson, 2022). Poland, for example, has to wait at least half a year from order to delivery to receive 28 new Abrams tanks from the USA even though this sale is being fast-tracked (Adamowski, 2022). Therefore, even if the requested gear is old industry stock that has to be updated, this can be a viable option over newly produced arms. In the context of the Ukraine crisis, the German defence company Rheinmetall offered to modernize from its stockpiles 50 old Leopard 1 tanks. The first one could be delivered within six weeks (Tagesschau, 2022).

In addition, technological compatibility is a vital aspect for the Ukrainian Army

when choosing second-hand arms over new ones. Old Soviet gear can, in some cases, be preferred to modern arms that lack familiarity and where time-intensive training is needed. This is why the transfer of around 240 Soviet-made T-72 tanks from Poland to Ukraine took place immediately, whereas the more modern German Gepard tanks require at least two to five months of training (Hinshaw and Ojewska (2022), Müller (2022)). For the exporters, this even remedies a problem: proper disposal of surplus weapons can be time-consuming and costly. Through the transfers, they can dissolve their stocks of second-hand arms efficiently while they modernize at the same time their army through replacements from allies. This is the case for Poland and, among others, Slovakia, which transfers its Soviet-designed S-300 air defence missile systems to Ukraine while receiving the modern, NATO-compatible Patriot system from the US (Iddon, 2022). Ultimately, this swap scheme benefits the whole alliance and raises the overall security level. To sum up, these examples illustrate that already existing arms are qualitatively different from newly produced arms in different aspects. Therefore, explanations for the *patterns*, *determinants*, and *consequences* of the international transfers of second-hand major conventional weapons are required.

Russia's war of aggression against Ukraine is exceptional in its international implications and in that we see a war between states, which is far less common than internal wars (Gleditsch et al., 2002). However, second-hand arms transfers between governments are indeed something that is happening regularly, and these transfers are of significant amount. Figure 1.1 gives an impression of the share of new vs. second-hand major conventional weapons transfers of all transfers since the end of the Second World War (SIPRI, 2019a).[1] The definition of second-hand arms is that the weapon is not newly produced for transfer.[2]

Figure 1.1 shows that over the years, the number of second-hand arm transfers

[1] Major conventional weapons are defined as aircraft, air defence systems, anti-submarine warfare weapons, armoured vehicles, artillery, engines, missiles, sensors, satellites, and ships, see in Appendix A Table A.1 (SIPRI, 2019b).

[2] The terms "second-hand" and "old" will be used interchangeably.

(SHT) varied but always remained on a substantial level. On average, over the whole period, the transfers were around 20%. The broad trends in SHT were the steady decrease of transfers since the end of the Second World War from around 50% until the end of the Cold War to around 10%. After 1990 the market was flooded with old Soviet gear from the successor states, and the SHT levels have fluctuated around the 20% level since then.

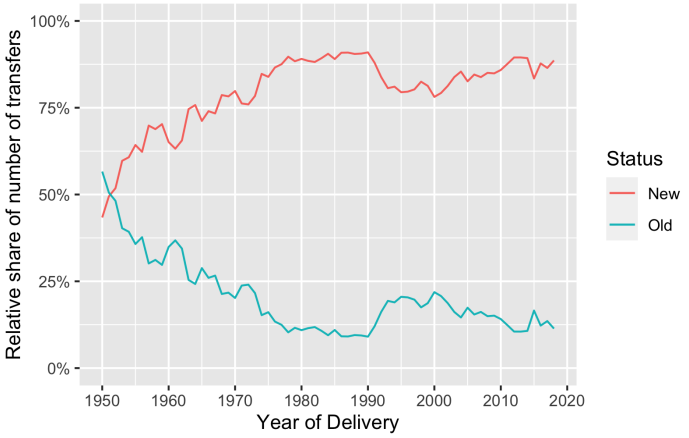

FIGURE 1.1: Percentage of new and old arms transfers as a share of the total arms transfer numbers from 1950-2018. Data is from SIPRI (2019a).

Because there is evidence that old arms are qualitatively different from new arms and that the proportion of SHT is large, it is surprising that research on arms transfers has mostly neglected this aspect so far. Arms trade studies are motivated by the notion that through analysing the transfers *patterns* can be uncovered. The results of this analysis allow us to disentangle to what extent economic, security, or political considerations influence arms transfer decisions (see for example Brzoska (2004), Krause (1995), Blanton (2005)). Also, arms transfer research can identify the various kinds of transfer relationships, be they dyadic or a network (see Kinne (2016), Thurner et al. (2019), Pamp et al. (2021),). Some relationships are, for example, *determined* by resource dependencies (e.g. Bove et al. (2018)) or alliance considerations (e.g. Martinez-Zarzoso and Johannsen (2017)). This ultimately helps to understand the global, regional, and national effects of international arms transfers.

In addition, arms transfer research has normative implications. Under certain conditions, arms transfers can be beneficial or harmful for both the exporter and the receiver. Exporting arms, e.g., to allies, can deter conflict but also challenge an adversary, as it is often argued regarding NATO and Russia. Also, arms imports can potentially have devastating *consequences* for the local population if civil war breaks out. Only if these relationships are known targeted measures can be applied.

So far, the implicit assumption of arms transfer research is that the underlying determinants and consequences of transfers of newly produced arms and second-hand arms are the same. Nevertheless, the introductory mapping exercise indicated different transfer patterns for new and old arms transfers. While international arms transfer (IAT) literature presents various findings, which give deep insights regarding transfer flows, these might not apply fully to the second-hand arms category.

Consequently, this dissertation will highlight that old arms transfers require their own explanations and carry their own normative implications. Studying SHT dynamics will improve IAT theory by providing a differentiated perspective. Furthermore, if SHT are different, arms transfer policies might need to be re-evaluated and future polices should take this aspect into account. In light of recent global developments, it is therefore critical to understand SHT from an academic as well as from an applied perspective. Once the main *patterns*, *determinants*, and *consequences* are known, they can be accounted for. Introducing SHT as a category and giving insight into different aspects of SHT through theoretical and empirical lenses in the context of IAT literature will be the main contribution of my dissertation.

To achieve this goal and provide the broadest possible insight into SHT in one dissertation, I will approach the topic by asking three questions in the three Papers A, B, and C. The first question derives from the idea that the IAT literature has so far been limited in its research on SHT. In order to empirically underscore the theoretical argument that new and old arms transfers require separate explanations, paper A maps the *patterns* of old arms transfers compared to new arms transfers.

The question of the paper is to what extent the indicators traditionally used in IAT literature work differently for the two categories. It reveals that, indeed, old arms are distinct and therefore need to be studied on their own as in Paper B and C.

Paper B asks what *determines* the transfer of old arms and questions when exporters decide to lower their arms stocks and export old arms. As security considerations should play a relevant role when arms stocks are reduced, external security guarantees are introduced. If security can remain on the same level through other options, this could determine old arms exports. The paper shows that arms stocks can be substituted through external security guarantees in the form of foreign troop presence. It adds to the IAT literature by introducing a new perspective on the determinants of arms transfer flows. It shows that arms stocks are a relevant category, and the change in arms stocks can be linked to a substitution of security-providing goods.

Paper C raises concerns about the *consequences* when a country imports old arms. While some studies have indicated that arms imports raise conflict onset risk the debate on this topic remains unsettled. To add to the conflict onset and arms transfer literature, the paper aims to disentangle the relationship between old arms imports and conflict onset risk. The paper relies on an explanatory framework based on three distinct old arms characteristics. While controlling for causality is challenging, the results indicate that old arms imports are more relevant in explaining conflict onset than new arms imports.

In sum, this dissertation shows that international arms transfer research has, so far, neglected that the category of second-hand arms is essential to be studied. Transfers of new and old arms need to be distinguished to account for the underlying, different dynamics. The three papers answer questions regarding the *patterns*, *determinants*, and *consequences* of international transfers of second-hand major conventional weapons. The papers reveal that SHT largely follow their own logic compared to new arms. Therefore, the contribution of my thesis is to increase awareness that the

implicit, general treatment of all arms transfers as new arms transfers might limit the validity of some studies. In addition, I deliver the first insights into the dynamics of old arms transfers.

The framework paper is structured as follows: Section 1.2 systematically discusses in 1.2.1 the relevant literature regarding arms transfers *determinants*. Subsection 1.2.2 describes the literature on IAT and the *consequences*. In 1.2.3, I introduce the category of second-hand arms transfers and illustrate the *patterns* of old arms transfers compared to new arms. This guides me in ascertaining the research gaps that will be studied in the three papers. In section 1.3.1, the overarching relationship between the three papers will be theorized. In section 1.3.2, the papers and their results and contributions will be presented. Section 1.4 summarizes the insights of this framing paper, discusses the dissertation's limitations, and lays the foundation for future research on second-hand arms transfers.

1.2 Research on IAT

A substantial body of research aims to explain international arms transfers. The following subsection presents various strands of IAT literature on the *determinants* of arms transfers. This discussion will show that IAT studies often focus on certain aspects that influence arms flows and that no dominating theory exists. This peculiar feature that there seems to be a lack of main IAT theories will also be looked at in general and to what extent it might have relevance to the SHT issue. The next subsection focuses on the research that has studied the *consequences* of IAT. Studies have found several implications of IAT, but the main issue remains to control for causality. The last subsection introduces the category of SHT and traces the different *patterns* of new and old arms transfers. Taken together, this will guide the subsequent development of the three dissertation papers.

1.2.1 Determinants of IAT

The research agenda of the dissertation is based on existing studies on IAT. This subsection focuses on research that studies the determinants of IAT. The literature on this topic can be divided and systematized into three research strands. The most significant proportion is papers that study the effect of specific influences that can be subsumed under either economic, political, or security actor motives. The second strand is the growing literature on the arms transfer network. The third and smallest strand, which I also present first, is the one that develops formal models in order to explain IAT.

Formal Arms Transfer Models

The formal models are a valuable start to gaining insight into the most relevant aspects of arms transfers. The studies first introduce a simple supply and demand model like any other traded goods. Based on the rational actor model, they then set out the preferences and objectives of the actors (see as an example Garcia-Alonso and Levine (2007)). The two most important specifications are, on the one hand, the market structure. Production of arms has high fixed costs, which are hard to overcome initially. Only with rising unit production, the average costs can fall. This impacts supply and price developments as there are budget constraints. On the other hand, the security consideration of both the supplier and the receiver shape if and to whom arms are transferred (Garcia-Alonso and Levine, 2007). These specifications are usually the basis for any further model developments.

For instance, formal models were also constructed to describe arms races, and still, the Richardson (1938) model is often a starting point to represent arms races (see also Intriligator (1975), Smith (2020)). Levine and Smith (1997) add as an innovation to the study of arms races the prices of arms to model the interaction of two hostile countries, who divide their national budget between arms imports and consumption goods (see also Levine et al. (1998)). Further questions were investigated in

the form of formal models, e.g., how the implementation of an arms control regime might foster the birth of a domestic production instead (see Levine and Smith (1995), Levine and Smith (2000)). In the Levine and Smith (2000) model, they test, given being a non-producer country, the implications of an investment in arms production under conditions of uncertainty (e.g. arms controls). Ultimately, they show how uncertainty regarding supply and prices can reduce the probability of proliferation.

The formal models give an abstract, reduced approach to IAT and how supply and demand react to certain conditions. Still, no simple demand and supply model provides an analytically sound solution. So far, only Anderton (1995) and Garcia-Alonso and Levine (2007) discuss modeling approaches to such a model of IAT. The difficulty lies in defining how the utility function of governments, consisting of security and consumption, actually looks in order to maximize their welfare. Overall, formal models are helpful in condensing information and revealing interdependencies, which might be hard to illustrate and analyse. Regarding SHT, the formal models, so far, have focused on the question if a country produces arms or doesn't and not if existing arms stocks are sold.

Economic Actor Motive

While formal models have benefits in approaching and describing IAT, their abstract worldview might not suffice for considering the complex variation over time and across countries. The studies which focus on either the economic, political, or security actor motive are, in contrast, able to do so. The studies focusing on economic explanations have a starting point similar to the formal models. The assumption is that through the production and export of arms, jobs are created, arms firms profit, and, subsequently, the governments' tax base increases.[3] It does not, however, explain why only a few countries produce and export arms. Lending from the Heckscher-Ohlin model of international trade theory, early explanations claimed that when a

[3]Still, DeGrasse (2016) shows that raising funds on military production with the aim to support the economy is only limited and investment in civilian project yield higher welfare gains.

country specializes in arms production, it is due to country-specific factor endowments. An arms-importing country's opportunity cost to produce arms is, therefore, too high compared to producing other goods. The model predicts that comparative advantage to produce arms will lead to trade with other countries, which differ from itself in factor endowment, production technologies, or tastes (Anderton, 1995). The model, however, does not explain why intra-industry trade exists.[4]

This is why most research now relies on the free trade model of economies of scale and learning economies. It is more suitable to describe why the economic motive for arms exports is so distinct from most other export goods transfers due to the characteristics of arms production. The idea is similar to the market structure specification in the formal models. Economies of scale represent a decrease in the average costs when increased output levels lead to lower unit costs.[5] The observed mechanism is via the high fixed R&D costs, which amortize through rising unit production. By enlarging production of, e.g., a tank series, the falling unit costs lead to a lower price. Due to the government's fixed demand, its defense spending is lowered. The firm can increase exports and gain profits and market shares through more competitive prices.

Economies of scale per se lead to a specialization of a country in one type of arms production and, therefore, greater production of each weapons system type of the world. However, security and political motives are additionally at interplay because one can observe that exports remain restricted and a greater variety of arms is produced within a country, e.g., the U.S., than the free trade economies of scale model would suggest. Arms production is, therefore, also an inefficient subsidy and binds recourses unnecessarily, leading to a welfare loss. Still, the economic motive

[4]Intra-industry trade is a two-way trade in differentiated products within a broad category. For example, France and Spain trade military aircraft, but these aircraft have distinct military purposes.

[5]Typical examples for economies of scale are firms with high entrance barrier costs, e.g., battery factories, aluminium or iron foundries.

for the arms exporter partly rests on the classic explanation of welfare gains (job creation, tax increase, economic growth) through exports. Nevertheless, the main economic motive of an exporter is largely traced back to the exploitation of economies of scale.[6]

There is also a research focus on the economic actor motive of the importer side. The literature determines firstly that they are on the receiving end of the economies of scale. While most of the importers cannot overcome the high fixed R&D costs to start their own production, they profit from the more competitive prices. Especially since the end of the Cold War, the arms producers faced shrinking domestic demand, and the support of the defense industry through pushing exports became vital (Cornish (1995), Levine and Smith (1997)). The importers take further advantage of the exporter's conundrum for their own economic benefit and often finance their purchases through credits given by the exporters. Even if a country is not able to pay for arms immediately, the budget restriction can be overcome through this form of financing. Under the economic motive of the importing actor, therefore, falls the possibility to negotiate with the exporters to allow credit installments for arms transfers (Catrina (1988), Menon (1982), Brzoska et al. (1994)). Another sign of an increasingly commercially driven export is that importers often demand cooperation in producing certain parts of the product domestically. Also, a standard negotiation tool is offsets, especially in the post-Cold War buyer's market. It means that the arms exporter has to reinvest a certain amount of the revenue it makes in the importing country (Brauer and Dunne, 2011).

Besides benefiting from the various implications of the exogenous effect of economies of scale, there are; secondly, further domestic economic motives determining arms import flows. Brzoska (2004) shows that less financially well-off customers, specifically post-Cold War, were less likely to receive arms. However, being a financially

[6] In addition, there are negative externalities within the economic motive: arms production is often subsidized, which supports inefficient production. This also means that funds are diverted from the civilian sector, where the investment could have led to higher welfare gains.

stable country makes arms transfer and credit financing more likely. Consequently, there is a strong economic motive for the importer to be perceived as stable. The impact of the importer's financial prowess on the likelihood of receiving arms is not only in absolute numbers but also depending on its economic growth rate. Smith and Tasiran (2005) and Smith and Tasiran (2010) give evidence that the propensity to import arms rises with growth in income and subsequent military expenditures. This relationship is non-linear, though, and arms imports fall at some point with rising income as a domestic arms industry is developed.

In sum, the economic motive of the importing actor mainly relates to the extent it can make use of the exporter's need to push production units to decrease costs. Still, there is no free lunch, and credible commitments that the exporter is not left to foot the bill alone are needed in order for an arms transfer to go through. The literature has, up until now, not given much consideration to how these mechanisms differ if the arms are not newly produced but are existing arms. Economies of scale do not directly impact old arms, and they should cost less than new arms, which might be a relevant selling point.

Political Actor Motive

IAT literature that focuses on the political motive of the exporting actor distinguishes between internal/domestic and external aspects. Regarding internal aspects concerning the exporter, the government sanctioning arms transfers runs the risk of potential domestic backlash, especially if the recipient country is a non-democratic regime. Indeed, there is evidence in the literature that exports are impacted, to a limited extent, by such human rights concerns. Blanton (2005) shows that only in the post-Cold War period human rights and democracy level had a meaningful impact in determining the eligibility of a country to receive arms from the U.S. (see also Perkins and Neumayer (2010), Akerman and Seim (2014), BBC (2022), Hansen and Marsh (2015), Schulze et al. (2017)). Martinez-Zarzoso and Johannsen (2017) were

able to determine that political factors such as democracy levels play a more prominent role in the probability of a transfer and a lesser role in the amount transferred. Domestic politics on arms transfers can also be shaped by civil society organizations, which have the capabilities for concerted action to push the work of norm entrepreneurs on the government's arms export agenda (de Moraes, 2019)).

Another internal aspect within the political motive of the exporter has less to do with the public arena and more with the national institutional structure. Due to the bureaucratic dynamics of resource allocations, the military also competes for funding. Military expenditures are determined along political conflict lines, and depending on how much agency they have to make demands, this will impact arms production possibilities and exports (Treddenick, 1985). Also, some argue that there is collusion between companies and government, dubbed the military-industrial complex, through helping each other to push contract volumes and to receive jobs (Silverstein and Burton-Rose, 2000). The stronger such relationship between politics and defense companies, the more likely arms transfers should be.

Regarding external aspects concerning the exporter, the government could frame arms transfers as a significant international signal of support of a friend, which is also less costly than sending troops or other forms of support. Involvement in foreign affairs always bears global reputational costs, and arms transfers are at the intersection of giving support and less visible and costly involvement (Pattison, 2010). Arms exports can also be used to influence the politics of a foreign country in one's favor. In return for discounts on arms sales, the exporter expects that the receiver, e.g., votes in the UN general assembly or other international organizations, in line with the sender.[7] Discounts and credit-financed arms transfers, therefore, can also be politically motivated by the exporter and not only an economic motive of the importer (as discussed above).

[7]Dreher et al. (2008) show how recipients of US aid are more likely to vote in line with the US in the UN general assembly.

Geopolitical, it is strategically useful to gain access via arms transfers to a spatially remote country. Transfers could then serve as an initial juncture to gain local access to military facilities. Using arms transfers, an exporter can, likewise, influence the outcome of an intra- or interstate war. In a global world, spreading one's influence can prove to be beneficial in the long term. There is evidence for the US and Russia that they aim to gain support for their ideology through discounted arms sales (Lansford, 2002). It is also a political motive to export to a specific country only to prevent another country from gaining political leverage there. During the Cold War, the above-listed political motives of the exporter regarding external aspects were amplified through the East-West conflict (Brzoska et al., 1994).

However, an ongoing prevalent political motive of the exporter is to export arms in return for access to the natural resources of the recipient. Bove et al. (2018) show how the oil dependence of an arms exporter from a specific country leads to higher arms transfers to this country. They consequently demonstrate that arms trade is an effective foreign policy tool to secure and maintain access to oil. Overall, there is a diverse set of political motives of the exporter, which IAT literature was able to determine.

Introducing the political motive of the importing actor, there are country leaders, which consolidate their power by having access to arms. To secure their position, the success of an arms deal itself can be a political factor. Villa and Weiffen (2014) argue that non-conflict-driven factors, in the case of Latin American arms purchases, play an increasing role. Through generous defense spending, a civilian government can buy the support of the armed forces. Their main argument relates to the balance of power thinking. As a symbol of power and status, armament is one tool to transform and renegotiate power relationships on the international stage. In addition to the international insertion and rising power aspirations, armament is driven by the aim to create a stronger regional identity by establishing a security community (Villa and Weiffen, 2014).

Besides gaining international leverage through increasing arms stocks, the arms transfer sector is one of the most corrupt ones in the world. Roebner (2005) from Transparency International calculated that 0.5 percent of global trade constitutes arms trade while representing 40 percent of corruption in world trade for the year 2003. Exporting actors often use "sweeteners" e.g. including long-term maintenance in the contract for free to seal the deal. However, government officials of an importing country can gain political influence and a monetary windfall through receiving "commissions" or "incentives" labeled payments. Securing such corrupt deals solidifies their political influence and is therefore desirable (Willett, 2009).

The theoretical considerations concerning the political motive of the actors in IAT do only fit partially into the category of SHT. For one, SHT might not be as prominent in the general public as the export of new arms because there is no arms firm pushing for sales but rather the government itself, which can complete the contract quietly and quickly. The trade volumes may not be high enough to attract attention. Due to the nature of already existent arms, a different bureaucratic dynamic and lack of a military-industrial complex add to the picture that SHT needs to be considered in its own frame. The external aspect of the exporter to influence a foreign country and pursue geo-strategic goals should apply to a lesser extent. Most second-hand arms exporters do not export on a consistent basis and sell various different categories and qualities of arms over the years. A long-term strategy for second-hand arms exports as a foreign policy tool should be unlikely.

For the political motive of the importer, one would expect that second-hand arms are often not the first choice and are mostly the fallback option. The more modern the arms equipment, the more political power can be claimed on the international stage. Prevalence of corruption in SHT is to be expected, but this political motive could also vary compared to new arms exports.

In sum, the part on the political actor motive has examined the exporter, who has to balance internal and external aspects in its decision to transfer arms. The importer's

political motive relates to a balance of power framework on the international stage. Domestic political motives of an importer can be analysed in a context where access to an ever-increasing arms arsenal constitutes a source from which authoritative power can be derived. Due to the nature of second-hand arms, transfers cannot be undertaken very strategically, and imports are of lesser quality, potentially resulting in only a marginal power increase.

Security Actor Motive

The third motive identified in the IAT literature is the security actor motive. The exporter faces the internal security motive that it needs to produce a wide variety of arms categories (tanks, ships, jets, etc.). Possessing this ability gives the advantage to deter possible conflicts as well as during conflict. This ability subsequently increases its level of security. Such a "love of variety" concept directly relates to the economic motive where the exporter faces the economies of scale problem. A country should focus on pushing production within a limited number of categories in order to decrease unit costs per category. This is, nevertheless, only observed to a limited extent. Often, when a country is a producer of arms, it produces a wide variety of different categories (Anderton, 1995). Still, for each category on its own, it is viable to increase production through exports to lower unit costs. Therefore, the economic gains of arms production are moderated by security considerations.

