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Sovereign Gravity: The Military Alliance Effect on Trade

Matteo Neri-Lainé

Highlights

- Military alliances increase trade between signatories, with important heterogeneities.
- This increase in trade is achieved through enhanced security cooperation and a reduction in international insecurity.
- Military alliances induce significant welfare gains for their members but also losses for non-aligned countries.

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Abstract

International insecurity can severely disrupt trade. This paper studies treaties aimed at preventing such insecurity: military alliances. We develop a quantitative model of trade with endogenous international insecurity, where alliances affect trade flows by reducing the risk of violent expropriation faced by firms. Taking a structural gravity approach, we show