The external security motive of an arms exporter relates to its consideration of how a transfer impacts the global and therefore own security level. If, e.g., a transfer is likely to stabilize a region through achieving a balance of power, then global security increases. If, e.g., a transfer, however, leads to or intensifies inter and/or intrastate war, this could impact the global security structure and lower the exporter's own level of security (Sanjian, 1999). A potential security cost attached to exports is that an allied or neutral importer can become an enemy in the future. An example is Iran, where after the revolution, the US arms imported by the Shah landed in the

hand of the revolutionists.[8] Relating the exporter motive to the subject of second-hand arms, the importing country might re-sell the arms at some point in the future without any option for the original producer (and exporter) to control this transfer.

There is also the dyad of the exporter and importer itself, which can carry a security motive in the form of alliances. Exporting to and importing from an allied country raises the security level of both partners. For one, the exporter supports a country that, in case of a conflict where the mutual defense clause is raised, is well endowed with military equipment that is even compatible with its own equipment. The importer's security is also raised by signaling its commitment to the alliance through such imports. If it imported from somewhere else, it might lower its chances that in the case of conflict, the ally would give broad military support (Kinsella, 1998).

Still, a concurrent and countervailing effect could be that forging an alliance could lead to lower arms imports. The mechanism is that an alliance increases the security level, so the arms demand is lowered. At the same time, however, a substitution mechanism of security and economic motives can also be at work: an increase in arms transfers to allies can be followed by a reduction in domestic military spending, ultimately resulting in economic welfare gains (Pamp et al., 2018). Also, having such alliances Morrow (1993) argues that countries have to choose how to combine domestic armament (internal security balancing) and forging alliances (external security balancing). Martinez-Zarzoso and Johannsen (2017) show in their analysis that such military pacts increase the probability of a transfer. There is no impact on the subsequent amount decision, meaning that while exporters per se consider allies as trustworthy receivers, it does not translate automatically into higher transfer volumes.

The security motive of the arms importer does encapsulate the primal reason for acquiring arms: to have an instrument of defense from an external and internal

[8] "Senator Joseph R. Biden observed in 1982. 'We had 30USD billion of the most sophisticated arms in the world in Iran, [and] without a shot being fired, the Shah was marched out of the country'."(Klare, 1998, p. 92)

threat. To preserve national security, the availability of arms for a coercive military response is required. Regarding the external threat, regional arms races between rivals have been a major driver of arms imports. Various empirical studies have investigated this topic. However, most of the studies have only considered military expenditures and did not differentiate further between expenditures for arms acquisitions, military personnel, etc. (see for example Wallace (1979), Buzan and Herring (1998), Glaser (2000)). Exceptions are, e.g., Mintz (1986), who can determine an action-reaction cycle of Third World countries reacting to arms imports of their rivals, which is largely limited by economic constraints. Depending on the complexity of the security environment, national decision-making structures, and other instruments at hand, Dunne et al. (2003) show that (levels of) arms imports are just one form of reaction to threats of rivals in order to preserve national security. Therefore, the security motive to import arms due to external threat is contingent on an eclectic evaluation of possible reaction scenarios.

Regarding the internal threats as part of the security motive of the arms importer, the acquisition of arms can be rationalized to deter threats of violent outbreaks and consolidate power. However, such military build-up, indeed, can ultimately be the actual cause of human rights violations, suppression of freedom, and the outbreak of intrastate violence (Blanton (1999), Blanton (2001), Pamp et al. (2016)). A government, fearing instability and loss of power, will be driven in its arms demand by the internal threat perception.

The security motive of the exporter, as stipulated by the theoretical considerations of the IAT literature, again, only partially fits into the category of SHT. An exporter of second-hand arms does not consider the production of arms varieties and also, if being a non-producer, will be limited in developing a long-term global export strategy to maintain global security. Similarly, a consistent alliance strategy based on second-hand arms exports will be restricted in its scope. Regarding the importer side and external threats, when entangled in an arms race, an actor will prefer to

secure access to a partner who can guarantee a constant stream of arms deliveries. A country that is only able to sell second-hand arms does not constitute such a partner and would play, from a strategic point of view, only a minor role in that it can be used to smooth over arms consumption if demand cannot be satisfied or if there are budget constraints. Analogous, a reliable, consistent export partner is preferred for deterring an internal threat, which a second-hand arms exporter cannot guarantee.

This part has explored, in sum, the exporter security motive specified by the IAT literature, which can be distinguished between internal and external motives. The alliance dyad of exporter and importer is also framed by the IAT literature in security motives terms, as such a tie carries information on the strength of an alliance. The importer security motive is driven by external threats, rivalries leading to arms races, and internal threats, where power preservation goals lead to arms imports. Transfers of second-hand arms do not fit into the established IAT framework well because they cannot be relied on to secure a long-term strategic orientation.

Network models

The exploration of the previous IAT literature strands is mainly concerned with the motive of a focal actor who exports and/or imports arms and to a limited extent, with the information carried by the exporter and importer dyad. Recently, an emerging IAT literature strand has explored the impact of hyper-dyadic relationships (e.g. friend-of-a-friend relations) on arms transfers. Modeling such relationships is computationally demanding because the number of existent ties relative to the number of possible ties is low. Research conceiving IAT as a network is, therefore, scant. The idea behind this research is that the topology of the arms network itself has a causal effect on the formation and evolution of the IAT network.

Investigations with a network perspective start with Kinsella (2003), who gives a descriptive overview of the arms network characteristics, and Akerman and Seim (2014) expand this analysis, as well as visualize the arms network evolution over

time. Childs (2012) is the first to consider the impact of the arms network structure in that he considers a country's degree of integration in the arms market via a network centrality measure. The higher the integration, the results show, the higher the arms import volumes.

Studies with the most encompassing approach to model the arms trade network are mostly able to analyse the impact of hyper-dyadic relationships on the probability of a transfer but not the amount transferred. Kinne (2016) models the co-evolution of formal weapons cooperation agreements on the global arms trade between 1995 – 2010 and shows that a high centrality in the weapons cooperation network increases the probability of an arms trade. Also, an increase in arms trade raises the probability of weapon agreement ratification. Thurner et al. (2019) reveals that the previously neglected endogenous network processes, such as preferential attachment and transitivity, are the main drivers of arms transfer ties. Still, so far, Pamp et al. (2021) are the first to evaluate the impact of the network structure on the first decision stage and then on the second amount stage. Their results reveal that the dyadic and hyper-dyadic relationships are influential in determining the creation of trade links but are far less influential in determining the amount to be transferred.

Considering that the topological properties of the arms transfer network inform the creation of the network itself has proven to be a valuable addition to the study of IAT. The question of to what extent the theoretical idea that the network carries relevant information for the exporter and importer of arms applies to the same extent for SHT remains open. Simply looking at the category of SHT networks exclusively would neglect the information of the over-arching IAT network. There is one further issue in determining if, e.g., a friend-of-a-friend relationship, only consisting of second-hand arms transfers, increases the chance of a direct tie (e.g. trust might play in such less frequent transfers a higher role): if the low number of all arms transfers makes modeling demanding, the even lower number of SHT will do so even more.

Altogether, this subsection has explored the, newly emerging, strand of IAT literature on arms networks. This literature strand has determined that the arms transfer network topology should be part of IAT analysis. While implementation is still challenging to achieve due to computational restraints, future research on IAT needs to pay attention to this topic. Regarding SHT and network effects modeling would be challenging but, nevertheless, should not be left out of the debate.

SHT research

The literature on SHT is limited but gives an impression of relevant and different from newly produced arms, factors which might play a role. So far, only case-specific reports or studies of policy impacts deal with this subject. Additionally, these accounts remain bound in time and space. For instance, Wezeman and Wezeman (1996) describe the partially carried out disposal plans of Dutch surplus arms to modernize the army. However, since then, there has been no investigation on the underlying drivers of Dutch SHT (see Davis and Schofield (1997) for a similar report on the UK). Holtom (2011) gives an account of the Sub-Saharan receivers of second-hand Ukrainian arms but does not investigate further the drivers behind it. Beraud-Sudreau (2010) reports that France does limit its SHT in order to bolster sales of newly produced arms. The most encompassing study of both the export and import side is a non-published paper from Beraud-Sudreau and Holtom (2013), who examine the consequences of the defense reform in Europe on SHTs. However, their focus is only on one point in time and is EU-centric. Therefore, this literature serves as a valuable first insight into SHT as it proposes a few explanations but is limited in scope.

This subsection has presented the separate strands of IAT literature that study the *determinants*. These have given insight into different mechanisms and motives, usually distinguishing between the exporter and importer sides. The various perspectives from which these papers investigate IAT have resulted in a lack of competing

general arms transfer theories. Most theoretical IAT approaches focus only on certain aspects and develop specific rather than overarching explanatory frameworks. Subsequently, separate and narrow indicators are derived and tested according to models. Herefore, tracing back the reason why there are no grand IAT theories can be related to researchers focusing on single explanatory factors instead of centering on comprehensively studying the explanandum. This approach will also guide the development of the research agenda for this dissertation.

1.2.2 Consequences of IAT

While the previous subsection has described the research on what determines IAT, the consequences of IAT can also be analysed. The majority of the studies on the consequences of IAT focus on conflict onset. An early account of this relationship is from Craft and Smaldone (2002). They study the effect of the arms trade on the incidence of political violence in sub-Saharan Africa, as many studies on conflict onset had omitted this aspect or conflated it with military spending. Their analysis supports the view that arms imports are a relevant predictor for conflict onset (see also Pearson et al. (1987), Sislin and Pearson (2001)).

The main issue of this literature on the relationship between IAT and conflict onset is to disentangle cause and effect. A study that considers the question of causality specifically is from Pamp et al. (2016). They show that the built-up of arms might not cause the breakout of conflict but increases the probability of conflict onset. This is especially the case in countries that are already more fragile. Mehrl and Thurner (2020) expand on this and show that arms imports do not only increase conflict onset risk but also render these conflicts more violent.

Auer and Meierrieks (2021) have shown that IAT can lead to a higher incidence of terrorist attacks. Based on a grievance model, they trace arms imports leading to eroding institutions due to increased corruption, exclusion, and a lower quality of the rule of law. These effects vary across countries depending on how resilient their

institutions were before the import of arms. In their analysis, Auer and Meierrieks (2021) tackle the question of causality and control for it in their research design. The result is supported by previous research from Blanton (1999). Her analysis shows that arms imports correlate with human rights repression in developing countries.

A less highlighted consequence of IAT is the fiscal effect. The importers often acquire arms through credit financing or military aid from the exporter. Brzoska (2004) shows that indebtedness due to arms imports rose mainly during the Cold War. The import of arms was primarily financed through increases in debt and military aid during this period. With the end of the Cold War, the arms market turned more commercial, and buyers were required more and more to pay for arms transfers directly. This is mainly due to the collapse of the Soviet Union, which was financing the arms imports of its allies (see also Looney (1989)). Yeung (2010) gives insight into the fiscal effect for the exporter. His analysis traces the cost savings of the U.S. government if it exports arms. By lowering the unit costs through increasing the production base, the exporter has, as a consequence, a lower financial burden.

Therefore, this subsection shows that arms transfers carry *consequences* for both the importer and the exporter. These consequences can be particularly severe for the importer because institutional and financial stability can be negatively affected. These IAT studies have, so far, not distinguished between the transfers of new or old arms. However, old arms are qualitatively different, e.g., they can be imported quickly and in larger volumes as they are cheaper. The study of the consequences of IAT should subsequently be amended by an approach that differentiates between new and second-hand arms.

1.2.3 Patterns of New and Second-Hand Arms Transfers

While the discussed studies have delivered deep insights into the *determinants* and *consequences* of IAT, these seem to remain limited in their application to the category of SHT. To underscore the indications from the previous subsections that new and

old arms transfers are different, this section will consider the specific *patterns* across the two categories descriptively. The graphical analysis will reveal that SHT patterns are distinct in several aspects and that SHT need to be considered a category of its own. In addition, a look at the variation within the SHT category will further guide the development of the three research questions, which are addressed in the three papers of this dissertation. Due to the fact that there is very little research on SHT, the aim of this thesis is after Paper A has given an overview of the SHT *patterns*, to add with paper B to the debates on the *determinants* and with paper C to the debates on the *consequences* of IAT.

Figure 1.1 has already shown that SHT constitute a significant proportion of IAT. Figure 1.2 decomposes the data further. The graphic on the left shows the development over time of countries that only export new arms (yellow line), only export old arms (green line), or export both new and old arms (blue line). The graphic shows that around 20-25% of the countries over the whole period only export old arms. The post-Cold War period is dominated by countries that exported both new and old arms. Regarding the importer side, the graphic on the left, most countries do rely on new arms. Since the 1970s, the market has been dominated by countries that import only new arms but are closely followed by countries that import from both categories. The share of countries that only rely on old arms imports is relatively consistent, with a slight jump after the end of the Cold War. In sum, Figure 1.2 shows that for both the exporter and importer, there is different variation over time and across the two categories.

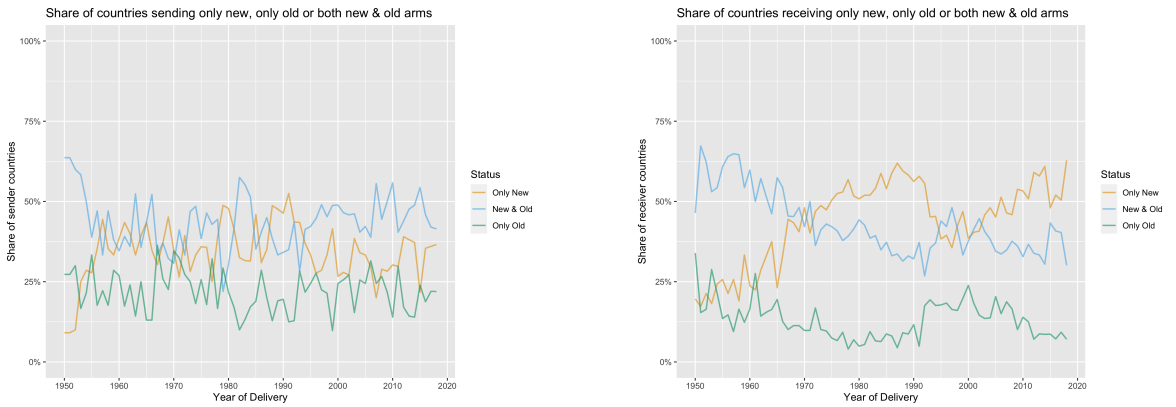

FIGURE 1.2: Variation of countries that export (left side) or import (right side) only new or only old or both new & old arms. Data is from SIPRI (2019a).

In addition, there is variation between the countries that send (or receive) the highest number of new and old arms. Figure 1.3 shows on the left the 20 countries which have exported the highest number of old arms and on the right the 20 countries which have imported the highest number of old arms during the Cold War (top) and after the Cold War (bottom) (see in Appendix A Figure A.1 for the top 20 overall exporters and importers). Regarding the largest senders of old arms compared to the largest overall senders in both periods, the top 10 are roughly the same except for The Netherlands. However, the countries that follow do differ for the old arms exporters in both periods, e.g., Portugal, Belgium, or Libya are usually not larger overall exporters but appear in the top 20 old arms exporters.

The variation that emerges for the top 20 old arms receivers compared to the top 20 overall receivers is even larger. While India is the largest overall importer in both periods, it is not in the top 20 old arms receivers. Countries such as Jordan, Chile, and Angola, which are among the top 4 importers of old arms after the Cold War otherwise, are not relevant in the general arms transfer market. In sum, Figure 1.3 reveals that old arms not only vary over time differently to new arms but also across countries that export and import arms.

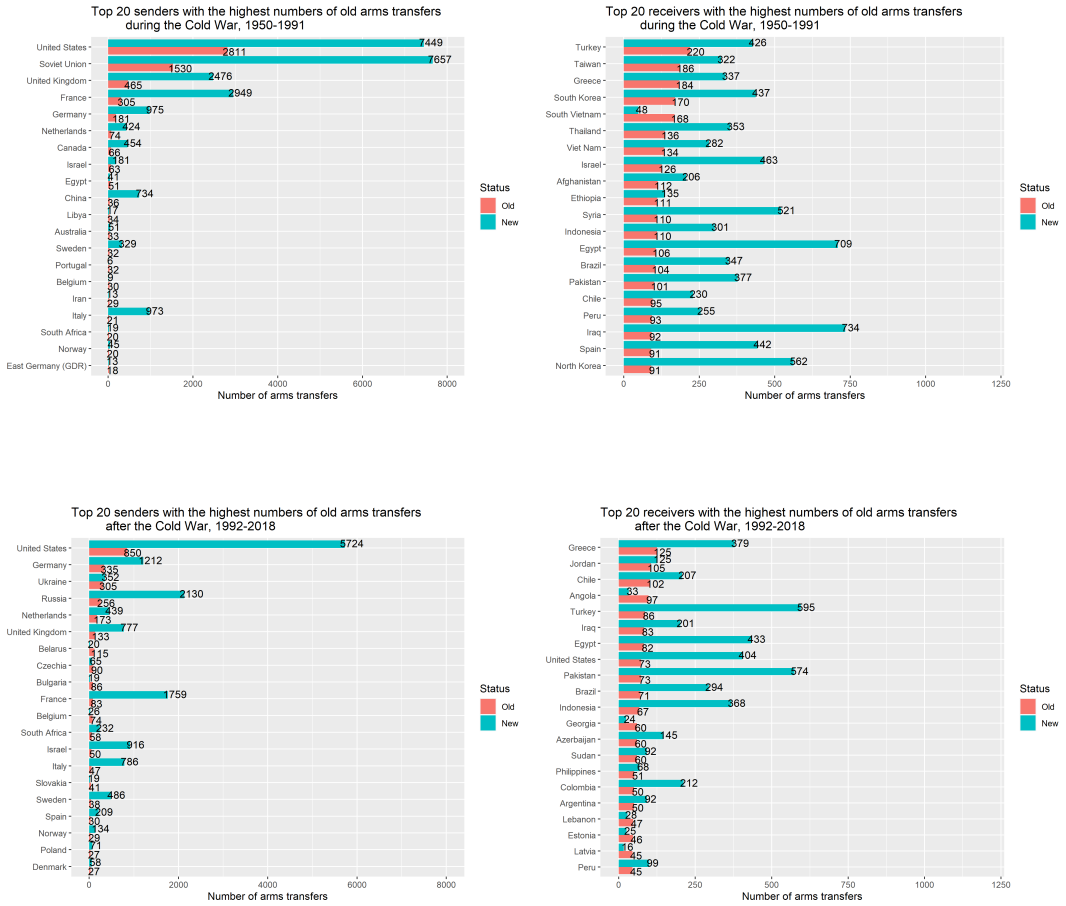

FIGURE 1.3: The top 20 senders (left) and receivers (right) during the Cold War (top) and after the Cold War (bottom) with the highest number of old arms exports and imports. Data is from SIPRI (2019a).

Therefore, Figures 1.2 and 1.3 call for a closer investigation of old arms transfers and show that it is necessary to consider them as their own category. Following the argument that SHT should be explicitly investigated, the question arises to what extent the findings from the IAT literature are a helpful starting point for understanding SHT processes. While IAT research has uncovered several explanatory factors, which drive arms transfers, these might differ in their explanatory power for SHT. To determine this, the aspect I investigate in paper A is to what extent traditional explanations from the IAT literature explain SHT *patterns*. This will shed further light on this blind spot within IAT research.

Due to the fact that SHT has, so far, not been analysed extensively as a category of its own, this dissertation aims to deliver broad, valuable insights that will guide further research agendas on SHT. Following the example from IAT literature, paper B will focus on the *determinants* and paper C on the *consequences* of SHT. Research has separated between *determinants* and *consequences*. Regarding paper B, the question arises of what *determines* a country's decision to lower its existing stock of arms. In general, arms provide security for a nation to defend itself against external or internal threats. As these weapons exist and can be employed directly, there are potential security implications if these arms stocks, otherwise called "old" in this dissertation, are reduced.

Of course, the export of arms from the existing stock is not independent of new arms. For example, arms stocks could be reduced as a delivery of new arms is expected. Also, the otherwise highly relevant production factor could still apply indirectly in the form that, if a country is a producer, there might be competition between new and old arms exports. The government could decide to support domestic production instead of selling old arms stocks. Still, most countries are not even producer countries but potential old arms exporters. This notion is supported by Figure 1.2, left graphic that a substantial amount of countries only export old arms. In addition, Figure 1.1 reveals that old arms exporters differ from new arms exporters. Therefore, paper B will study under which conditions countries modify their security level, determining a reduction of their stock of arms.

Paper C will look at the *consequences* of old arms on the importing country. While paper B looks at SHT as an outcome paper C considers the effect of old arms. This will add a further aspect to broaden the debate on SHT to not only consider old arms as a result but also as having implications. Generally, if a country imports arms, this impacts its security structure. This can set various processes in motion, e.g., escalating arms races, increasing domestic stability, or enabling conflict. Regarding old arms, the fact that they can be acquired from almost any country in the world

and not only from producers, plus they have no production time, could influence these processes differently compared to new arms. Due to the fact that there is substantial theoretical and empirical evidence regarding conflict to build on, the third paper will consider the impact of old arms imports on conflict occurrence.

In sum, this subsection has traced the SHT variation over time and across exporter and importer countries. Compared to new arms transfers, the descriptive analysis has shown that SHT are different. This calls for further investigations, which treat SHT as their own category. Given the IAT literature from the previous subsection, a research agenda can be derived for the three papers of this dissertation. This agenda will be outlined in the next section.

1.3 The Research Agenda of the Dissertation

Research on IAT can be broadly distinguished between tracing *patterns* and studying *determinants* and *consequences* as the previous section has shown. The three papers of this dissertation will contribute to each of these strands. The next subsection will first connect the three papers and give insight on the overall SHT debate. The subsequent subsection will present the three papers separately.

1.3.1 Systematizing SHT Research

The approach of this dissertation to address three different strands of IAT research is to demonstrate that SHT research needs to be carried out to improve the overall knowledge of IAT processes. As SHT research has been quite limited, so far, the dissertation will focus on separate aspects of SHT, which stand in connection with each other but deliver a wide overview on the topic. As shown in Table 1.1 the first paper focuses on the *patterns* of old and new arms transfers. There are traditional explanations for IAT in the literature and the paper tests the assumption, derived from the developed explanatory framework, that the mechanisms of old arms transfers

must differ. The second paper has a focus on the *determinants* debate and relies on external security guarantees in the context of regime security debates to explain old arms exports. The third paper focuses on the *consequences* of old arms. It considers, based on existing research, the impact of old arms imports on conflict.

TABLE 1.1: Overview of the three papers of this dissertation.

	Paper Focus	Explanatory Franework
Paper A	Patterns of new & second-hand arms	Separate SHT mechanism
Paper B	Determinants of SHT	External security guarantees
Paper C	Consequences of SHT	Time, cost & reliability characteristics

What connects the three papers is that they all develop their research agenda based on the different debates of the IAT literature. Paper A shows that, in addition to breaking down the arms transfer patterns into, e.g., types of weapons or capabilities there is the category of second-hand arms, which differs in its variation to new arms. Paper B introduces the aspect of the arms stock which differs from the usual producer perspective that dominates IAT literature. Based on this approach the exporter logic should differ between new and old arms. Paper C stems from the literature on conflict onset studies, which discusses various perspectives for why arms imports could impact conflict risk.

The actor focus in the three papers vary. Paper A considers the transfer dyad of an exporter and the importer. For both sides there are aspects that can be subsumed under supply and demand, or pull and push factors. The question of the paper is what explains cases where the arms transfer between sender and receiver is an old

arm. Paper B looks at the sender side, which determines if it reduces its old arms stock and exports old arms. The process the paper analyses is mainly the internal decision-making process of the sender and excludes the receiver side. The focus in Paper C is in regard to the effect on the actor that imports arms. The consequence for the actor itself is the central question.

In addition, a factor, which all three papers contain is that the old arms aspect is put in context with its possible relationship and interaction with the new arms category. In Paper A, the comparison is central but also in Paper B the export of old arms could be contingent on new arms and therefore added to the research model. In Paper C the constructed model also contains the imports of new arms as these might simultaneously affect old arms imports and conflict.

Moreover, the empirical approach of the three papers is to apply panel data analysis and all papers employ the data from SIPRI (2019a). To have access to data, which varies over time as well as over countries (time-series cross-section) means that the reliability of the results are high. The large-n dataset on which this dissertation relies on allows to be highly confident in the posited relationships.

In sum, the three papers all focus on a SHT aspect and deepen our knowledge of IAT. The rely on previous research and draw on the same arms transfer data. The three aspects which are studied are tested and put into the context of the existing literature. Taken together, a theoretically and empirically comprehensive picture on SHT emerges from the three different papers of this dissertation. Their implications are similar, in that they all reveal a need for policymakers to adopt a more nuanced view. If previously the attention was too much on the producers it should be shifted more on the observation of these second-hand arms flows. Doing so might prove essential in predicting and preventing conflict.

1.3.2 Summary of the Three Papers

Paper A: Mapping Second-Hand Arms Transfer Patterns

The first paper tests to what extent the traditional explanations in IAT literature apply to the observed SHT *patterns*. IAT research has identified key determinants of international arms transfers. Therefore, this paper derives and tests new hypotheses to what extent these traditional explanations of arms transfers have the same impact on the probability of second-hand arms transfers compared to new arms transfers. This will further support the notion that SHT should be studied as a separate category while delivering already first insights into how SHT are shaped.

The paper introduces the traditional IAT explanations. For each traditional explanation, an argument will be developed why and to what extent a different mechanism is expected for SHT. For example, the high fixed costs factor of arms production does not exist for old arms. Therefore, the fact that a country is wealthy should have a more considerable impact on the probability of exporting new arms compared to old arms. A different mechanism is also expected for the transfer within an alliance. Old arms often can only be sold for a mere fraction of the original price even though the arms are still combat-ready. New arms are expensive, and demand is not high enough to transfer these simply within the alliance. The inside alliance transfer option for old arms is subsequently more attractive than the inside alliance transfer option for new arms.

At the same time, some traditional explanations will follow the same mechanism for both new and old. For example, the effect of political ideology should be similar. If an export does not want to sell arms to human rights-abusing countries, this will apply to both new and old arms. Overall, the results show that, indeed, in some cases, the traditional explanations divert in their impact of new and old arms. The most relevant result is that a conflict in a receiver country strongly drives the import of old arms compared to new arms.

The paper contributes to the IAT literature by formally introducing SHT as its own category through mapping the variation in *patterns*. It develops the concept of SHT,

and the theoretical contribution includes the delineation of the extent that the traditional IAT explanations are similar in their explanatory power for SHT. Empirically, the dyadic exporter-importer perspective with a time-series analysis provides a reliable, comprehensive picture that allows to compare the new and old arms categories. It supports the notion that SHT should be studied on their own. Especially the result that conflicts drive old arms demand has practical relevance. A more differentiated arms control is required if mechanisms differ for new and old arms transfers.

Paper B: Second-Hand Arms Transfers: Foreign Troop Presence as an Export Factor

Paper B focuses on the *determinants* of international transfers of second-hand major conventional weapons. Specifically, it considers the exporter side of old arms. IAT literature usually focuses on one side exclusively to gain the most insight possible. Starting from the security actor motive, the paper develops an approach from a regime security perspective. A country decides in a "guns-versus-butter-problem" fashion how it allocates its budget between civilian and defence goods. Based on conflict studies, this paper introduces external security guarantees in the form of foreign troop presence as an explanation for old arms exports. Countries optimise their security and partly substitute their domestic arms stock with external security guarantees. This results in the export of old arms.

Empirically, the analysis provides the first evidence that if the security providing old arms stocks are substituted through, in this case, external security guarantees, the old arms are exported. The theoretical contribution is that old arms require different explanations, as arms stock reduction has different regime security implications than the export of newly produced arms. Overall, the paper further supports the dissertation's notion that old arms exports require different explanations and delivers the first indication regarding the *determinants* of old arms transfers. For policymakers, the implications could be that when countries want to host foreign troops

or receive some other form of external security guarantees, they must agree to arms export controls by a third party. This can ensure that due to foreign troop presence, the reduction of arms stocks does not lead to exports to, e.g., human-rights-abusing countries. Therefore, the international flow of arms could be controlled.

Paper C: Conflict Onset Causes: the Role of Second-Hand Arms Imports

The third paper of this dissertation focuses on the *consequences* of international transfers of second-hand major conventional weapons. The paper asks if old arms imports impact conflict onset risk more than new arms imports. Up until now, it has been contested in IAT research whether arms imports drive war. The main issue is to account for the causal relationship if arms imports drive conflict or if conflict drives arms imports. Following established research, the paper develops a theoretical framework for why old arms imports specifically are expected to have a larger impact on conflict probability compared to new arms imports.

Three explanations are derived from existing theories, and I argue that due to specific old arms characteristics, these explanations apply even more strongly to why old arms imports have a larger impact on conflict onset than new arms imports. The three explanations are time, cost, and reliability. This means, in short, that old arms, compared to new arms, are delivered faster, are instantly available, and because they are cheaper, can be bought in larger volumes, plus are more reliable in their ease of use and delivery should relate them to conflict onset risk more strongly. The result we see is that an inflow of old arms makes conflict more likely, while the imports of new arms do not have a significant effect at all on conflict onset.

Empirically, the paper follows an instrumental variable approach in order to leverage exogenous variation. The causal relationship is central to consider as conflict could also impact the import of arms. Controlling for this is therefore paramount. In sum, the third paper is able to deliver the first insight that old arms import characteristics lead to a different outcome compared if only arms imports, in general, were

considered. Policy-wise the results call for, e.g., an early warning system when an already fragile country shifts its arms imports to mainly old arms imports. This could then activate resilience and peace-building measures.

TABLE 1.2: Categorisation of paper A, B and C

	Determinants	Consequences
Research on IAT	e.g. Brzoska (2004) Bove et al. (2018)	e.g. Craft and Smaldone (2002) Pamp et al. (2016)
Research on second-hand arms transfers **Paper A**	**Paper B**	**Paper C**

Table 1.2 categorizes paper A, B and C within the existing research of international arms transfers. Table 1.2 visualizes how the two papers each contribute to a strand of arms transfer literature, "determinants" and "consequences". Paper A relates to this categorisation in that it establishes the bottom row "research on second-hand arms transfers" by showing that old arms transfers differ in a meaningful way. This raises questions of which two in regard to the determinants and the consequences will be answered in this dissertation.

1.4 Conclusion and Outlook on Future SHT Research

So far, the category of second-hand arms was not a relevant part of the debate regarding international arms transfers. This dissertation aims to introduce SHT as a separate category, contribute to three strands of IAT research, and demonstrate

where the prevailing logic needs to be amended to fit SHT dynamics. The dissertation seeks to advance the IAT debate by giving evidence that old arms have different characteristics compared to new arms, which impact the transfer dynamics differently. All three papers aim to account for these variations while giving a broad first insight.

While the first paper focuses on establishing the argument that old arms require separate explanations, the other two papers follow the usual approach from the IAT literature and focus either on determinants or consequences. While the discussion from subsection 1.2.1 shows that IAT literature also considers economic and political actor motives, papers B and C focus more on the security actor motive. This leads subsequently to a need to establish a future research agenda for SHT, which also considers these two aspects as well as network and formal models.

Specifically, an in-depth analysis of the economic factors of second-hand arms transfers could uncover other arms transfer determinants. For example, one could consider the relationship between a country's military budget and the decision on how to allocate the funds between new and old arms imports. The political motive could also play out differently between new and old arms. For example, arms producers are often heavily criticized, and these sales may be more under scrutiny than governments deciding to lower their arms stocks. Media analysis could reveal whether these exports are discussed differently or receive different forms of attention.

Also, network analysis could be insightful if, e.g., friend-of-a-friend relationships are less robust for old arms transfers because they might be less regular. Another question might be if an old arms transfer precedes new arms transfers to build trust. The network that results over time might be then due to old arms transfers.

Future studies on the consequences of arms transfers could also look at the financial effect on the exporter. Beraud-Sudreau (2010) claim that there are indications that France limits old arms exports to bolster their domestic arms industry. Decomposing the data into countries that produce and those which do not and then analyzing

if we see different export patterns could be worthwhile. Furthermore, an idea could be to compare if old or new arms impact conflict outcomes. Familiarity and reliability could potentially outweigh the benefits of modern arms when used in a conflict.

These are some initial ideas for a future research agenda on second-hand arms transfers. In addition, future SHT research should focus on improving the theoretical IAT approaches. This framing paper has shown that IAT usually focuses on single aspects that determine transfers or that have an impact. Advancing the development of theory and expanding the explanatory frameworks from this dissertation are needed to understand and interpret what is observed.

Ultimately, international arms transfers will remain a key factor that shapes the behaviour of nations and structures global power distribution. The boundaries of what defines a weapon will likely continue to shift in light of, e.g., dual-use capabilities, developments in artificial intelligence, and cyberspace. However, wars are still predominantly fought through heavy gear, presumably for many years. The current war in Ukraine has once more made this clear. Therefore, the relevance of understanding arms transfers, specifically second-hand arms transfers, has become painfully apparent to the public. As this dissertation has shown, second-hand arms transfers are a highly relevant factor in these conflicts and represent an essential role in the security considerations of nations. Thus, I hope that this dissertation can contribute a small part to a better understanding of these transfers.

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Chapter 2

Mapping Second-Hand Arms Transfer Patterns

Abstract

So far, the implicit assumption of the arms transfer literature is that the underlying drivers of transfers of newly produced arms and second-hand arms are the same. Nevertheless, descriptive empirical patterns point out that the market for second-hand arms dramatically differs. The research question therefore is: what explains second-hand arms transfers compared to new arms transfers? As this paper is the starting point for papers B and C, I focus on the key drivers of international arms transfers identified by the literature. So far, no attention has been paid if those traditional explanatory factors diverge in their mechanisms for old arms transfers. Therefore, this paper derives and tests new hypotheses to what extent these traditional explanations of arms transfers explain the variation of old and new transfers. I argue that the mechanisms differ due to the idiosyncratic nature of second-hand arms e.g. the export of second-hand arms is not limited to the few arms-producing countries and transfers have a by far shorter delivery time. Drawing on data from the Stockholm International Peace Research Institute (SIPRI), I test the claim that the traditional explanations diverge for old arms relative to new arms transfers. Taken together, my approach sheds light on a blind spot in the security studies literature by systematically theorizing second-hand arms transfers patterns and testing these claims. The research also enables policy-makers to develop a more nuanced approach toward arms control.

2.1 Introduction

In the ongoing Yemen war, F-15 fighter jets are employed by Saudi Arabia, F-16 fighter jets by Jordan, and M109 Howitzer tanks by the United Arab Emirates (Wapenhandel, 2015). While all these arms are US-made, they share another characteristic: they were acquired as second-hand arms transfers from the Netherlands. A recent UN report states 8.700 conflict-related incidents in Yemen from July 2016 through June 2017, with coalition airstrikes continuing "to be the leading cause of civilian casualties in the conflict" (UNHRC, 2018, p. 7). This example is one of many where transfers of second-hand arms turn out to be a relevant factor in conflict-prone regions. However, as of yet, the mechanisms behind transfers of major conventional weapons (MCW), which were not transferred as newly produced MCWs, has never received further scholarly attention.

The paper starts at this point: there is no broader research on the topic of second-hand transfers if marked differences can be determined between the mechanisms behind transfers of new and second-hand arms - even though a small but consistent share of around 10% of arms exports is second-hand. The definition of second-hand arms exports is that the exported weapon is not newly produced for export.[1] Subsequently, a few arms-producing countries, such as the U.S., France, and Germany, can sell their old, domestically produced arms stock. However, any country without an arms industry can also export second-hand arms.

Evidence on potentially distinct second-hand arms transfer (SHT) processes is scarce. The limited literature on SHT already gives an impression of relevant and different from newly produced arms, factors which might play a role. So far, only case-specific reports or studies of policy impacts deal with this subject. Additionally, these accounts remain bound in time and space. For instance, Wezeman and Wezeman (1996) describe the partially carried out disposal plans of Dutch surplus arms to modernize the army. However, since then, there has been no investigation on

[1] The terms "second-hand" and "old" will be used interchangeably.

the underlying drivers of Dutch SHT (see Davis and Schofield (1997) for a similar report on the UK). Holtom (2011) gives an account of the Sub-Saharan receivers of second-hand Ukrainian arms but does not investigate further the drivers behind it. Beraud-Sudreau (2010) reports that France limits its SHT to bolster sales of newly produced arms. The most encompassing study of both the export and import side is a non-published paper from Beraud-Sudreau and Holtom (2013), who examine the consequences of the defense reform in Europe on SHT. Still, their focus is only on one point in time and is EU-centric. This literature, therefore, serves as a valuable avenue for the theoretical approach to SHT as it proposes a few explanations, such as modernization pressure and reforms, but is limited in scope.

Considering the existing literature on arms transfers, the presented paper tests to what extent the traditional explanations of international arms transfers can explain the old arms transfer patterns. The question, therefore, is: what explains second-hand arms transfers compared to new arms transfers? What do the mechanisms behind second-hand arms transfers look like? I conceptualize sender countries, based on conditions, as the decision-makers who decide to send old, new, or no arms. Based on certain conditions, the receivers have a choice between old, new, or no arms. The investigation will show that indeed, e.g., wealthy countries will have a lower share of old arms imports.

Further, the results reveal a new research avenue for conflict studies: in the case of a conflict, a country will increase its share of old arms imports. While this is logically understandable, this dimension has been, to my knowledge, not yet investigated in the area of conflict studies. The paper has two main contributions. First, it adds to arms transfer research as it uncovers an important but neglected element. Second, it is policy relevant because only if such nuances are known effective arms control can be implemented.

To answer these questions, I proceed as follows: in the next section, I delve into the

intricacies of what is understood to be old arms. With maps plots, I trace the variations between old and new arms transfer patterns. I also discuss how arms senders make decisions for exports and receivers make choices for imports. The following section lines out my argument on how the traditional explanations diverge for old arms compared to new arms transfers. In order to test the newly derived hypotheses, the data and method section describes the sources I use in my analysis, which is executed with a logit model. The results section discusses if the claimed mechanisms have to be refuted or do fit, and the paper ends with a summary section.

2.2 Tracing SHT Patterns

The need for arms can be analysed within the three prominent IR theories realism, liberalism, and constructivism. Realists see states as the primary actors in an anarchic structure (Morgenthau (1978), Waltz (1990), Mearsheimer et al. (2001)). To have power ensures the state's survival. Power is derived from military capabilities - such as arms stocks (Schimmelfennig (1994), Schweller (2004), Meijer et al. (2018)). Liberalism emphasizes cooperation, institutions, and shared norms (Stein, 2008, p. 204). Efficient security cooperation (e.g. arms transfers) with similar regimes would result in mutually beneficial outcomes (Willardson and Johnson (2021), De Soysa and Midford (2012)). The constructivist logic, in short, emphasizes the social construction of interest, ideas, cultures, and identities (Wendt (1995), Finnemore and Sikkink (1998)). Arms transfers from a democracy to an autocratic leader have a different symbolic meaning compared to arms transfers among democracies (Willardson and Johnson, 2021).

In addition, further important theoretical accounts describe "the key to understanding the apparent permanence of the arms trade is the powerful constellation of vested interests that support it: 'supply push' from *producers*, and 'demand pull' from consumers." (Buzan and Herring, 1998, p. 34) (emphasis added). Similar, (Krause, 1995) argues that the transformation of the sphere of international politics

is connected with how states perceive "the role of arms *production* and the arms trade in guaranteeing wealth, power and victory in warfare" (Krause, 1995, p. 1) (emphasis added). What these scholars have in common is that they are exemplary for the arms transfer literature, which assumes - at least implicitly - that an arms transfer stems from an arms-producing country.[2] However, this may not necessarily be the case.

This fact, that a substantive number of non-producers export arms, can be derived from the world maps in Figure 2.1. Also, Figure 2.2 shows variations between the importers of old and new arms. Before diving into the analysis of the variation across the maps, first, a short manual on interpreting the maps. The data for the maps comes from SIPRI (2019a), who track all transfers of old and new major conventional weapons (see discussion of the dependent variable for more information). Figure 2.1 shows only the exporters of arms and Figure 2.2 shows the importers of arms.

The interpretation is as follows. Suppose country i exports to country j in year t an export is counted. If country i exports to country z in the same year t, another export is counted - the number of exports is two in total for country i. Considering the top left map in Figure 2.1 the country with the highest number of old arms exports during the Cold War is the U.S., with 979 exports. The darkest shade represents the top quartile of sender countries of old arms during the Cold War. The U.S. is followed by the Soviet Union (508), U.K (274), France (204), Germany (102), Netherlands (48), Canada (47), Egypt (42).[3] The bottom quartile, in this case, consists of countries that had only one single old arms export. The white shade represents no export. The same logic applies to the other maps - the darkest shade representing a category's top 25 senders (or receivers). Therefore, the universe of cases is all existing countries

[2]Krause distinguishes between first Tier producers, who are innovators and produce any type of arms second Tier producers, who produce a wide range of arms but do not innovate much and third-tier producers, who produce a limited range of arms types and rely on key components from a higher-tier producer.

[3]As a comparison: the export of new arms during the Cold War has the U.S. at the top with 1750, France (1274), U.K (1092), Soviet Union (871), Germany (618), Italy (589), Canada (365).

u in year t. A country i can have between zero export numbers up to $u - 1$ export numbers in year t.

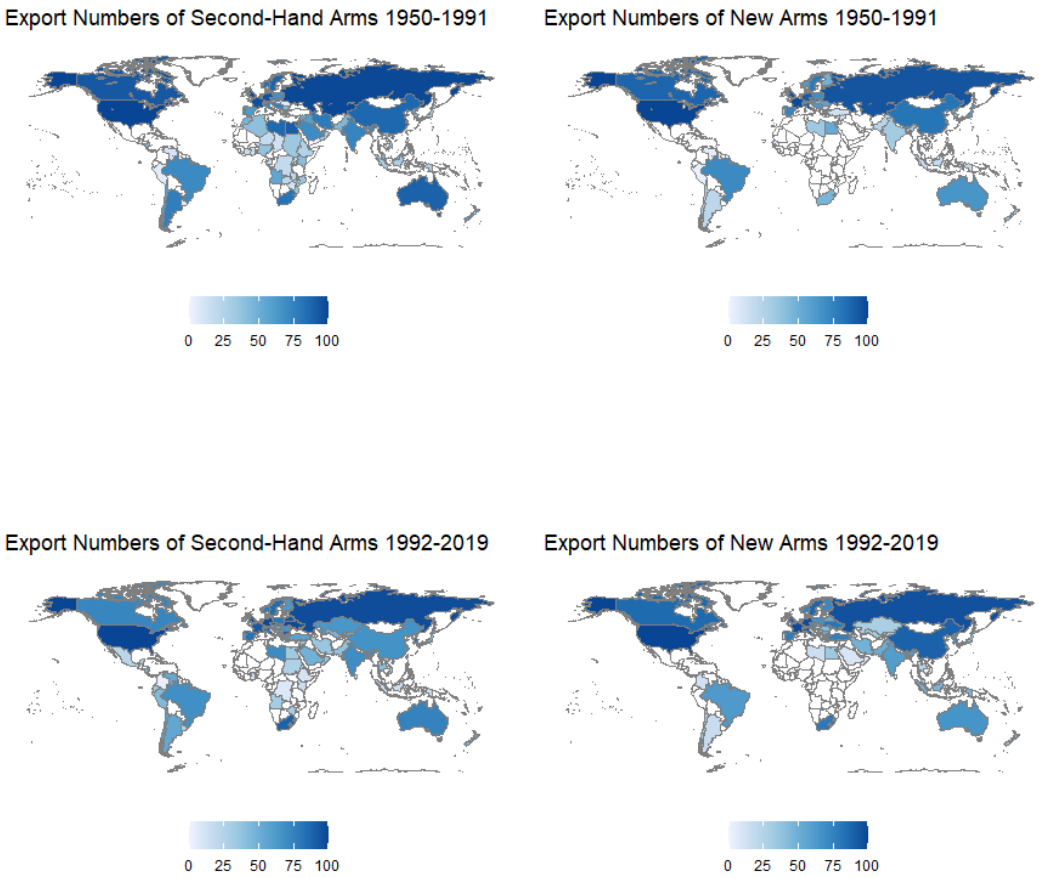

FIGURE 2.1: Exporters of old (left side) and new (right side) arms during the Cold War (top) and post-Cold War (bottom) period. The shades represent quartiles with the largest exporters in the highest quartile. Countries in white record no transfer. Data is from SIPRI (2019a).

Starting with analysing the old and new arms exporters in Figure 2.1, I have split the maps between the Cold War (top) and post-Cold War (bottom) periods and old (left) and new (right) arms transfers. The end of the Cold War represents a structural break, especially for the arms transfer market (see Thurner et al. (2019)). Analytically this makes sense because the successor states from the Soviet Union represent

a major export source, as the map shows. In addition, comparing the exporters of old arms across the two periods, it is striking that African countries were, during the Cold War, more active old arms exporters compared to the post-Cold War Period. Such a contrast cannot be seen for the exporters of new arms during the two periods. This hints at how static the producers of arms remain.

Concerning the analytically interesting point about the exporters of old vs. new arms during the Cold War, we see that the biggest exporters of new arms also export the most old arms. However, the exporters of old arms are more diverse and include several African countries. Also, the shades vary, and more countries in Figure 2.1, which are located in the southern hemisphere, appear in higher (=darker) quartiles. For the post-Cold War period, a similar picture emerges, but the difference between new and old export numbers appears less strong.

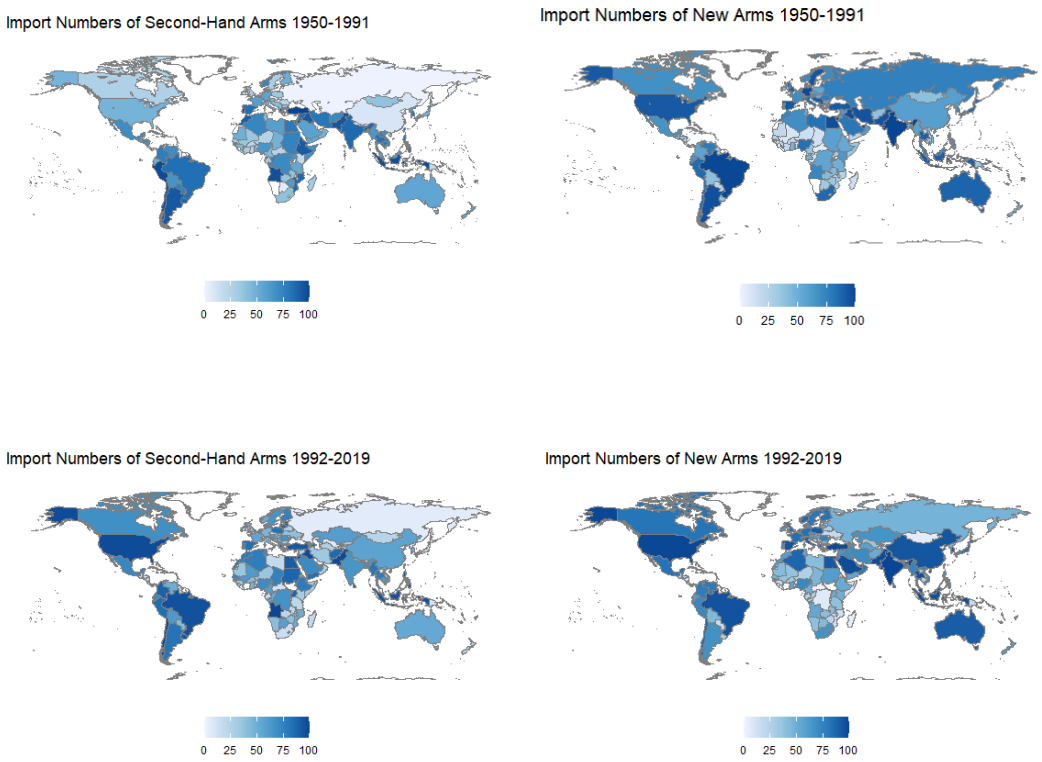

FIGURE 2.2: Importers of old (left side) and new (right side) arms during the Cold War (top) and post-Cold War (bottom) period. The shades represent quartiles with the largest importers in the highest quartile. Countries in white record no transfer. Data is from SIPRI (2019a).

Figure 2.2 also shows variation between countries that import new and old arms. During the Cold War, both new and old arms were in demand from all countries. However, old arms receivers are more strongly represented in the southern hemisphere, especially the African countries. Latin American countries considerably import new and old arms. During the post-Cold War period, the new arms imports are focused in Western countries in addition to India and China. Second-hand arms imports are, again mainly focused in African countries, followed by Latin America. In sum, this mapping exercise has helped us to see for the first time that there is considerable heterogeneity between the patterns of who sends and receives new and old arms.

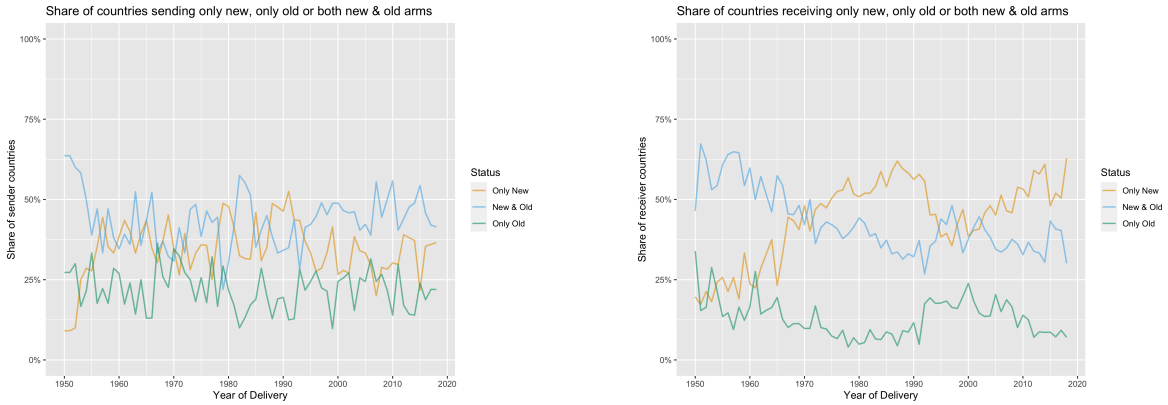

FIGURE 2.3: Relative development over time of countries sending (left) or receiving (right) either only new, new & old or only old arms. Data is from SIPRI (2019a).

In order to give some more insight into the variation over time Figure 2.3 shows on the left side that the share of countries that exported only old arms is considerable and moves plus or minus around 10%. Also, a substantial number of countries exported both new and old arms. Figure 2.3 on the right side shows the share of countries that imported only new or old or both types of arms. Similar for exporter and importer only a maximum of half of the exports and imports are only new arms transfers and the other half contains old arms transfers. For both the sender and receiver, a sharp increase can be seen after the end of the Cold War. This increase is primarily due to the successor states of the Soviet Union, who flooded the market with surplus weapons. However, second-hand transfers have, to a varying degree, always represented a substantial share of the arms trade since the end of the Second World War.

What explains this variance between different origins and destinations for new and old arms over time? I conceptualize the sender *decision* and the receiver *choice* as a "new or old arms" question. The sender's decision is conditional if the country is a producer or not. If a sender only has old arms to export, it decides if it wants to sell them or not. The sender is ultimately the one who takes action and makes

the decision if it exports or not. The receiver choice is conditional to finding an export partner which offers arms, even if they accept old arms. The receiver might have several alternatives as a choice and always includes the option for choosing no import at all. The decisions and choices of old vs. new arms are made on an individual level and based on individual characteristics. Besides these individual decisions and choices of the sender and receiver of balancing old and new arms transfers, their mutual, dyadic relationship also defines the patterns in the transfers of old and new arms. To distinguish this decision and choice level for new and old arms transfers is the novel idea in this paper. My focus is, therefore, on the driving forces that favour old arms over new arms and the relationship of this ratio. In the next section, I discuss the traditional arms transfer explanations, which also affect old arm transfers but through different channels.

2.3 Explaining SHT

My central argument is that senders and receivers make decisions and choices across the two types of arms. Due to the idiosyncratic nature of second-hand arms, one driver can lead to favouring old arms over new arms or vice versa. These different drivers together, as a consequence, impact the share of old weapons transferred relative to new arms transfers. In the arms transfer literature, several traditional explanations have shown to influence the international arms trade. So far, the logic, as stated by the research literature, of any arms transfer rests mainly on the economic and political strategic supply decisions of a producer country and the demand by importing countries, who depend on the producer. While this research has delivered broad insight into arms transfers *per se*, my argument is that a differentiated perspective, which carves out the mechanisms that lead to the decisions and choices for or against old arms, is needed to understand arms transfers as a whole. To address this idiosyncratic nature of second-hand arms, I rely on the existing arms transfer literature as a starting point to develop my argument. The traditional explanations

will guide the debate regarding the drivers that impact the sender's decision and the receiver's choice for or against old arms.

2.3.1 The Supply Side

The supply side of arms transfers can be traced back, to a large extent, to the pressure on the producer to exploit economies of scale. Economies of scale represent a decrease in the average costs when increased output levels lead to lower unit costs.[4] The observed mechanism is via the high fixed R&D costs, which amortize through rising unit production. By enlarging production and exports of, e.g., a tank series, the falling unit costs lead to a lower price. Due to the government's fixed demand, its defense spending is lowered. Through more competitive prices, the firm can increase exports and gain profits as well as market shares (see Harkavy (1994), Anderton (1995)).

To overcome these high fixed costs, which hinder the initial establishment of a defence industry, usually, a country has, on the one hand, a large economy to support production (Levine and Smith, 1997). Such countries would be, e.g., the United States, China, Germany, and the United Kingdom, which constitute top arms producers. On the other hand, Smith and Tasiran (2005) and Smith and Tasiran (2010) give evidence that with growth in military expenditures, the propensity of creating a domestic arms production rises, with Russia being a prime example. Research on arms exports has, thus, determined that either wealthy and/or militarized economies are more likely to be producers and, therefore, exporters of arms.

The posited question is now if these two economic motives of the exporter, wealth and military expenditures, are plausible explanations for the decision to send old arms or if they are only able to explain newly produced arms exports. Previous research shows that a large economy is often accompanied by a domestic defence

[4]Typical examples for economies of scale are firms with high entrance barrier costs, e.g., battery factories, aluminium or iron foundries.

industry. This industry is under pressure to exploit economies of scale by pushing new arms exports. Possessing old arms does not create such similar export pressure. However, being a wealthy economy, one can afford a high stock of arms per se. Having such a large stock leads to being able to sell off old arms, which are not needed anymore - but without the pressure. The decision mechanism is different to new arms transfers due to the lack of economies of scale pressures for old arms but goes through the ability to afford to possess arms. Subsequently, there should be a positive impact of wealthy countries deciding to sell their old arms surplus stock. This effect might be mitigated for wealthy countries that are producers, who want to limit old arms export to sell new arms, but the positive effect on the old arms transfer share should prevail. Therefore, the first hypothesis is:

> *H*1: A wealthy sender country leads to an increase of the old arms transfer share.

Regarding the argument for the economic motive of defence spending of a potential exporter of arms, I posit: on the one hand, with higher defence spending, the old arms, which are not needed anymore, can be sold off to generate revenue. On the other hand, a high defence budget could also mean that there is an urgent need for arms, and any kind of weapon, even old ones, is indispensable and will not be exported. Still, even if there is a threat, indicated by high military spending, if there is an export, it is expected to be an old arm, not new arms export. New arms are likely to be kept due to their advanced technology, their share of the transfer volume decreases compared to old arms, and the hypothesis is:

> *H*2: High military spending by the sender leads to an increase of the old arms transfer share.

Besides the economic side discussed above, research on arms transfers has stressed the political motive of the supply side's decision to whom to export. A government that sanctions arms transfers runs the risk of potential domestic backlash, especially if the recipient country is a non-democratic regime. Indeed, there is evidence in the literature that exports are impacted, to a limited extent, by such human rights concerns. Blanton (2005) shows that only in the post-Cold War period human rights and democracy level had a meaningful impact in determining the eligibility of a country to receive arms from the U.S. (see Perkins and Neumayer (2010), Akerman and Seim (2014), Schulze et al. (2017)). Martínez-Zarzoso and Johannsen (2019) were able to determine that political factors such as democracy levels play a more prominent role in the probability of a transfer and a lesser role in the amount transferred.

The implicit assumption of the literature that the mechanism of political ideology on arms transfer works similarly for both new and second-hand arms transfers is also analysed in the presented paper. The producer will always prefer an ideological close receiver to a less close one. A nation adhering to human rights concerns will tend to export to countries with similar values. At the same time, countries, be it producers or only exporters of old arms, with low levels of democracy and human rights concerns will rather not be concerned by the political situation in the receiver country. Therefore, the assumption is that ideology's effect is the same regarding transfers of new or second-hand arms because belief and value systems are expected to play out independently of the type of good. The hypothesis is as follows:

> *H*3: There is no effect of distance in ideology of a sender-receiver dyad on the old arms transfer share.

There is also the dyad of the exporter and importer itself, which can carry a security motive in the form of alliances, as research has shown (Yarhi-Milo et al., 2016).

Exporting to and importing from an allied country raises the security level of both partners. For one, the exporter supports a country that, in case of a conflict where the mutual defense clause is raised, is well endowed with military equipment that is even compatible with its own equipment. The importer's security is also raised by signaling its commitment to the alliance through such imports. If it imported from somewhere else, it might lower its chances that the ally would give broad military support in the case of conflict. Also, having alliances Morrow (1993) argues that countries have to choose how to combine domestic armament (internal security balancing) and forging alliances (external security balancing). Martínez-Zarzoso and Johannsen (2019) show in their analysis that such military pacts increase the probability of a transfer.

Combining the research findings from the literature, an overall positive effect of an alliance on transfer probability can be discerned. Transferring to an ally new arms as well as old arms will raise the security levels of both. What effect alliances have on the export share of old arms compared to new arms remains an open question so far. The mechanism for a positive effect for alliances, I argue, is that, for one, surplus arms are dead weight and a quick transfer to an allied partner is an easy and cheap way to get rid of them while making revenue and raising security levels. Secondly, old arms often can only be sold for only a fraction of the original price even though the arms are still combat-ready. New arms are highly expensive, and demand is not high enough to transfer these simply within the alliance. The inside alliance transfer option for old arms is subsequently more attractive than the inside alliance transfer option for new arms.

> *H*4: There is a positive effect of an alliance of a sender-receiver dyad on the old arms transfer share.

One more mechanism where the supply side is highlighted is path dependence. Transfer relationships over the previous years should inform transfers in year t. If

an old arms transfer was successful, a trusted relationship should make another transfer more likely. Also, exports of old arms could take place in several tranches. Consequently, the hypothesis is:

> *H*5: There is a positive effect of the path dependence of a sender-receiver dyad on the old arms transfer share.

The last point concerns the endogenous relationship between old and new arms transfers. Pamp et al. (2021) have shown an interdependency between arms transfers. This should also be the case when an exporter country has received new arms. After new arms replace outdated arms, this surplus can be reduced. This aspect is important to include because, in addition to a demilitarisation logic leading to old arms exports, also the replacement of old arms through new arms can result in exports. Therefore, the final hypothesis is:

> *H*6: Imports of new arms increase the old arms transfer share.

2.3.2 The Demand Side

Regarding the receiving side of arms transfers, the importer is not able to overcome the high fixed costs of industry entry but does profit from the economies of scale problem of the producer to push sales (Levine and Smith (1997), Garcia-Alonso and Levine (2007)). Brzoska (2004) shows that less financially well-off customers, specifically after the Cold War, were less likely to receive arms. However, being a financially stable country makes arms transfer and credit financing more likely. Consequently, there is a strong economic motive for the importer to be perceived as stable. The impact of the importer's financial prowess on the likelihood of receiving arms is not only in absolute numbers but also depends on its economic growth

rate. Smith and Tasiran (2005) and Smith and Tasiran (2010) give evidence that the propensity to import arms rises with growth in income and subsequent higher military expenditures. This relationship is non-linear, though, and arms imports fall at some point with rising income as a domestic arms industry is developed.

For an increasingly wealthy economy, the assumption can be made that old arms are preferred less. The need to rely on second-hand arms, whose lifespan is also limited, is reduced as new arms can be afforded. The relationship between increasing national income and the share of second-hand arms relative to new arms imports should be negative. Regarding defence spending, the argument is similar. With a larger weight on a militarized economy, more defence spending means that the constraint to import only cheaper old arms is levied, and more new arms can be imported.[5] The derived hypotheses subsequently are:

> *H7*: A wealthy receiver country leads to a decrease of the old arms transfer share.

> *H8*: High military spending by the receiver leads to a decrease of the old arms transfer share.

Research on arms transfers has further analysed the relationship between conflict and the import of arms. The acquisition of arms can be rationalized to deter threats of violent outbreaks and to consolidate power. Such a military build-up, however, can ultimately be the actual cause of human rights violations, suppression of freedom, and the outbreak of intrastate violence (Blanton (2001), Blanton (1999), Pamp et al. (2016)). A government, fearing or experiencing instability and loss of power, will be driven in its arms demand by the internal threat perception. The occurrence

[5] Even if higher military expenditures mean that arms are urgently needed, it still levies the monetary constraint to focus on mainly buying old arms.

of conflict increases the immediate need to increase arms stocks. As second-hand arms do not need to be produced, they are immediately available and should be favoured over new arms imports. The final hypothesis is:

> *H*9: Given the receiver country is involved in a conflict the higher the share of old arms transferred.

2.4 Research Design

The analysis covers the years 1955 to 2018 and includes 171 countries. In order to test the hypothesis, the operationalisation closely follows the approaches from existing research on arms transfers. The estimation strategy used is the generalized linear model (GLM) with a logit link and the binomial distribution. The GLM is a model where the predicted values fall between zero and one. This model is suitable for the present data structure because the dependent variable represents a proportion, the share of old arms transferred. I also include a robust option to obtain robust standard errors and control for time and country heterogeneity in the panel data.

2.4.1 Description of Dependent Variable

For the dependent variable, I rely on the most comprehensive database on transfers of major conventional weapons from Stockholm International Peace Research Institute (SIPRI).[6] The data, which SIPRI (2019a) tracks via open sources, covers the years 1950 to 2017. SIPRI would also allow for comparisons across categories of weapons, and over time "SIPRI has developed a unique system to measure the volume of international transfers of major conventional weapons using a common unit, the

[6]The data is freely available here: `http://armstrade.sipri.org/armstrade/html/tiv/index.php`

trend-indicator value (TIV). The TIV is based on the known unit production costs of a core set of weapons and is intended to represent the transfer of military resources rather than the financial value of the transfer." (SIPRI, 2019b) The data is collected on a highly granular level and also gives for each transfer deal the information on *inter alia* the sender, receiver, armament type, order, and delivery date, numbers ordered and delivered and the TIV of the delivery. I use the delivery date as this is more reliable but will lag all independent variables by one year.

The crucial category for the presented paper, which I employ, is the "status" category, which distinguishes if a transfer consists of either *new* or *second-hand* or *second-hand but modernized* arms. *Second-hand but modernized* arms were refurbished before export and constitute a very small part of the total amount. To create the dependent variable of the share of old arms transfers, I construct the dyadic variable $OldShare_{ijt}$. This dyadic variable divides the number of delivered deals between i and j in year t for *second-hand* or *second-hand but modernized* arms through all transfer deals between sender i and receiver j in year t. As it would introduce a selection bias I do not only consider the transfers which occurred but also the dyads without transfers.

2.4.2 Description of the Explanatory Variables

As mentioned above, all independent variables lagged by one year as transfers will be a result of previous conditions.[7] The main interest of this paper is how the traditional explanations impact the share of old arms transfers. The operationalisation of the explanatory variables is as follows. For the wealthy economy effect, for the sender and the receiver, the log of the GDP is added, that is, GDP_{it} and GDP_{jt}. The data comes from Gleditsch (2013), see for explanation Gleditsch (2002), and the World Bank (2017), which are merged and inflation corrected. For both the sender and the receiver, the scale of their militarized economy is represented by the log of

[7] Lags of 2 or 3 years do not change results substantially.

their military expenditures. The data is merged from Nordhaus et al. (2012), who rely on information from SIPRI and the Correlates of War Project (2017b), and the data is extended to 2017 based on the most recent SIPRI military expenditure data SIPRI (2019c). The variables added are, therefore, $MilEx_{it}$ and $MilEx_{jt}$.

Furthermore, the ideology similarity is constructed from the Polity-IV scores from Marshall and Jaggers (2002), and Center for Systemic Peace (2017). The score ranges from -10 (hereditary monarchy) to +10 (consolidated democracy), and the measure is constructed as the absolute difference between the two countries. This means that with an increase in $PolDiff_{ijt}$, the more distant are i and j in their ideology in t. The alliance variable is a dummy of 1 if i and j share in t an alliance in the form of a defence and offensive support, neutrality, non-aggression or consultation pact, and a takes 0 for no alliance. The data is from the Alliances dataset version 4.1 from Gibler (2008)(see also Singer and Small (1966), Small and Singer (1969), Correlates of War Project (2017a)). The added variable is $Alliance_{ijt}$. Further on, the discussion above has argued for a differentiated effect of conflict, and the dummy variable $Conflict_{jt}$ is added and takes the value one if the receiver j is involved in t in any kind of interstate, intrastate or extra-systemic violent conflict. The data is available in the UCDP/PRIO Armed Conflict Dataset version 19.1 (see Pettersson and Öberg (2020) Gleditsch et al. (2002)). The endogenous impact of new arms imports resulting in old arms exports is added and based on SIPRI (2019a) data. The indicator is therefore $NewArms_{it}$. The explanation that previous old arms transfers lead to current old arms transfer is conceptualized in $PathDep_{ij[t-z],z=[1,5]}$. Path dependence is added as a five-year moving window if a transfer occurs between i and j.

In addition, I add a control for the absolute yearly population number for a sender Pop_{it} and a receiver Pop_{jt}, see Correlates of War Project (2017b).[8] The population size should affect the size of the economy as well as the scale of demand for arms.

[8] If no data for a specific year was available, extrapolation was executed.

2.5 Empirical Results

The results of the analysis in Table 2.1, in general, can support the expectations that the traditional explanations impact the old arms export share. The first column shows the results for the whole period. As the end of the Cold War represents a structural break, I conduct two separate analyses for each period. This reveals if there are substantive differences between the two periods. The number of observations is high because I consider all possible dyadic links between senders and receivers. The research question of to what extent traditional arms transfer explanations impact old arms transfers relative to new arms transfers can be answered as follows.

Starting with the results for the whole period GDP_{it}, which represents how wealthy an arms exporter i is, has a positive and significant coefficient. This means with an increase in wealth of an exporter there is an increase in the share of old arms exports. This result is in line with the argument that a wealthy economy is more likely to have a surplus, which it decides to sell but is not under such pressure as regarding new arms producers. Thus, $H1$ cannot be rejected.

The impact of GDP_{jt}, representing the wealth of an arms receiver j sheds new light on arms transfer research: a rise in GDP of a possible importer has a negative and significant effect on the share of old arms transfers. While the claimed mechanism, that with little budget constraint, a country chooses modern and more long-lasting new arms, is straight forward, it has not been investigated before. This result is line with the expectation from $H7$.

However, for both the sender and the receiver, their economy size, the GDP_{it} and GDP_{jt}, is not a relevant explanation for the outcome during the Cold War. This supports the literature which argues that the arms transfer market has changed after the Cold War to a buyers market (Thurner et al., 2019). It could be the case that during the Cold War, the sender country decided to export old arms independent

TABLE 2.1: GLM estimations on the share of old arms transfers

	Dependent variable:		
	$OldShare_{ijt}$		
	Whole Period	Cold War	Post-Cold War
GDP_{it}	0.328^{***}	0.062	0.407^{***}
	(0.024)	(0.041)	(0.033)
GDP_{jt}	-0.034^{*}	-0.013	-0.073^{***}
	(0.020)	(0.026)	(0.028)
$MilEx_{it}$	0.360^{***}	0.720^{***}	0.219^{***}
	(0.022)	(0.040)	(0.031)
$MilEx_{jt}$	0.030	-0.057^{**}	0.122^{***}
	(0.019)	(0.026)	(0.027)
$PolDiff_{ijt}$	-0.023^{***}	-0.009^{**}	-0.027^{***}
	(0.003)	(0.004)	(0.005)
$Alliance_{ijt}$	0.471^{***}	0.752^{***}	0.356^{***}
	(0.051)	(0.073)	(0.073)
$NewArms_{it}$	0.607^{***}	0.584^{***}	0.648^{***}
	(0.056)	(0.076)	(0.082)
$Conflict_{jt}$	0.472^{***}	0.601^{***}	0.458^{***}
	(0.048)	(0.073)	(0.064)
$PathDep_{ij[t-z],z=[1,5]}$	7.135^{***}	5.708^{***}	7.943^{***}
	(0.098)	(0.143)	(0.137)
Pop_{it}	-0.00000^{***}	-0.00000^{***}	-0.00000^{***}
	(0.00000)	(0.00000)	(0.00000)
Pop_{jt}	-0.00000	-0.00000	-0.00000
	(0.00000)	(0.00000)	(0.00000)
Constant	-12.431^{***}	-11.694^{***}	-11.506^{***}
	(0.206)	(0.319)	(0.331)
Observations	1,353,538	619,015	734,523
Note:			*p<0.1; **p<0.05; ***p<0.01

of domestic producer pressures. Also, the receiver apparently imports old and new arms independent from their wealth during the Cold War.

The $MilEx_{it}$ variable has the same impact for the dependent variables as stated in $H2$. This supports the argument that the share of old arms exports could increase with higher military spending as a country can afford to sell old arms to replace them. The effect size for the Cold War period is substantially larger than for the post-Cold War period. This is

$MilEx_{jt}$, the military spending of an arms receiver, shows only an impact if one splits the sample between the period of the Cold War and post-Cold War. The hypothesis that with rising military spending, the share of old arms should be reduced only applies to the Cold War period. For the post-Cold War period, the relationship period turns, and the sign of the estimator is positive. Conjectures for this observation could be that the estimation does not control for the technical advancement of old arms, which might make them more attractive over the years. With a higher military budget, these cheaper, but technologically not outdated, old arms can be additionally bought.

In the case of $PolDiff_{ijt}$ there is a negative and significant effect for a more distant political ideology. This rejects the posited relationship from $H3$, which assumes that ideology is evenly applied across the two transfer types. However, apparently, if a potential sender and receiver dyad are increasingly different in their ideology positions, the old arms share is reduced. This relationship holds for both periods. A conjecture here could be that new arms are rather being transferred anywhere by the producers in order to cover the fixed costs and support the defence industry. Ideological differences matter less for new arms producers, which subsequently lowers the share of old arms exports.

The existence of an alliance yields a positive and significant result. The mechanism of the attractive inside-alliance option to bolster an ally instead of an outsider through this option seems at play here. Not only is income generated but at the

same time, security levels increase. Therefore, the result is in line with $H4$. During the Cold War period, the impact of the alliance on the share of old arms transfers was much more significant compared to the post-Cold War period. This aligns with existing research that arms transfers were more ideologically driven during the Cold War. The exporters were more likely to transfer their surplus arms within the alliance than outside it.

Regarding $H6$ the idea that an endogenous process, due to the dependency structure, takes place is supported. A country that receives new arms subsequently is more likely to decide to decrease the surplus, resulting in a higher share of old arms. The impact of $NewArms_{it}$ is also relatively large.

The $Conflict_{jt}$ variable impact is positive and significant for the dependent variables as expected in $H9$. A possible importer who experiences a conflict is in urgent need of defence goods, and second-hand arms are quicker available and, in theory, from any country in the world and not certain producer countries.

Regarding the impact of $PathDep_{ij[t-z],z=[1,5]}$, representing the completed transfers of the last five years, it has a large positive and significant impact on the share of second-hand arms. The impact size is by far the biggest, which means that an established relationship is an important predictor.

Overall, there are some results where the expected relationship is not reflected in the results, and the hypothesis has to be rejected. This is the case, e.g., for the $PolDiff_{ijt}$ where the result was contrary to the expectation. Instead of evenly applying the same ideology on both new and old arms, the export of old arms is reduced with increasing ideology distance. Also, in some cases, the distinction between the Cold War and post-Cold War period leads to results that run counter to the postulated hypothesis, e.g., GDP_{jt}, GDP_{jt}, $MilEx_{jt}$. This warrants further scrutiny by future research.

2.6 Conclusion

To summarize, the presented paper has, for the first time, analysed to what extent traditional explanations for arms transfers apply differently for new and old arms transfers. Previously, these explanations have been at least implicitly applied to new and second-hand arms. To answer the questions of this paper: *what explains second-hand arms transfers compared to new arms transfers? What do the mechanisms behind second-hand transfers look like?* I first took a step back to familiarize the reader with what old arms transfers actually are. I conceptualized the detected patterns between old and new arms exports and imports as a decision-making process for the exporter and a choice for the importer.

Based on the derived patterns, traditional explanations for arms transfers were discussed. The argument was made that in several cases, the causal mechanism for second-hand arms transfers should be different due to the idiosyncratic nature of old arms. Second-hand arms are *inter alia* instantly available, not modern, therefore cheaper, and can be sold, in theory, by any nation regardless if it has a defence industry or not. Also, they might be preferred to modern arms because they are more easily managed from a technical viewpoint. These characteristics have resulted in differentiated hypotheses of how second-hand arms transfers occur relative to new arms transfers. For the exporter side, it was revealed, for example, that an alliance tie changes the arms transfer flow in favour of sending old arms to the ally. The idea that a country's trade-off between security and economic concerns is relevant is investigated further in Paper B of this dissertation. It will take a closer look at the determinants of old arms transfers.

Furthermore, the results reveal a potential new research avenue for conflict studies: in the case of a conflict in a given receiver country, the receiver prefers old arms over new arms. While this is logically comprehensible, this dimension has been, to my knowledge, not yet investigated in the area of conflict studies. However, this observation could hint at an aspect that impacts conflict dynamics. A closer look at

the relationship between old arms imports and conflicts could lead to new insights into the consequences of arms transfers. This step will be taken in Paper C of this dissertation.

Finally, this paper has contributed to the debate of what explains international arms transfers. So far, to my knowledge, the perspective to distinguish between old and new arms transfers has played a neglectable role in research. This paper has given insight that traditional explanations appear to apply differently for old and new arms transfers and different mechanisms are at work. The results of this paper inform the subsequent Papers B and C. Also, the paper gives policymakers are more nuanced understanding of the patterns of arms transfers. Effective control mechanisms can be established only by understanding the flow of arms.

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Chapter 3

Second-Hand Arms Transfers: Foreign Troop Presence as an Export Factor

Abstract

What determines the export of second-hand weapons? Studies show that arms exports have serious consequences, but, so far, implicitly assume that the determinants of new and second-hand arms transfers are the same. However, second-hand arms are distinct in their transfer patterns from new arms, and while constituting a non-neglectable share of overall transfers, this question still needs to be answered. Therefore, based on conflict studies, this paper introduces external security guarantees in the form of foreign troop presence as an explanation for old arms exports. Countries optimise their security and partly substitute their domestic arms stock with external security guarantees. Drawing on SIPRI data, the panel data analysis supports the notion that troop presence increases old arms exports. The paper contributes to the arms transfer and conflict literature and sheds light on a blind spot regarding arms transfer policies.

3.1 Introduction

Transfers of second-hand major conventional weapons (MCW) constitute around 10% of all annual arms transfers (SIPRI, 2019a).[1] For example, 31 of 185 aircraft export deals and 7 of 34 ship export deals in 2018 were for second-hand arms. This amount of second-hand transfers is significant enough to investigate it more closely. In particular, second-hand arms supply is not restricted to the small number of producer countries, but any country in possession of arms is able to export. The definition of second-hand arms export is that the exported weapon is not newly produced for export.[2] The lack of differentiation, so far, results ultimately in scrutiny by existing research of large producer countries, e.g., the U.S., the Soviet Union/Russia, and China, and to whom and why they export their newly produced major conventional weapons (e.g. Blanton (2000), Menon (1982), Gill (1998), Sanjian (1991), Johnson and Willardson (2018)).

Therefore, this paper's conjecture is that if second-hand arms exports are studied on their own, previously neglected determinants for exports can be uncovered. Understanding arms export patterns is essential because research has uncovered serious consequences of international arms transfers (IAT). For example, arms exports exacerbated interstate rivalry between exporters during the Cold War (Kinsella, 2002), allowing for manipulation of the receiver (Sislin, 1994) and worsening the human rights situation in the receiver country (Blanton (1999)).

Second-hand arms are conceptually different from new arms, as the current war of aggression of Russia against Ukraine exemplary shows. For example, the old arms supply to Ukraine mainly comes from existing arms stocks of countries. It is technically easier to use as it is often old Soviet gear (Hinshaw and Ojewska, 2022). In addition, this reduction of domestic arms stocks through exports poses a

[1] Only MCW will be considered because small arms data only starts from 1990, is harder to track, and is more likely to be flawed because small arms suffer more from illicit transfers. MCW include almost everything larger than small arms and light weapons. For details, see point 3 in SIPRI (2019b)

[2] The terms "second-hand" and "old" will be used interchangeably.

security risk. The decision by, e.g., Poland and Slovakia to export old arms was also primarily driven by the agreement with the U.S. and Germany to re-supply their arms stocks to remedy this security risk (Kyranoudi et al., 2022).

In sum, the arms stock and its level change can be seen as an important part of a country's security consideration. In general, the arms transfer debate has determined a trade-off between economic and security aspects when governments optimize their welfare (see Levine and Smith (2000), Levine et al. (1994a)). For example, if security increases exogenously and the country finds itself over its security optimum, it could then optimise its overall welfare by selling its old arms. The argument this paper develops is that external security guarantees, e.g., in the form of foreign troop presence, are such an exogenous source. The external security guarantees work as substitutes for the arms stocks, which can then be reduced. The guiding research question follows from this: *do external security guarantees drive old arms exports?*

The existing literature on arms transfers has uncovered various influences on both the supply and demand side, which can be grouped broadly under economic, security, or ideational influences. A major determinant on both the supply and demand side is the size of the economy. Mostly wealthy countries are able to overcome the initial high fixed costs of arms production (see Harkavy (1994), Anderton (1995), Levine and Smith (1997), Brzoska (2004)). Besides, the scale of militarization, e.g., the size of military expenditures, has an impact on both the exports and imports of arms (Smith and Tasiran (2005), Smith and Tasiran (2010)). Arms demand has shown to be driven, e.g., by internal conflicts to prevent or deter threats of violence (see Blanton (2005), Blomberg and Tocoian (2016)). Dyadic attributes between the sender and the receiver also matter for the occurrence of a transfer tie. Martínez-Zarzoso and Johannsen (2019) show that arms transfer within alliances is more likely because it raises the security level of both partners (see also Morrow (1993)). They also show that ideological similarity between sender and receiver plays a significant role

in determining transfers (Martínez-Zarzoso and Johannsen (2019), see also Blanton (2005), Perkins and Neumayer (2010), Akerman and Seim (2014)).

Nevertheless, studies on arms transfers still need to attach more importance to the distinction between transfer patterns of new and old arms transfers. Therefore, evidence of what explains second-hand arms transfers is scarce, and a literature gap remains. The limited literature on second-hand arms transfers (SHT) already gives an impression of relevant factors, which are different from newly produced arms, which might play a role. So far, only case-specific reports or studies of policy impacts deal with this subject. Additionally, these accounts remain bound in time and space. For instance, Wezeman and Wezeman (1996) describe the partially carried out disposal plans of Dutch surplus arms to modernize the army. However, since then, there has been no investigation on the underlying drivers of Dutch SHT (see Davis and Schofield (1997) for a similar report on the UK). Holtom (2011) gives an account of the Sub-Saharan receivers of second-hand Ukrainian arms but does not investigate further the drivers behind it. Beraud-Sudreau (2010) reports that France limits its SHT to bolster sales of newly produced arms. The most encompassing study of both the export and import side is a non-published paper from Beraud-Sudreau and Holtom (2013), who examine the consequences of the defense reform in Europe on SHTs. However, their focus is only on one point in time and is EU-centric. Therefore, this literature serves as a valuable first insight into SHT as it proposes a few explanations but is limited in scope.

This article goes one step further and adopts a global view of the period from 1986 until 2008. By incorporating concepts from the literature on conflict, while relying on existing arms transfer research findings, I aim to make a threefold contribution. First, I bring awareness to an understudied area of arms transfer research. Old arms transfers have to be yet assessed consistently and systematically. This paper presents the first approach to the determinants of old arms exports. Second, I contribute to the arms transfer literature by introducing external security guarantees as

a new explanatory factor for arms exports. Third, I can show that arms stocks and external security guarantees are security-providing goods that serve as substitutes.

These findings can enable policymakers to develop a more nuanced approach toward arms control in general. If external security guarantees are a determinant of old arms exports, countries should consider this as an effect if they plan to station their forces abroad. To sum up, I uncover a critical blind spot, representing a theoretical and policy-relevant contribution. The paper implies that future arms transfer research needs to account for the category of old arms.

The paper proceeds as follows. First, I will outline the argument that external security guarantees serve the host country as a security substitute. The following section develops the research design to test the developed hypotheses. After presenting the results, I discuss the implications of these findings for the research community and policymakers.

3.2 External Security Guarantees and Second-Hand Arms Exports

The balance between economic and security factors that shape international arms transfers (IAT) has been broadly investigated through the neorealist lens of Waltz (1993), who claims that economic and security interests predominantly drive (internal) state behaviour (see also Krause (1991)). The IAT literature conceptualizes this as the "the guns-versus-butter-problem". It illustrates that states must decide how to allocate their budget between civilian and defence goods — or, as an extension of this concept, weigh economic benefits from arms exports against possible security repercussions from the receiver (Mintz (1989), Mintz and Huang (1991), Powell (1993)). This balancing can be formalized in a model. An early example is Richardson (1938), who formalized how arms races impact the arms transfer equilibrium. Additional formal models were introduced for the decision-making process of how

to divide the national budget between economic and security goods to maximise welfare (see Levine et al. (1994b), Levine et al. (1998), Levine and Smith (1995)). I follow the idea that an exporting nation optimizes its welfare and introduce, similar to Pamp et al. (2018) and Pamp et al. (2021), the function

$$W_t = U(S_t) + p(x_t)x_t - C(x_t)$$

which describes the trade-off between the level of security S_t, the revenue function, $p(x_t)x_t$, from arms exports, multiplying the arms price $p(x_t)$ with the number of arms x_t, and the cost function $C(x_t)$ to produce and sell arms. The cost function $C(x_t)$ not only includes production costs for new arms but also includes search, information, and transaction costs that are entailed for every transfer (Pamp et al., 2021). The utility function for security $U(S_t)$ traditionally includes the arms stock, the military personnel, and the security effect of an arms transfer. Depending if arms are exported to an ally, security should rise. Pamp et al. (2018) show that when arms exports go to an ally, there is an incentive to reduce domestic military spending. If arms exports lead to positive security externalities, the exporting country has the scope to substitute this by lowering domestic defence expenditures. The authors determine a strategic process where a state decides to increase arms exports to reduce its military budget. A substitution effect takes place. Also, if a country with a similar ideology receives arms, it should be beneficial because the receiver is likely to follow the same interests as the exporter.

The new aspect I introduce is that this security function should include external security guarantees, i.e., foreign troop presence. Hosting foreign troops is beneficial for the country as it carries a stabilizing effect and represents a sign of security, studies on conflict claim. Before I delve into these studies, a brief overview of what "foreign troop presence" means is needed. Hosting foreign troops has been common since the end of the Second World War.

France, for example, had around 8,000 troops in Africa during the Cold War, which were cut to be reduced after the Cold War to 4-5,000 troops (Gregory, 2000, p. 442). While the U.S. deploys most troops, other countries, besides major powers, increasingly also deploy their forces, and "[I]n the past decade, more than 30 other countries deployed an additional 175,000 troops abroad." (Braithwaite and Kucik, 2018, p. 5) (see also Dietrich (2000)). Also, the number of deployed troops started to decrease slowly from a maximum of circa 1,800,000 in 1986 to around 500,000 in the 2000s while the number of host countries fluctuated around 40-60 (in a period between 1981-2006) (Braithwaite and Kucik, 2018, p. 5). An important feature is that foreign troop presence occurs for various reasons, e.g., economic or deterrence, and not necessarily due to conflict intervention (in contrast to peacekeeping missions) and can persist for a long time (see Biglaiser and DeRouen Jr (2007), Huth (1988, p. 424)).

Several studies indicate a stabilizing effect of hosting foreign troops. Allen et al. (2016) show that non-allied countries hosting U.S. troops reduce their defence spending. Based on the guns versus butter model, they argue that the U.S. presence increases security and the host country can consume more "butter". Higher economic growth in the host country can be traced back to increased security through foreign troop presence, and they can also serve as institutional change agents (Jones and Kane, 2012). FDI inflows increase in the host country due to investment security provided by the troop-sending country. A "follow the flag" effect occurs when companies from the troop-sending nation start investing in the host country (Biglaiser and DeRouen Jr, 2007).

A case study by Bell et al. (2017) shows that if regime security is guaranteed through external security providers, the regime relies on it to deter internal and external threats. The analysis reveals that given U.S. foreign troop presence, leaders become less reliant on popular support, which may result in more human rights violations. In a similar vein, studies have shown that France has emerged as the "gendarme

of Africa" where its military presence has, in some cases, e.g., Senegal in 1962, supported regimes in fending off coup attempts (Vallin, 2015). Wang (1998) also gives evidence that France plays through its military presence an essential factor in regime stability (see also Mehrl and Choulis (2021)). Overall, foreign troop presence has shown an effect on regime behaviour and stability, and such external security provision, I argue, also affects the export of old arms.

In addition, the host country can broadly rely on the foreign troops that they are stationed with the aim to deliver security. To bring troops to another country is always a costly signal, and success in meeting the goal of providing security is essential. In case of failure, the sending government has costs in the form of domestic audience costs ("tied hands") as well as sunk costs from sending troops (Slantchev, 2005). The host country can, therefore, expect the foreign troops to pursue their proclaimed goal of delivering security.

To paint a full picture, studies have also indicated certain costs of being a host. Evidence points to assaults and proliferation of prostitution due to foreign troop presence (Zimelis (2009), Lutz (2009, p. 21), Bell et al. (2018)). Higher levels of property-related crimes in a host country also stand in association with it (Allen and Flynn, 2013). These adverse effects, severe as they are, are borne by the individual citizens and less by the ruling government that profits from the stabilizing influence of foreign troop presence.

Nevertheless, how does foreign troop presence relate to the argument that it leads to exporting old arms? Studies have shown a positive externality for the security of a nation if it hosts foreign troops. As a case example, Bahrain closed for the first time an arms export deal, a second-hand helicopter for Chile, only one year after the U.S. formalized its administrative support presence to a military one (Weitz, 2011). After the formalized presence, there was a rapid growth in the number of U.S. military personnel as well as the size and sophistication of military equipment at the U.S. base on which Bahrain then could rely as a guarantee for its security (Nugent, 2014).

The positive externalities of external security guarantees should impact the utility of S_t in the welfare function. Subsequently, suppose the country finds itself over its security optimum. In that case, it has the possibility to reduce its arms stocks by selling them and increase its overall welfare through an increase in revenues. This is not only more straightforward than reducing the employed military personnel. The assumption is that upkeep, training, and storage of MCW are costly, whereas an export leads to revenues. In addition, if the sales go to an ally, the state welfare increases even further through $U(S_t)$ (see Pamp et al. (2018)). Arms stocks represent; therefore, a form of substitution to foreign troop presence.[3] Perceived long- and short-term threats of (violent) conflict and military obligations are balanced against both arms stocks and external security providers. If there is a foreign troop presence, security increases & subsequently, arms stocks could be reduced, leading to the hypothesis:

H: Foreign troop presence increases the probability of old arms exports.

Substituting between external security guarantees and arms stock can drive the decision, via the welfare function, to reduce the arms stock, which can be observed in the form of old arms exports. There are some limitations to this model. The model simplifies the decision to export down to whether the nation finds itself over the domestic and external security optimum. However, a nation could find itself over the optimum and could also decide against old arms exports. The relationship is not deterministic. Maybe instead, the country employs another form of substitution, e.g., reducing arms imports or alliance commitments. Also, the model is reduced because it does not account for countries that produce their own arms. This can also affect the overall described relationship.

[3]See for further ideas on security substitution Yarhi-Milo et al. (2016), Morgan and Palmer (2000) and Most and Starr (1984)

3.3 Research Design

In order to test the hypothesis, a dataset is constructed where the unit of observation is a country i in year t. The dataset records if there is foreign troop presence in a given country-year observation. It also records if the country i has exported old arms in t. The panel dataset includes 170 countries and runs from 1981 to 2008. Even if it only covers 27 years, the panel setup is preferred over pure time series or cross-sectional data because trends can be detected across time and countries in the estimates.

3.3.1 Dependent Variable

For the dependent variable of an old arms export, I rely on the most comprehensive database on transfers of major conventional weapons from the Stockholm International Peace Research Institute (SIPRI). The data set, in which SIPRI (2019a) tracks all international arms transfers via open sources, covers the years from 1950 to 2019. The data is collected on a highly granular level and gives for each transfer deal the information on inter alia the sender, receiver, status, armament type, order and delivery date, numbers ordered and delivered, and their trend-indicator value (TIV) of the delivery. The trend-indicator represents: "The TIV is based on the known unit production costs of a core set of weapons and is intended to represent the transfer of military resources rather than the financial value of the transfer." (SIPRI, 2019b).

The average time from order to delivery is only around 1.5 years for old arms (and about 4 years for new arms). In addition, delivery dates are far more reliable. Therefore, I choose the delivery year but will lag all independent variables by one year. Subsequently, I operationalize an export to take the binary value 1 if there is an arms export with the status type *Second-hand* and/or *Second-hand but modernized* from country i in year t.[4] If no export takes place for the given country i in year

[4]Only very few arms exports fall under the category *Second-hand but modernized* leaving this data out has no further impact on the outcome.

t the outcome value is zero.

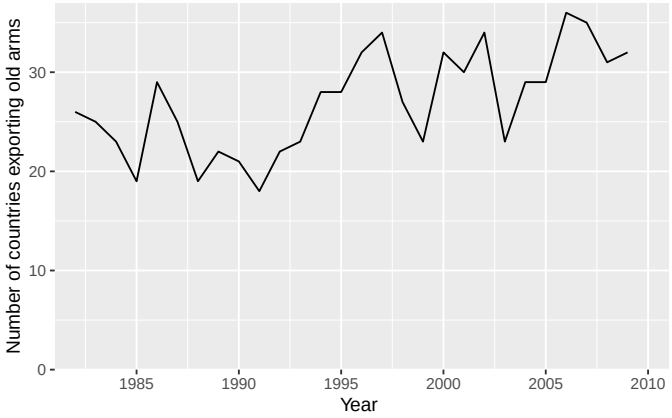

FIGURE 3.1: Number of countries that export old arms per year. Data is from SIPRI (2019a).

Figure 3.1 visualises the data of the dependent variable. It shows the number of countries that received old arms over time. The number of countries that draw on their existing arms stock to export arms gradually increased of the years. This increase is also due to the new successor states of the Soviet Union, who became exporters. Overall, the number of exporters varies over the years between minimum 18 and maximum 36 exports, with a slight time trend included.

3.3.2 Explanatory Variable

The operationalization of foreign troop presence (FTP) follows the paper from Braithwaite (2015). Braithwaite (2015) extracts troop deployment data "from the International Institute for Strategic Studies (IISS) annual publication, *The Military Balance*. A total of 93 countries deployed at least one troop at any time during the period 1981 to 2007." (Braithwaite, 2015, p. 361).[5] The variable "measures the total number of troops deployed by one country and stationed in another country overseas in a given year." (Braithwaite, 2015, p. 360-361). As hypothesis $H1$ relates only to a security effect *if* any foreign troops are present and not from *where* these troops

[5]The downloaded data goes until 2008 instead of 2007.

come from I collapse this dyadic information to a monadic attribute if any troops are present in a potential exporter country i in year t. Therefore, the variable takes a binary form of zero for no presence and one for a presence. A lag of one year is introduced to estimate the impact of foreign troop presence on subsequent second-hand arms transfers. Consequently, the variable BINARY FTP represents the lagged binary foreign troop presence in a potential exporter country i in year t. This is the variable that restricts the analysis period to 1981-2008. All other data is available from 1950-2019.

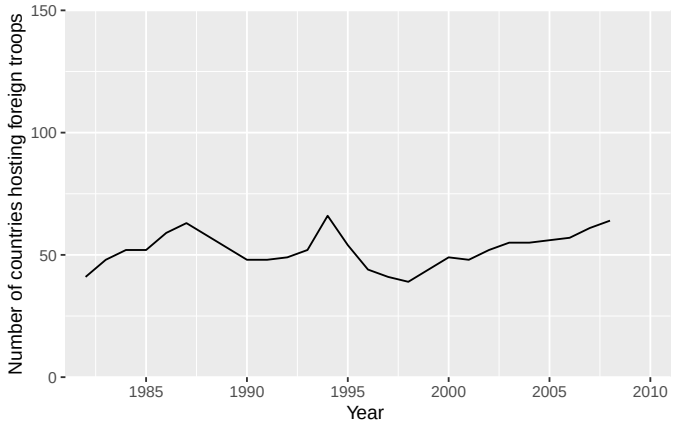

FIGURE 3.2: Number of countries that hosted foreign troops per year.
Data is from Braithwaite (2015).

Figure 3.2 visualises the explanatory variable. It shows the number of countries which hosted foreign troops over the years. The number of countries hosting foreign troops averages around 50 over the years. After the Cold War, there was a peak in 1994 with 66 countries hosting foreign troops. After this peak, a decline occurred with the lowest number of countries, namely 39, hosting foreign troops in 1998. Since then, a gradual increase can be traced.

As a robustness check, I also introduce the logged number of foreign troops hosted, LOG FTP. The main idea is still that independent of the number of external forces in the country the troop presence is a security sign. To station forces abroad signals the hosting government that there is a substantive interest in delivering security. Still,

in anticipation that it could be argued that the size of the troop presence is relevant for the government's security considerations and not only presence, I will replace BINARY FTP with LOG FTP. The new indicator is also from Braithwaite (2015) and follows the recommendation to take the log of the troop number. This accounts for skewed data as well as that a change in troop size from 1000 to 2000 should have a larger impact than an increase from 11000 to 12000. I employ the same estimation but with the new variable of logged foreign troop numbers.

3.3.3 Control Variables

All control variables are lagged by one year as an arms transfer will result from previous conditions. I include the log of the GDP as a measure of wealth for the exporting country. This controls for the effect that troops could be stationed at economically interesting countries as well as that wealthy economies are likely to have a higher stock of arms they can potentially sell. The data for the variable GDP comes from Gleditsch (2013), see for explanation Gleditsch (2002), and the World Bank (2017), which are merged and inflation corrected. In a similar vein, military potent countries could attract FTP and explain old arms exports, and I add a control for the logged military expenditures, MILEXP. The data is merged from Nordhaus et al. (2012), which rely on information from SIPRI and the Correlates of War Project (2017b), and the data is extended to 2008 based on the most recent SIPRI military expenditure data SIPRI (2019c).

Furthermore, a control is added if conflict is observed in a given country-year unit. Conflict could impact the decision to host foreign troops which support the government side. It is a confounder because it is likely that it also has an impact on the export decision. The dummy variable CONFLICT is added and takes the value one if country i is involved in any kind of interstate, intrastate or extra-systemic violent conflict which resulted in at least 25 battle related deaths in year t. The data and definition are from the UCDP/PRIO Armed Conflict Dataset version 20.1 (see

Pettersson and Öberg (2020), Gleditsch et al. (2002)).

The degree to which a country is part of an alliance might affect the hosting of alliance partners. Also, to be part of an alliance should affect security considerations that impact the export of old arms. The variable ALLIANCE counts the number of alliances the sender is part of. The data is from the Alliances dataset version 4.1 from Gibler (2008) and considers defence and offensive support, neutrality, non-aggression or consultation pacts (see also Singer and Small (1966), Small and Singer (1969), Correlates of War Project (2017a)).

Old arms exports could persist over multiple years if exported in multiple tranches. Previous exports could inform current exports and attract FTP as there is interest to influence such arms flows. A path dependence control is added as a five-year moving window if an export has taken place PATHDEP. Finally, it is reasonable to assume that importing new arms will result in the subsequent export of old, surplus arms. Also, an influx of new weapons could make it more interesting to establish a FTP to build a deeper military relationship. Therefore, the NEW IMPORT, based on SIPRI (2019a) data, is added.

3.3.4 The Estimation Strategy

The dependent variable takes in a given country-year in either the form of a one if there is an export or a zero if there is no export of the country in the given year. Therefore, I choose a binary logistic regression model. I include time and country-fixed effects to control for time-specific confounders, e.g., unexpected variation or special events, and unobserved country-specific characteristics (see Greene (2003, chapter 13)). The Hausman test results support the inclusion of fixed effects over random effects. The estimation method I employ is also suitable for the large N small T sample because it controls for the incidental parameter problem, which could result in an inconsistent estimator. The universe of cases exists of 755 recorded

exports of countries between 1982 to 2009, while in 3599 cases, a country did not export old arms in a given year. With around 17% of cases taking the value of one, a rare event model is not required, and I have a large enough sample. Also, heterogeneous effects such as year and country-fixed effects are likely to be more important to control for than for rare events. I can only control for either of them.

The dependent variable could also have been modeled as a count variable where the number of exports of a country in a given year could have been counted and analysed via a Poisson model. However, I decided due to two reasons against a count model. First, the theoretical approach focuses on the decision *per se* that leads to an export of old arms. Second, the poisson model requires independence of events and exports not taking place simultaneously, which is unlikely in the case of exports from one country.

In addition, this estimation strategy is superior to the conditional logit estimator because it is computationally costly with a quadratic increase of computational burden in T. Furthermore, the conditional logit does not deliver estimates of the fixed effects, therefore, cannot estimate average partial effects (Stammann, 2020, p. 9). Endogeneity concerns will be discussed in the robustness checks section.

3.4 Empirical Results

Table 3.1 shows the results across several model specifications. Overall, the hypothesis that foreign troop presence increases the probability of old arms exports cannot be rejected. Models (1) and (3) have binary FTP as the explanatory variable, and models (2) and (4) have the logged FTP number as the explanatory variable. The parsimonious model (1) and (2) show the expected relationship and are robust to the additional controls in the model (3) and model (4). I will refrain from discussing the control variables as they do not lend themselves to causal interpretation (Hünermund and Louw, 2020). There is no constant reported because, with fixed effects,

there is not one constant but a time-country dummy for each individual case and therefore a separate intercept for each individual case. In sum, the results support the posited relationship that external security guarantees are a positive externality for the local government. Subsequently, the government can optimize its security level by reducing its arms stock, as FTP serves as a substitute. In addition, the sale of second-hand arms can further increase state welfare through the sale revenues.

TABLE 3.1: Export of old arms from country i in year t, from 1986 to 2008

	(1)	(2)	(3)	(4)
BINARY FTP	0.47^{***}		0.47^{***}	
	(0.18)		(0.18)	
LOG FTP		0.06^{***}		0.06^{***}
		(0.02)		(0.02)
GDP			0.01	-0.01
			(0.00)	(0.00)
MILEXP			-0.08	-0.09
			(0.11)	(0.11)
CONFLICT			-0.22	-0.19
			(0.28)	(0.27)
ALLIANCE			0.02	0.02
			(0.03)	(0.03)
NEW IMPORT			0.28	0.28
			(0.27)	(0.27)
PATHDEP			0.48^{***}	0.48^{***}
			(0.13)	(0.13)
Num. obs.	2421	2421	2421	2421

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Logistic regression models with time and country fixed effects. Standard errors are in parentheses.

The coefficients in Table 3.1 are not directly interpretable in that the coefficient is the change, *ceteris paribus*, in the dependent variable, given a one-unit increase in the independent variable. Or in other words, the effect will differ for each country as logit is a non-linear model where the effect is not unconditional. This is why in

Table 3.2 the average marginal effects are reported to give an insight into the substantive impact of the estimates.[6] Average marginal effects calculate the effect for each individual and then compute the average across the resulting effect estimates (Leeper, 2017, p. 7). They are favourable as they capture variability, produce a single quantity summary that reflects the full distribution of the covariates and respects the distribution of the data (Leeper, 2017). The applied post-estimation routine estimates the "average partial effects with respect to all covariates in the model and the corresponding covariance matrix. The estimation of the covariance is based on a linear approximation (delta method)." Stammann et al. (2016).

TABLE 3.2: Average marginal effects of FTP on old arms exports

	(1)	(2)
BINARY FTP	0.11^{***}	
	(0.042)	
LOG FTP		0.01^{***}
		(0.01)
GDP	0.01	-0.01
	(0.00)	(0.00)
MILEXP	-0.02	-0.02
	(0.02)	(0.02)
CONFLICT	-0.05	-0.04
	(0.064)	(0.06)
ALLIANCE	0.01	0.01
	(0.01)	(0.01)
NEW IMPORT	0.07	0.06
	(0.06)	(0.06)
PATHDEP	0.11^{***}	0.11^{***}
	(0.03)	(0.03)
Num. obs.	2421	2421

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$

Average marginal effects from the logistic regression models (3) and (4) in Table 3.1. Standard errors are in parentheses.

The model (1) in Table 3.2 shows the average marginal effects from the regression model (3) in Table 3.1, which includes the BINARY FTP variable. The interpretation for model (1) in Table 3.2 is that a change from no foreign troop presence to

[6] Marginal effects also called partial effects (Wooldridge, 2015, p. 179).

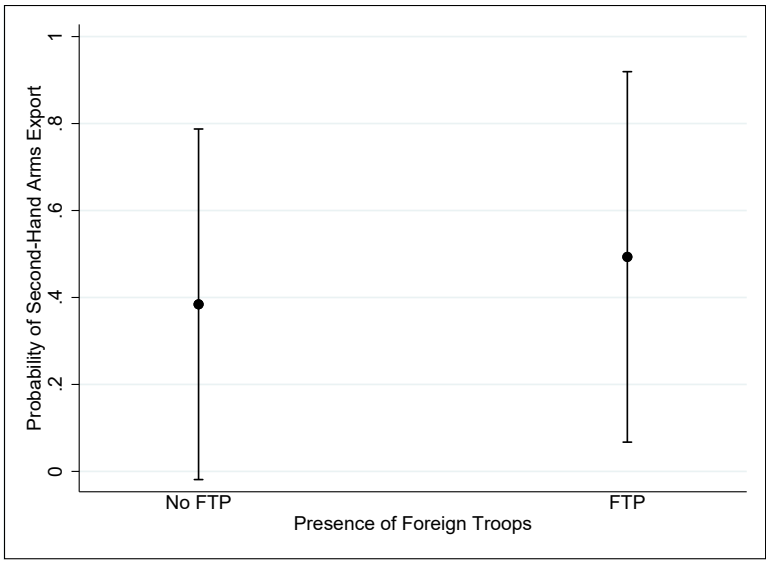

FIGURE 3.3: Predicted probability of binary export of second-hand arms. The Figure is based on model (3) in Table 3.1. All variables are kept constant at their means. Overlapping 95% confidence intervals do not suggest statistical insignificance.

presence increases the probability of an arms transfer by 11 percentage points, on average. This change is substantial and significant and further supports the posited relationship of the developed framework.

Figure 3.3 visualizes the difference in the predicted probabilities if foreign troops are present (left side) or not (right side). The average model without FTP indicates a 38% probability of an export of old arms. This changes to a predicted probability of 49% if foreign troops are present. The large confidence intervals can represent that the sample size is relatively small and/or that the variation in the population is high. A large confidence interval is not a problem per se. It represents, however, that the degree of precision is relatively low. Still, the results point in the direction that there is an increase in the likelihood of old arms exports if foreign troops are present.

The model (2) in Table 3.2 delivers the average marginal effects from the regression model (4) in Table 3.1, which included the LOG FTP variable. In the case of a logged variable, the result can be interpreted that with a 10% increase in the number of

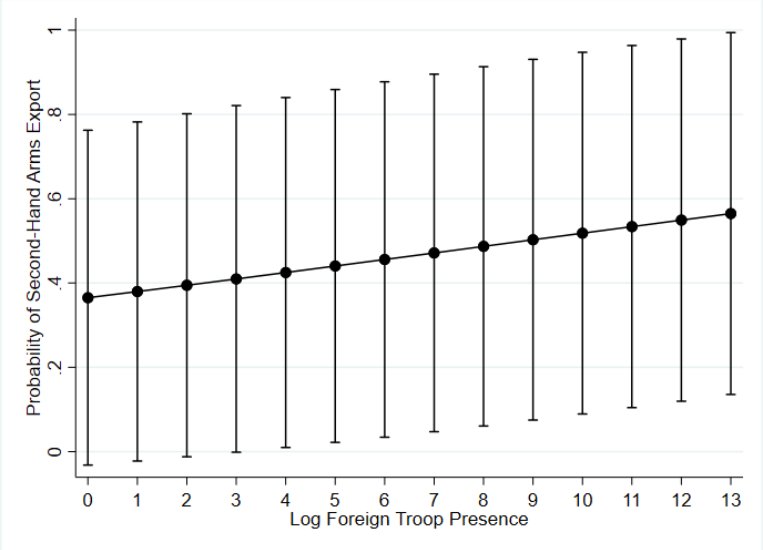

FIGURE 3.4: Predicted probability of binary export of second-hand arms. The Figure is based on model (4) in Table 3.1. All variables are kept constant at their means. Overlapping 95% confidence intervals do not suggest statistical insignificance.

foreign troops, the probability increases by 1 percentage point. Figure 3.4 plots the marginal effects for specifically defined values. The values for LOG FTP range from 0 to a maximum 13.22. If there is no FTP, the predicted probability of old arms exports is 36% and goes up to almost 57% for the maximum value of 13.22. On average, the value is around 2.5, representing a predicted probability of 40% of old arms exports. Again, the confidence intervals are rather large, which calls, e.g., for a larger sample size, in this case probably a longer period than 1981 to 2008.

To anticipate possible endogeneity concerns, I argue that while foreign troop deployment is non-random, the strategic decision to deploy is unrelated to the outcome of interest, the export of old arms. Also, it is unlikely that exporting old arms is endogenous to foreign troop presence. In Braithwaite and Kucik (2018), for example, the use of the instrumental variable is suitable. Here, the dependent variable host country stability could represent reverse causality as it could impact the explanatory variable, foreign troop presence. In my case, however, the strategic decision to deploy is unrelated to the outcome of interest, the export of old arms by the

host. In other words, the decision to deploy is unlikely, driven by the fact that the host country exports old arms. In addition, my theory considers the effect of FTP on security and not what determines FTP.

3.5 Conclusion

The aim of this paper is to enhance the understanding of arms transfers, specifically second-hand arms exports. Old arms play a meaningful role in the overall arms transfer market. Due to their quantity, they cannot be neglected. The current example of Russia's war of aggression against Ukraine has also shown that they must be addressed due to their specific characteristics. I add to the arms transfer literature by introducing old arms transfers and studying old arms exports as a unique category that requires its own explanations. I also introduce external security guarantees as a new explanatory factor for international arms transfers.

In order to answer the research question: *do external security guarantees drive old arms exports?* I rely on previous research, which shows that states aim to balance security and economic considerations to optimize their welfare. The framework I develop introduces external security guarantees as an exogenous factor that changes a nation's security perception. If a country subsequently finds itself over its security optimum, it can decide to further optimize its overall welfare by then reducing its arms stock. Through the export of old arms, the nation also can have an economic benefit. I test this argument by estimating if foreign troop presence, representing external security guarantees, impacts old arms exports. The results indicate that such a relationship exists, as posited by the research question. However, the analysis results remain limited due to the short period in which data is available.

This paper contributes to an understudied area of arms transfer studies. It gives evidence that old arms transfers require different explanations compared to new arms transfers. First, I have delivered a possible explanation for old arms exports. The

finding speaks to the debates if countries are internally weighing security-providing goods against each other. Indeed, there seems to be a substitution effect between foreign troop presence and arms stocks. It gives weight to the literature that claims that there is a substitution effect between arms exports and military spending (Pamp et al., 2018).

Finally, the results are relevant for policymakers. An implication could be that when countries want to host foreign troops or receive some other form of external security guarantees, they must agree to arms export controls by a third party. This can ensure that the implication of foreign troop presence, the reduction of arms stocks, does not lead to exports to, e.g., human-rights-abusing countries. Therefore, the international flow of arms could be controlled.

As an implication, future research needs to consider the analytical difference between old and new arms when analysing transfers. In addition, this paper opens further research areas. While foreign troop presence appears to be relevant for old arms exports, there are potentially many further explanations that are worthwhile investigating. The mechanism through which foreign troop presence delivers security, even though well studied, has not been conclusively clarified. In general, a focus on external security guarantees could be beneficial for future research. These could shed further light on the idea that security can be seen as a good that can be substituted.

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Chapter 4

Conflict Onset Causes: the Role of Second-Hand Arms Imports

Abstract

While research, up until now, remains inconclusive rising evidence suggests that arms imports impact intrastate conflict onset. One main challenge is to control for causality if arms imports are conducive to conflict. This paper takes a step further in the debate on the consequences of arms transfers and asks: Does the import of second-hand arms impact the risk of the outbreak of intrastate conflicts more than new arms imports? I derive three explanations from existing theories on arms imports and conflict onset. I argue that these explanations, time, cost, and reliability, apply even more strongly to the relationship of old arms imports impacting conflict onset. This hypothesis is tested using an instrumental variable approach to control for causality. The results indicate that old arms have a positive, significant impact on conflict onset, while new arms imports do not gain significance. The paper contributes to the conflict studies literature by introducing a previously neglected influence.

4.1 Introduction

Caught between geopolitical security interests, economic considerations, and normative ideas arms transfers have always been contentious. Especially the export to conflict prone regions has been controversial in the public. For example, arms exports to Saudi Arabia have been under public scrutiny in the European Union (EU) because European-manufactured arms were employed by the Saudi-led coalition against the Houthi rebels in the Yemeni Civil War (ECCHR, 2020). This case is well known to the public due to the ongoing humanitarian disaster in Yemen and with an estimated 154,000 people killed through military action (Raleigh et al., 2010). Other, less publicized examples are second-hand arms transfers from Germany or France, which supplied trainer aircraft and military vehicles to Ethiopia in recent years. These exported arms are considered by some to have played a role in the Tigray conflict, where air and artillery strikes reportedly were responsible for numerous casualties (UN News (2022), Deen (2021)). As a result, arms transfers are often accompanied by political debates about the negative consequences they can carry. This debate is the starting point for research on arms transfers and conflict.

The relationship between arms imports of governments and conflict onset has slowly received more attention over the last few years. Up until now, it has been contested in research whether arms transfers drive war. Academic research has posited that arms imports could lead to predatory attacks from the importing government. However, it could also lead to a pre-emptive attack by the challengers before the government becomes too powerful (e.g. Walter (2009a), Lichbach (1998)). Also, arms imports could deter challengers (e.g. Huth (1988), Fearon and Laitin (2003)).

A significant problem has been to account for the direction of causality if arms imports drive conflict or conflict drives arms imports. Disentangling this relationship has given evidence into the direction that while arms imports do not *cause* internal conflict, they do increase the probability of an outbreak of conflict (Moore (2012), Pamp et al. (2016)). Still, the debate remains unsettled. This paper aims to shed

further light on the debate by introducing the second-hand arms aspect.

In this paper, I argue that the existing research on arms imports and conflict onset lacks a crucial explanatory factor: They have so far overlooked that the consequence of an arms import is different if it is a new or an old arm. This paper shows that distinguishing between the two import types is relevant because it increases our understanding of conflict dynamics. Building on existing theories, I will first derive three explanations for why arms imports generally drive conflict onset. In a second step, I will develop a theory of why due to the old arms' characteristics, these three explanations even apply more strongly to old arms. Subsequently, the aim is to answer the question: *Does the import of second-hand arms impact the risk of the outbreak of intrastate conflicts more than new arms imports?*

Second-hand arms transfer matters as they are of relevant size compared to the overall arms transfers. They represent, on average, 10% of the yearly number of arms transferred. Research on second-hand arms remains scarce, and existing studies mainly consider why countries export their old arms. For example, Wezeman and Wezeman (1996) and Davis and Schofield (1997) study Dutch and British Exports, respectively. However, even these remain on a case level and do not focus on the consequences old arms can bear (see also Beraud-Sudreau (2010) and Beraud-Sudreau and Holtom (2013)). Therefore, theoretical insight into old arms transfers is still very limited. There are first analytical indications from paper A and B of this dissertation that old arms transfers differ in a meaningful way from new arms transfers. Paper A shows that old arms transfer patterns are different from new arms transfer patterns and paper B looks at the determinants of old arms transfers.

From the studies of arms imports and conflict onset three explanations can be derived: time, cost, and reliability. I claim that the three explanations apply more strongly for old arms imports due to their specific characteristics. The second-hand arms theoretical framework I develop based on the three explanations helps to understand conflict onset even better. Regarding time, old arms are delivered faster

and are instantly available compared to new arms. Old arms are also different in cost characteristics and can be bought in larger volumes because they are cheaper than new arms. Plus, they are more reliable in their delivery and ease of use. These characteristics should result in the observation that old arms impact conflict onset risk more strongly than new arms imports.

From the theoretical framework, a hypothesis is derived and tested. It is important that the research design tackles the causality question. Relying on a so-called shift-share instrument, which is used in trade literature, one can control for endogeneity. The analysis results indicate a small but significant increase in conflict onset risk, given that old arms are imported. There is no statistically significant effect of new arms imports impacting conflict onset risk. The results remain limited because the findings are not very robust to alternative specifications. Still, the first insight is gained that there is a meaningful difference between the imports of old arms and new arms concerning conflict onset risk.

The paper is structured as follows: the next section summarizes the relevant literature and is followed by the development of the explanatory framework, which delivers a hypothesis. The next section presents the research design with the data and the instrumental variable approach, which allows me to leverage exogenous variation to control for the causal relationship between arms imports and conflict onset. The results will be discussed before I conclude with an outlook on policy relevance and future studies of arms imports and conflict.

4.2 Literature on Arms Imports and Intrastate Conflict Onset

So far, the research on arms imports and intrastate conflict onset has come to contradictory results. What the studies have in common is that they distinguish between two actors: governments and their domestic challengers. Both actors can initiate

conflict. A few studies find no link between arms imports and conflict. Suzuki (2007), for example, studies the impact of postcolonial countries' arms imports from major powers on conflict onset risk. For the analysed period 1956-1998, he finds no effect of these imports (see also Durch (2000)).

However, a larger share of studies does find a relationship between arms imports and conflict onset. Nevertheless, the researchers disagree on the exact relationship: some assume that the risk of conflict onset is decreasing, others argue that it is increasing. Huth (1988), Fearon and Laitin (2003), and Johnson et al. (2015) find that when governments signal resolve and capacity to use force, e.g., through arms imports, they can deter challengers. Fearon and Laitin (2003), for example, argue and show that, higher military capabilities deter challengers from attacking. This strand of literature contributes to the understanding that arms imports can prevent internal conflicts by effective deterrence.

Still, the larger share of studies does find a relationship between arms imports and conflict onset. A pre-emptive rebel attack can also occur and lead to conflict onset if the arms imports change the threat perception of rebels about the resolve and capacity of the government (e.g. Powell (2006), Walter (2009b), Powell (2012)). On the other hand, the willingness and opportunity structure of an arms-importing government could also lead to a predatory attack by the government (e.g. Craft and Smaldone (2002), Fordham (2004), Chassang and Miquel (2010), Moore (2012), (Kydd, 2015, p. 118)). In this case, both strands of literature show that a government's arms imports can result in conflict onset either initiated from the challenger or government side.

A methodological issue that most papers need to address adequately is the causality question. An exception to that is Pamp et al. (2016), who specifically tackle the question of endogeneity in their research through the use of an instrumental variable approach. They find that while arms imports do not cause intrastate conflict, they do not serve as a deterrent for rebels but contribute to conflict onset. This causality

debate will also be considered in this paper's research design. In sum, there are various studies with different theoretical approaches, and most of them indicate a positive relationship between arms imports and intrastate conflict onset.

A reason why these papers come to different conclusions is that they have yet to consider the different impact of new and old arms imports on conflict onset risk. Building on existing literature, I construct my framework and derive three main explanations for arms imports and conflict onset. Based on these, I argue that old arms have a more considerable impact on conflict onset risk than new arms imports due to old arms' characteristics. So far, the studies have yet to distinguish between new and old arms imports. To my knowledge, the old arms dimension has not been taken into account in any conflict onset study. By including it, I expand the existing theories to explain better what we observe. I will carve out that these theories implicitly assume, or disregard, characteristics of these arms imports that relate to conflict onset, which actually fit old arms. For example, when the theories mention time, costs of deterrence, or reliability. In sum, there were no assumptions made about the specific role of old arms in the context of conflict onset, while there are indications that they could be relevant to study.

4.3 Explanatory Framework for Second-Hand Arms Imports and Conflict Onset

In order to evaluate the question of whether second-hand arms imports impact the risk of the outbreak of intrastate conflicts more than new arms imports, I develop a new theoretical framework. First, I advance the debate by deriving from the existing theoretical approaches three explanations for arms imports in general impacting conflict onset. In the second step, the theoretical argument is developed that the three explanations should be even more valid for old arms due to old arms' characteristics. As a result, old arms imports should increase conflict onset risk more than

new arms imports. This holds true, I argue, even if these explanations are different from each other in their perspective on how conflict breaks out. As discussed in the previous literature section, either the challengers or the government pre-emptively or predatory attack, leading to an intrastate war. Based on the constructed framework a hypothesis is generated to test the arguments.

The first and probably the most relevant explanation for when arms imports impact the risk of conflict onset is time. This explanation is an important factor in the theoretical considerations of Fordham (2004) and also Powell (2006), but one which remains only implicit. Fordham (2004) studies the argument that increasing military capabilities make using force more likely. Fordham (2004) relies on the concept from Most and Starr (1989) where "opportunity" increases "willingness". Military capabilities influence decision-makers' opportunities and impact the willingness to act upon those. He states that changes in the military balance can change the opportunity structure for a predatory military action in order to take advantage of a currently weaker challenger (Fordham, 2004, p. 634-635). If this is the case, the government is forced to quickly take advantage of the challenger, who might only be weaker for a short time. This means that the government prefers to import arms rapidly to be able to act on the situation. In short, if the government can quickly import arms to attack a temporarily weaker challenger, conflict onset is more likely.

The model from Powell (2006) differs from Fordham (2004) in that the challengers' pre-emptively attack. Also, his approach implies that time plays an essential role if arms imports lead to conflict onset. Powell (2006) states that if there is a weaker bargainer who becomes stronger that it will renege on any agreements with the stronger adversary. The reneging of the agreement will especially be the case if the power shift for the once-weak bargainer is large and rapid (Powell, 2006, p. 181). The adversary will foresee this and pre-emptively attack to secure its advantage. An example is weak governments with peace agreements with domestic rebel groups.

While their governmental status remains fragile, they will not renege on the agreement. However, if the rebel groups expect a sudden shift in the power distribution, e.g., arms imports, the bargaining breaks down, and they pre-emptively attack the government. Therefore, time is relevant if, in a short period, a substantial amount of arms is imported by the government. The rapidly increasing governmental arms stocks will drive the challenger to attack, and conflict will break out.

Both Fordham (2004) and Powell (2006) show in their models that a sudden shift in the power distributions between government and challenger can lead to conflict onset. If the government wants to attack a temporarily weaker challenger, it will aim to increase its arms stocks in a short period of time. Also, if a weak government is able to increase its arms stocks rapidly, it might lead to a pre-emptive attack by a challenger. While these arguments apply to arms imports in general, they apply even more to old arms imports due to their specific characteristics in relation to time.

Old arms already exist and do not need to be produced. Therefore, they can be delivered faster than new arms, which need to be produced. On average, the delivery time is 3 years for old arms and 7 years for new arms (SIPRI, 2019a). As the SIPRI (2019a) data shows, old arms can even be transferred within the same year. This can also currently be seen live in the case of the current war in Ukraine. Therefore, if a country needs weapons immediately and with urgency it will prefer existing, meaning old, weapons. The time characteristic, in addition to the quick delivery, is also defined by the fact that a country could potentially import arms from any country in the world and not only a few countries which produce arms. This fact further shortens the import time of old arms. Overall, the fact that old arms are readily available and can be supplied by theoretically any country which owns arms makes old arms imports distinct regarding the concept of time.

Therefore, the government from the Fordham (2004) model will need to choose old arms over new arms in order to ensure it can attack the temporarily weaker challenger in time. Old arms are readily available and can be imported from potentially

any country. Therefore, old arms should play a more prominent role in the outbreak of conflict than new arms imports. New arms imports take much longer and cannot be relied upon to arrive in time to act on the sudden weaker challenger. Also, in the Powell (2006) model, I would expect old arms imports to play a larger role in increasing conflict risk compared to new arms. A rapid change of power through arms imports is only possible if the delivery time, as it is for old arms, is short. Sudden imports are unlikely for new arms because they are, in most cases, produced after the order. In addition, the government can choose from many different countries to import. Therefore, arms imports in both models are likely to impact conflict risk onset, but the explanation is more valid for the import of old arms.

The second explanation I derive is the cost component of arms imports, which can also impact conflict onset. Kydd (2015) is a case in point where the cost question plays a role in the outbreak of conflict. Looking at deterrence, he builds a formal model with a bound, which marks a threshold where deterrence becomes more costly than war. He argues that if built-up costs are lower than the cost of war, there will be no built-up. If built-up costs are too high, also no war breaks out as built-up would be prohibitively costly (Kydd, 2015, p. 118). However, if for one side, the built-up costs are "middling" (Kydd, 2015, p. 119) but the increase of the level of power with a built-up high, then this side is willing to initiate pre-emptive war. If this threshold is reached, arms imports can foster conflict onset.

The cost component, I argue, applies differently to the import of old arms compared to new ones. Second-hand arms are cheaper and do not suffer from cost explosions, which might arise during the production process of new arms. These characteristics make old arms more attractive to countries that cannot afford the newest production line. Arms costs are difficult to determine because these vary enormously across the different transfer (e.g. alliance) partners and contract types. Even the constructed measure from SIPRI only considers the unit production costs, which is not aimed to represent the financial value of the transfer (SIPRI, 2019b). Since second-hand arms

are cheaper than new ones, governments can also afford a larger amount.

A government needs to balance if a couple of arms with new technology is more valuable than a larger amount of older arms during conflict. In the case of internal conflict, it is unlikely that the domestic challenger has access to modern heavy arms and rather possesses inferior gear. Subsequently, the government's need for cutting-edge technology to fight domestic rebels might be lower. Therefore, a larger amount of arms for the government, even though not state-of-the-art, seems more practical, especially if one might need to handle some loss of arms during the conflict. In sum, the costs of arms should drive a government's decision in general, especially in favour of old arms if it faces a restricted budget and prefers quantity over new technology.

Subsequently, I argue that the Kydd (2015) model also implicitly applies more fittingly for the import of old arms. Old arms, as outlined above, are cheaper than new arms, which also allows for being bought in higher volumes. This goes hand in hand with the argument that costs will be "middling" (Kydd, 2015, p. 119) while the power built up is high. If a government is facing the need to deter challengers but secures access to some amount of old arms, the import surge, therefore, should lead to the decision to pre-emptively attack. Therefore, while the cost explanation applies to arms imports in general, this argument should be even more valid for old arms imports impacting conflict onset risk compared to new arms imports.

TABLE 4.1: Synopsis of the explanatory framework

Explanation	Old Arms Characteristic	Reference to Theory
Time	- Delivery time - Availability	Powell (2006) Fordham (2004)
Costs	- Lower price - Larger volume	Kydd (2015)
Reliability	- Ease of use - Reliable delivery	Chassang and Miquel (2010)

The reliability component is the third explanation, which I derive. The analysis from Chassang and Miquel (2010) introduces a setting under strategic risk, which means that the actors assess situations differently, with incomplete information, and can either make a predatory or pre-emptive attack. Pre-emptive strikes seem reasonable in case of an increase in military capacity by the adversary that is reliable and sustained through punctual deliveries. Suppose the challenger sees the government as able to rely on well-functioning arms delivered without delays. In that case, the cost of being a second mover becomes too high, and the challenger launches a pre-emptive attack (Chassang and Miquel, 2010, p. 13-14). If arms imports are reliable, then conflict onset risk increases.

Old arms imports are characterised by such reliability because they are more accessible and trusted in their application than new arms. The second-hand imported arms might be more of the same as the military already operates and is known to the army. Also, e.g., older gear is less technically demanding, whereas modern technology requires a sufficient amount of training to be proficient in operating it. In addition, old arms are more reliable in that the expected (short) delivery time should hold true. In comparison, new arms transfers often suffer from multiple delivery postponements. The application and expected delivery time are features of old arms that make them specifically reliable. This characteristic makes them attractive in certain situations when a government is in a situation where it needs such reliability. Overall, given the Chassang and Miquel (2010) example, one should also expect that since old arms imports are more reliable, they will link to the impact of conflict risk onset more than new arms imports.

To introduce a last theoretical perspective, independent of the three characteristics, the network approach to arms transfers can help explain why old arms transfers have a link to conflict onset. First, the production of new arms might receive more scrutiny than a one-off sale of old arms. When governments decide to sell their

stocks, far fewer parties are involved than in a whole, years-long production process. Therefore, new arms might be less likely to be sold to countries prone to conflict, while old arms get sent there. This is why old arms are likely linked to conflict onset. Second, if new arms are sold, the importing governments might want to avoid risking the arms transfer link, which is hard to establish (Pamp et al., 2021), by employing them in an internal conflict. The supplier government might get pressured by its voters to end the transfer relationship. The result we see is that an inflow of old arms is more likely linked to conflict onset than new arms as importing governments would rather employ old arms for conflict.

To summarize the theoretical approach of this paper: I have derived three explanations of how a government's arms import impacts conflict risk. Subsequently, I developed the argument that due to characteristics of old arms, the three explanations, time, costs, and reliability, apply more strongly for old arms imports than new arms imports. A synopsis of the framework is in Table 4.1. The framework applies independently from which actor, government, or challenger, attacks first and independently if the actor's motive is a predatory or pre-emptive attack. Ultimately, the fact that old arms, compared to new arms, are delivered faster, are instantly available and because at their lower price can be bought in larger volumes, plus are more reliable in their ease of use and delivery should relate them to conflict onset risk more strongly. Taking together the preceding theoretical considerations in this section, this finally leads to the hypothesis:

H: Imports of old arms increase the risk of conflict onset more than new arms imports.

4.4 Research Design

The analysis relies on a large, unbalanced dataset covering the years 1950 to 2019 and includes 171 countries. The main issue of studying anything related to conflict, be it onset, duration, or how conflicts end, is the concern about endogeneity. It is difficult to disentangle the definite link between cause and effect. See, for example, other studies which analyse further causal links to intrastate conflict onset, e.g., resource abundance (Collier and Hoeffler (2012)) or inequality (Hillesund et al. (2018)). The correct statistical analysis tools for the given data problem are needed to control for reverse causality. In order to attempt an answer to the question, the research design employs an instrumental variable (IV) approach, which estimates specifically causal relationships. Still, the selection of an instrumental variable needs to follow strict guidelines. I will discuss these in the estimation strategy section but will first present the operationalisation of the dependent, explanatory, and control variables.

4.4.1 Dependent Variable

The dependent variable *conflict onset* is a binary variable which represents if in a country i and a year t a conflict starts. The definition of an armed intrastate conflict is "a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 25 battle-related deaths in a calendar year."[1]. The conflict data is from the UCDP/PRIO Armed Conflict Dataset version 20.1 (see Pettersson and Öberg (2020) and Pettersson and Öberg (2020)) and represents in a given country-year observation that the variable *conflict onset* takes the value 0 if there is no conflict and 1 if a conflict begins in this year. If the subsequent years continue to record conflicts after conflict onset, these country-year observations are set to missing. According to McGrath (2015), the results would be biased if the ongoing conflict years were set to zero, and inference would not be possible.

[1] For a more in-depth discussion on definitions, see http://www.pcr.uu.se/research/ucdp/definitions/

Figure 4.1 displays, based on the Pettersson and Öberg (2020) and Pettersson and Öberg (2020) data, how many conflict onsets were recorded per year. On average, 3.8 conflicts broke out per year between 1950 and 2019. The year 1990 had 11 conflict onsets, the highest number, and there were only four years without any conflict onsets. While during the Cold War, an average of 3.3 conflict onsets were recorded per year, after the Cold War, 4.5 conflict onsets were recorded on average per year. This observation could be due to correlation: after the Cold War, new countries were established. Newly created states are more fragile than long-established states, and as sovereignty was internally still contested, they might be more prone to intrastate conflict. In addition, the more countries that exist over time, the more countries potentially experience conflict onset. This fact will later be taken into account through controlling for the two different periods.

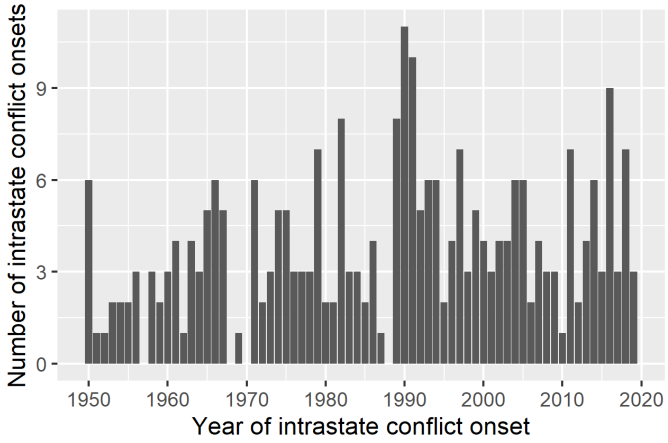

FIGURE 4.1: Number of conflict onsets per year over time. Data is from Pettersson and Öberg (2020) and Pettersson and Öberg (2020).

4.4.2 Explanatory Variables

The explanatory variable is the logged number of old arms (LOG OLD IMPORT) and the logged number of new arms (LOG NEW IMPORT) imported by a countries government in year t over the period 1950 to 2019. The data is from the Arms Transfers Database of the Stockholm International Peace Research Institute (SIPRI, 2019a).

SIPRI collects data on a highly granular level, such as transfer dyad, order, delivery date, type of weapon (see in Appendix A Table A.1), and the number of arms transferred. For my analysis, I use the delivery date, which is more reliable but lag the variables by one year. I prefer to use the number of arms imported instead of the Trend Indicator Value (TIV) constructed by SIPRI to measure the transfer value. Specifically, the TIV "is based on the known unit production costs of a core set of weapons and is intended to represent the transfer of military resources rather than the financial value of the transfer." (SIPRI, 2019b).

A second hand-hand weapon is discounted in its TIV value and represents 40% of the value of a new arm. I consider this as a very blunt measure as these second-hand arms might cost far more or less than the assumed 40%. Also, their value could be rather independent of the military power they represent. Therefore, I rely on the logged number of second-hand arms imported and the logged number of new arms imported as a measure if arms imports condition conflict. The reason for the log transformation is that it makes interpretation of the impact easier and is helpful if the data varies significantly on the relative scale.

In Figure 4.2, the graphic on the left side shows that over time the total yearly number of new arms imports (solid line) and the number of old arms imports (dotted line). The graphic on the right side shows the logged version of the number of arms imports. New arms imports are far larger than old arms imports and vary much more over time. Old arms imports remained on a constant level and showed a small increase after the end of the Cold War but went down to the usual level after a few years. As the import of arms several years before a conflict might play a role, I also control for a 5 and 10-year moving average of logged old arms imports. This average is represented by the LOG 5/10 OLD IMPORT variable.

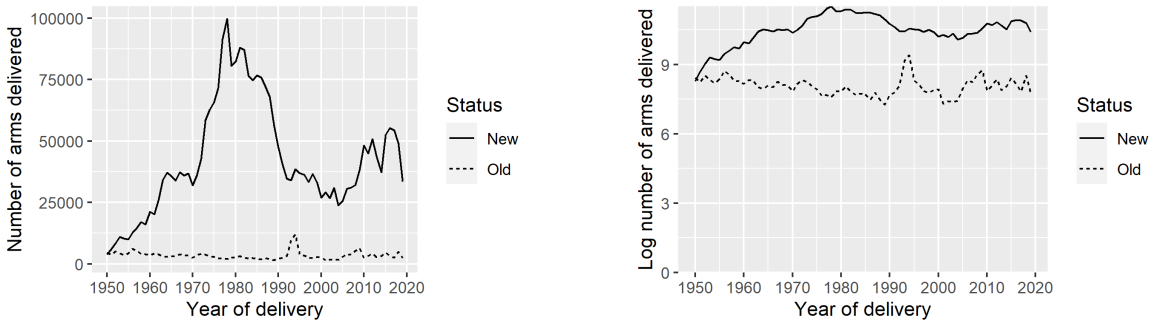

FIGURE 4.2: Number of new and old arms imports over time (left) and the log transformation (right). Data is from SIPRI (2019a).

4.4.3 Control Variables

The included controls are broadly discussed in the conflict onset literature. Statistical analysis includes control variables when it expects that they impact the dependent and explanatory variables. Therefore, I include the log of GDP as well as the log of military expenditures. Both are seen as potential drivers of conflict propensity. A wealthy country should experience less internal conflict. However, higher military expenditures could indicate preparation for internal conflicts. Also, with rising wealth and military expenditures, the countries can invest in domestic arms production and import fewer old arms but more new ones. The LOG GDP comes from Gleditsch (2013), see for explanation Gleditsch (2002), and the World Bank (2017), which are merged and inflation corrected. The military expenditure data for LOG MILEX is merged from Nordhaus et al. (2012), which relies on information from SIPRI and the Correlates of War Project (2017), and the data is extended to 2019 based on the most recent SIPRI military expenditure data (SIPRI, 2019c).

The democratic level is correlated to both conflict onset and old and new arms imports. The more a country adheres to the rule of law, respects human rights, and has free and fair elections, the less likely conflict will occur. In addition, a more democratic country has less of a need to acquire arms, as they are less likely to require

arms quickly and to be involved in situations where they need arms to solve issues. To control for this influence I rely on the standard measure of authority characteristics of states in the world system, the Polity5 project from Marshall and Gurr (2020). The measure goes from -10 (hereditary monarchy) to +10 (consolidated democracy) based on six different component measures.

Furthermore, there is the issue that imports of new and old arms correlate. For example, technically compatible old arms could accompany new arms imports. These old arms are imported in addition to new arms. In order to account for this relationship, I include in a robustness check the new arms import variable with a one-year lag, LAG NEW IMPORT. In doing so, I control for the temporal sequence if new arms imports lead to old arms imports.

In addition, conflict is more likely if the country has experienced conflict recently. Therefore, I add CONFLICT5Y if a conflict has occurred in the last 5 years. Finally, I add a binary POST CW dummy, which takes the value of 1 if the observation occurred after 1991, the end of the Cold War. The reason is that research has shown that the arms transfer market and occurrence of conflicts have changed after the Cold War.

4.4.4 The Estimation Strategy

The model to estimate the relationship between the import of old arms and conflict is based on an instrumental variable (IV) approach to control for endogeneity. Endogeneity means that arms imports can impact conflict onset risk, but it could also be the case that conflict onset impacts arms imports. Before applying the IV approach to the research question of this paper, I give a brief impression of the idea behind IVs. The starting point of the IV development was to account for causality in an environment where no controlled experiments were possible. The idea was to introduce a third variable to introduce exogenous variation.

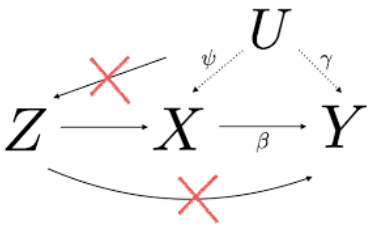

FIGURE 4.3: Graphic represents the IV approach where the relationship between X and Y is confounded by U. Exogenous variation is introduced through the instrument Z and no causal relationship channels are allowed where the crosses are. Graphic taken from Peysakhovich and Eckles (2018, p. 700).

Figure 4.3 is from Peysakhovich and Eckles (2018, p. 700) and visualizes the IV model. The problem is that the relationship between X and Y is confounded through U. The causal impact of X on Y cannot be disentangled. By adding variable Z, exogenous variation is introduced, and the causal relationship can be identified. The idea is that variable Z only impacts X and is the relevance condition for valid instruments. Any effect of Z on Y is ruled out, as represented by the crossed-out relationship, the so-called exclusion restriction, and the second condition of a valid instrument. Also, any relationship needs to be ruled out between U and Z.

A simple example is the analysis of the impact of smoking on health from Leigh and Schembri (2004). They introduced exogenous variation to rule out confounders, e.g., mental health. They exploited changes in tobacco taxes, which should only directly impact the rate of smoking, in the first stage, through decreasing demand, but not health. With a rise in tobacco tax, health should increase via higher cigarette prices in the second stage (Leigh and Schembri, 2004).

The IV this paper relies on is often used in trade and migration studies. It is called the Bartik or shift-share instrument. The concept behind this instrument is that there is a shock. However, the exposure to the shock and the resulting changes are different. The typical example is from Autor et al. (2013). They measure if and how China's accession to the WTO and the subsequent trade liberalization has impacted

employment rates in the U.S. They break down the U.S. exposure to Chinese imports based on regional variation in their manufacturing industries in the first stage. Indeed, the labour-intensive U.S. industries, where China has a comparative advantage, saw a more considerable decline in employment compared to other industries in the second stage.

A similar IV idea is employed by Auer and Meierrieks (2021), who estimate the impact of arms imports on domestic terrorist attacks. They argue that the *global supply* of arms is based on the strategic considerations of the exporting countries. Therefore, the factors in the exporting countries determine the supply, or "shock" of arms and represent the instrumental variable, which introduces exogenous variation. This paper follows their argument that the exporters' ideological preferences, geostrategic concerns, and political economy considerations drive arms exports. This instrument Z is a "shock" that "cannot be systematically influenced by individual importing countries" (Auer and Meierrieks, 2021, p. 8). The importers ultimately cannot influence the factors in the exporting countries, and the global supply introduces the exogenous variation, which is needed. The only difference to the Auer and Meierrieks (2021) IV is that this paper has two separate IVs, one for the global new arms supply and the global old arms supply.

The estimation of the model takes the following form:

First Stage A:

$$OldImports_{i,t} = \beta_1 + OldGlobalExp_{i,t} + \delta_1 * \mathbf{X}_{i,t} + \lambda_{1,i} + \tau_{1,t} + \varepsilon_{1,i,t}$$

First Stage B:

$$NewImports_{i,t} = \beta_1 + NewGlobalExp_{i,t} + \delta_1 * \mathbf{X}_{i,t} + \lambda_{1,i} + \tau_{1,t} + \varepsilon_{1,i,t}$$

Second Stage:

$$Conflict_{i,t} = \beta_2 + \widehat{OldImports}_{i,t-1} + \widehat{NewImports}_{i,t-1} + \delta_2 * \mathbf{X}_{i,t-1} + \lambda_{2,i} + \tau_{2,t} + \varepsilon_{2,i,t}$$

The model describes the vector of controls $\mathbf{X}$ and country λ and year τ effects. The fixed effects are employed as there is potential country-specific heterogeneity and time-invariant factors.

The *first stage A* regression includes the instrument, $OldGlobalExp_{i,t}$, which predicts the endogenous $OldImports_{i,t}$, the number of old arms imports. The same is done for *first stage B*. In the *second stage*, the predicted $\widehat{OldImports}_{i,t-1}$ and $\widehat{NewImports}_{i,t-1}$ are employed to predict our dependent variable $conflict_{i,t}$, specifically the probability of a conflict. The numerical construction of both instruments takes the same steps and follows the idea from Auer and Meierrieks (2021). Because both instruments are constructed the same way, the following explanation is the example for the old arms import instrument but applies the same way for new arms imports.

The instrument $OldGlobalExp_{i,t}$ relates the global old arms exports of the supplier with the importing country of interest. It is corrected by the arms exporter supply to other regions as well as weighted by the suppliers' relative importance of the total arms imports of the country of interest. To break it down into an example similar to

the smoking and tax study, imagine that global supply increases because of innovations in military technology or because a new government decides to approve more arms deals. This leads to a shift in the supply that can be measured.

An example for the numerical construction is if there is a country A which imports in one year 12 arms, 4 arms from country X, and 8 from country Z. Country X has exported 20 old arms, and country Z has exported 40 old arms in total this year. To rule out that regional developments influence the supply of arms, transfers to the region (e.g. Central Asia) that country A belongs to by the suppliers X and Y will be subtracted. For example, country X exports in total (including the ones to country A) 6 old arms, and country Z exports 12 old arms during the year in the region of country A.[2] The following equation calculates the value of the instrument $OldGlobalExp_{i,t}$, of country A arms imports for the given year:

$$\underbrace{(20-6)}_{\text{country X out of region export}} * \underbrace{\frac{4}{4+8}}_{\text{country X weight}} + \underbrace{(40-12)}_{\text{country Z out of region export}} * \underbrace{\frac{8}{4+8}}_{\text{country Z weight}} \approx 23$$

The construction of the $NewGlobalExp_{i,t}$ instrument follows the same steps. To summarize the research design, the IV approach is employed to control for endogeneity. The IV needs to fulfil two conditions to be valid: relevance and exogeneity. Regarding relevance, I argue that as the global supply of old arms increases, domestic imports are also expected to increase as domestic demand can be satisfied. This correlation between the instrument and the explanatory variable can be empirically tested. The exogeneity condition, as argued above, is due to the fact that the importing country cannot affect the export factors, that is, ideological preferences, geostrategic

[2]The regional neighbourhoods are: Northern Africa, Eastern Africa, Middle Africa, Southern Africa, Western Africa, Caribbean, Central America, South America, Northern America, Central Asia, Eastern Asia, South-eastern Asia, Southern Asia, Western Asia, Eastern Europe, Northern Europe, Channel Islands, Southern Europe, Western Europe, Australia and New Zealand, Melanesia, Micronesia, Polynesia (UNSD, 1999)

concerns, and political economy considerations, which drive global supply. This ultimately leads to the desired exogenous variation needed to estimate the impact of old arms imports and new arms imports on conflict onset.

4.5 Empirical Results

Table 4.2 reports the results of the analysis. The model (1) tests in a basic OLS estimation if there is in general a link between old and new arms imports on conflict onset. Model (2) includes the control variables in the OLS regression. There seems to be a significant and positive relationship between old arms imports and conflict onset while new arms imports do not show any effect.

Models (3) to (7) report the results of the IV estimation. These are the results of the structural equation from above. In order to give a clearer overview the first stage only shows the results from the instruments and the control variables are left out. Control variables in general do not need to be interpreted as they do not lend themselves to causal interpretation (Hünermund and Louw, 2020). Model (3) shows the full estimation with both old and new arms imports included as instrumented explanatory variables. The results confirm in part the hypothesis of the paper. Old arms imports do have a positive and significant impact on the conflict onset risk. However, the new arms imports have no significant effect on the conflict onset risk. Before turning to the interpretation of the results I discuss the robustness of the results.

First, the model (3) itself shows for the first stage that both instruments have a positive significant impact on the first stage. This means that, indeed, the global supply of old arms and the global supply of new arms lead to an increase of arms imports in the observed country *i*. This introduces the desired exogenous variation. In order to evaluate the validity of the instrument I rely on the commonly used Cragg-Donald statistic (Stock and Yogo, 2002). It represents a set of critical values that tests when

the nominal 5 percent 2SLS t-test for the hypothesis that $\beta = 0$ has (in this case) the size potentially exceeding 15 percent. In all models (3) to (6) the critical value is surpassed. In addition, the F statistic is over the conventional threshold of > 10 and therefore indicates that the instrument is relevant.

The subsequent models test the robustness of the main model (3) and how sensitive it is to changes. The main issue of the estimation is that old and new arms could correlate with each other. It could be the case that newly produced arms are being delivered together with older arms versions. Also, an arms transfer deal could consist of a package of old and new arms. As a first check model (4) leaves out the NEW IMPORT variable to see if the model still hold. The model (5) leaves out OLD IMPORT. Both models do not change substantively indicating that the correlation should not have a substantial impact.

A further robustness check to control for the sequential relationship is model (6). If the old and new arms transfers take place within a year they could condition each other and a post-treatment bias would occur. For example, an import of new arms could lead to an additional transfer of old arms of e.g. arms that are similar but only the older version. This would yield biased estimates. A solution to the problem is to include the NEW IMPORT with a one year lag. Including LAG NEW IMPORT would control for a sequential relationship where the imports of new arms in time *t* would be lagged to *t-1*. Also in this setting the results do mainly stay the same.

A final robustness check in model (7) looked at the question if the imports over the years are more relevant in explaining conflict onset. It could be that the arms imports over the years makes conflict onset more likely. The results show that the average old and new arms imports over 5 years, AVG 5Y OLD IMPORT, do not have a significant impact. Apparently, the rapid change of power, as stipulated in the theory section is relevant for conflict onset. However, there is the issue that the IV for the IV AVG 5Y NEW IMPORT does not gain significance so the overall validity of the estimation is reduced.

In sum, the main model (3) is robust to alternative specification and one cannot reject the postulated hypothesis the second-hand arms imports impact conflict onset risk more tan new arms imports. Only the import of old arms yields a positive and significant impact on conflict onset risk. A 10 percentage point increase of the number of old arms imported leads to a 4% increase in the probability that we see conflict outbreak in the subsequent year ($p < .1$). The second part of the hypothesis, that new arms imports have also an impact though, smaller than older arms imports, does not apply. There is no significant effect over all model specifications of new arms imports on conflict onset.

What does this result imply? Referring to the theoretical framework it could represent that when time is of essence the government always prefers old arms and only if it has the possibility to access new arms it will do so. If it has the option it will also import new arms but does not specifically seek them. In addition, relating to costs, due to the fact that old arms can be afforded in higher amounts, a quick built-up of power and subsequent conflict is not achievable through new arms. Again, the results further represent that if the government gains access to new arms imports, it will not discriminate against it. The reliability characteristic could also factor in why old arms imports impact conflict onset risk and new arms imports have no causal link. As they are more trusted in their application the shift in power could result in pre-emptive or predatory attacks.

Overall, based on the results one can conclude that old arms imports are causally linked to conflict onset and new arms imports not. The results describe that imports of old arms are different to new arms imports in their impact on conflict onset risk. This means that if certain situations can be observed within a country, e.g. that a challenger is temporally weaker, and the government imports old arms, that the risk of conflict onset increases. Or, if a country imports large amounts of old arms in a short period of time, the same applies. Lastly, if the government imports arms that have been proven reliable, maybe even in previous conflicts it has fought, this

TABLE 4.2: Two-stage least squares: intrastate conflict onset on old arms imports

	OLS (Conflict)		*Second Stage (Conflict)*				
Independent variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
OLD IMPORT	.006***	.005***	.004**	.004*		.005**	
	(.002)	(.001)	(.002)	(.002)		(.002)	
NEW IMPORT	-.002		-.002		-.003		
		(.001)	(.002)		(.002)		
LAG NEW IMPORT						-.001	
						(.003)	
AVG 5Y OLD IMPORT							-.061
							(.059)
AVG 5Y NEW IMPORT							.38
							(.343)
GDP		-.001	-.001	-.001	-.001	-.001	-.001
		(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
MILEXP		.001	.002	.001	.002	.001	-.003
		(.001)	(.002)	(.001)	(.002)	(.003)	(.004)
POLITY		-.001***	-.001***	-.001***	-.001***	-.001***	.001
		.001	(.001)	(.001)	(.001)	(.001)	(.001)
POPULATION		.001	.001	.001	.001	.001	.001
		(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
CONFLICT5Y		.075***	.075***	.075***	.074***	.075***	.059***
		(.010)	(.010)	(.010)	(.010)	(.010)	(.018)
POST CW		.003	-.052**	-.052*	-.050	.012	-.244**
		(.004)	(.031)	(.031)	(.030)	(.017)	(.132)
Cragg-Donald statistic			829	2519	1681	850	
					First Stage		
IV OLD ARMS			.001***	.001***		.001***	
			(.001)	(.001)		(.001)	
IV NEW ARMS					.001***		
					(.001)		
IV LAG NEW ARMS						.001***	
						(.001)	
IV AVG 5Y OLD IMPORT							-.001**
							(.001)
IV AVG 5Y NEW IMPORT							-.001
							(.001)
Number of observations	8762	8762	8762	8762	8762	8594	8757

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

Note: Each regression includes country and year dummies. Newey-West heterosketastistic and autocorrelation consistent standard errors in parentheses with the standard Bartlett kernel, bandwith = 2

should also signal a potentially higher conflict onset risk.

4.6 Conclusion

This paper has set out to answer the question: Does the import of second-hand arms impact the risk of the outbreak of intrastate conflicts more than new arms imports? The starting point was that literature suggests a positive relationship between arms imports and conflict onset risk. My argument was that the existing theories apply for new arms imports but due to certain old arms characteristics even more strongly for old arms imports. First, I derived three explanations from the arms imports and conflict onset literature. Second, the subsequent explanatory framework argued that due to old arms characteristics these imports have a larger impact on conflict onset risk than new arms imports.

The old arms characteristics are time, cost and reliability. Together they explain why under certain situations e.g. power shifts between government and challenger, old arms imports are chosen over new arms. In order to test the developed hypothesis a research design was constructed, which is able to account for causality. The aim of the IV approach was to leverage exogenous variation in the global supply of old arms and the global supply of new arms to determine the effect of old arms imports and new arms imports on conflict onset.

The results support the hypothesis. While old arms imports do show a significant effect on conflict onset, new arms imports had no significant effect at all. This means that under the theorized situations old arms are chosen due to their characteristics, while new arms do not have a significant impact. The results of this paper are limited because neither the side which initiates conflict can be determined or if a predatory or pre-emptive attack takes place. In addition, the framework of this paper only tested through the proxy of old arms the three characteristics. Future research should develop methods how to test separately to what extent each characteristic

explains the impact on conflict onset. In addition, further conceptualisations can be tested, e.g. instead of the numbers of arms imported one could use the TIV values of these transfers.

To conclude, the framework, which was tested in this paper and the subsequent results contribute to the conflict onset literature. It introduces a neglected influence and calls for a differentiation between new and old arms imports. Furthermore, the results could be policy relevant. For example, an early warning system could be established, which tracks specifically the old arms imports and the amount of these old arms imports. Through relating these imports to the internal situation of the country, e.g. how fragile it is, the degree of conflict onset risk could be determined. Subsequently, policies could be developed, e.g. peace building measures, that pro-actively engage instead of reacting to the conflict.

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Appendix A

Appendix

Arms Categories

TABLE A.1: Types of major conventional weapons, as defined by SIPRI (2019b)

Type	Definition
Aircraft	All fixed-wing aircraft and helicopters, including unmanned aircraft (UAV/UCAV) with a minimum loaded weight of 20 kg. Exceptions are microlight aircraft, powered and unpowered gliders and target drones.
Air-defence systems	(a) All land-based surface-to-air missile (SAM) systems, and (b) all anti-aircraft guns with a calibre of more than 40 mm or with multiple barrels with a combined caliber of at least 70 mm. This includes self-propelled systems on armoured or unarmoured chassis.
Anti-submarine warfare weapons	Rocket launchers, multiple rocket launchers and mortars for use against submarines, with a calibre equal to or above 100 mm.
Armoured vehicles	All vehicles with integral armour protection, including all types of tank, tank destroyer, armoured car, armoured personnel carrier, armoured support vehicle and infantry fighting vehicle. Vehicles with very light armour protection (such as trucks with an integral but lightly armoured cabin) are excluded.
Artillery	Naval, fixed, self-propelled and towed guns, howitzers, multiple rocket launchers and mortars, with a calibre equal to or above 100 mm.
Engines	a) engines for military aircraft, for example, combat-capable aircraft, larger military transport and support aircraft, including large helicopters; (b) engines for combat ships - fast attack craft, corvettes, frigates, destroyers, cruisers, aircraft carriers and submarines; (c) engines for most armoured vehicles - generally engines of more than 200 horsepower output*.
Missiles	(a) all powered, guided missiles and torpedoes, and (b) all unpowered but guided bombs and shells. This includes man-portable air defence systems (MANPADS) and portable guided anti-tank missiles. Unguided rockets, free-fall aerial munitions, anti-submarine rockets and target drones are excluded.
Sensors	(a) all land-, aircraft- and ship-based active (radar) and passive (e.g. electro-optical) surveillance systems with a range of at least 25 kilometres, with the exception of navigation and weather radars, (b) all fire-control radars, with the exception of range-only radars, and (c) anti-submarine warfare and anti-ship sonar systems for ships and helicopters (In cases where the system is fitted on a platform (vehicle, aircraft or ship), the database only includes those systems that come from a different supplier from the supplier of the platform)*.
Satellites	Reconnaissance satellites.
Ships	(a) All ships with a standard tonnage of 100 tonnes or more, and (b) all ships armed with artillery of 100-mm calibre or more, torpedoes or guided missiles, and (c) all ships below 100 tonnes where the maximum speed (in kmh) multiplied with the full tonnage equals 3500 or more. Exceptions are most survey ships, tugs and some transport ships.
Other	(a) all turrets for armoured vehicles fitted with a gun of at least 12.7 mm calibre or with guided anti-tank missiles, (b) all turrets for ships fitted with a gun of at least 57-mm calibre, and (c) all turrets for ships fitted with multiple guns with a combined calibre of at least 57 mm, and (d) air refueling systems as used on tanker aircraft*.

*In cases where the system is fitted on a platform (vehicle, aircraft or ship), the database only includes those systems that come from a different supplier from the supplier of the platform.

Note: The Arms Transfers Database does not cover other military equipment such as small arms and light weapons (SALW) other than portable guided missiles such as man-portable air defence systems (MANPADS) and guided anti-tank missiles. Trucks, artillery under 100-mm calibre, ammunition, support equipment and components (other than those mentioned above), repair and support services or technology transfers are also not included in the database.

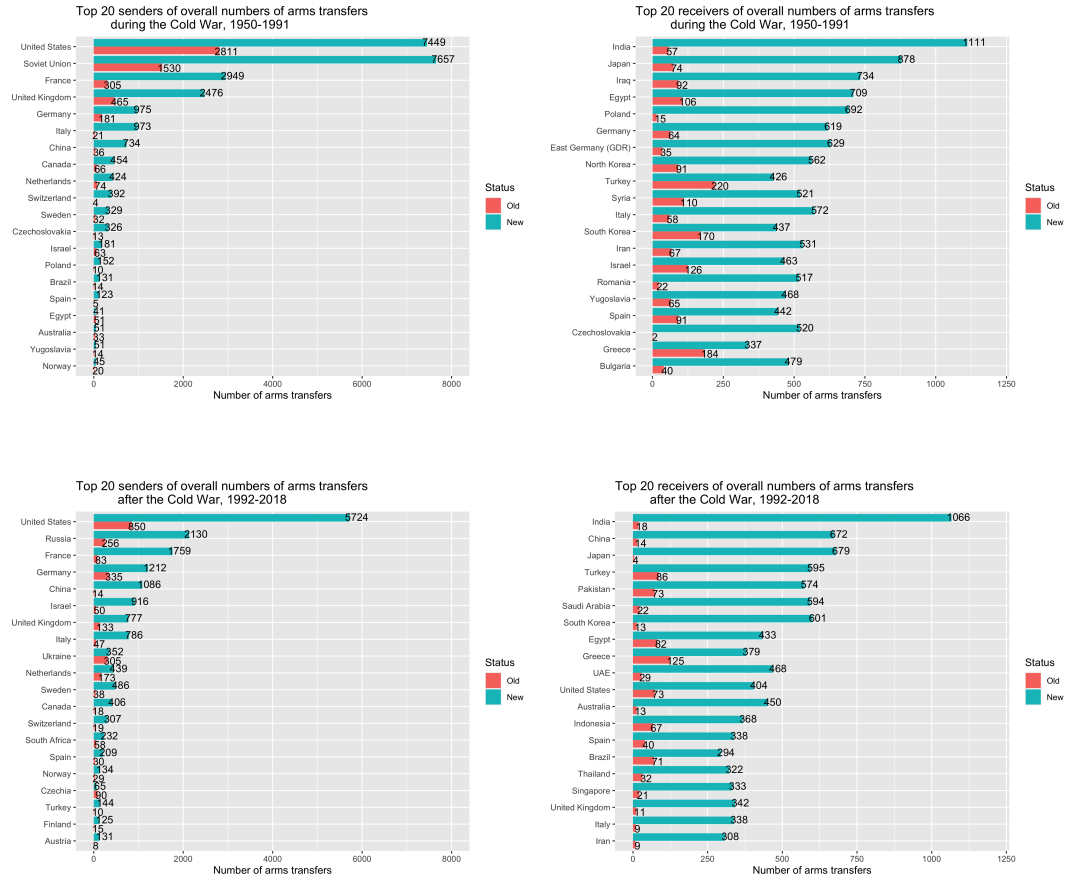

FIGURE A.1: The Top 20 senders (left) and receivers (right) during the Cold War (top) and after the Cold War (bottom) with the highest number of overall arms exports and imports. Data is from SIPRI (2019a).

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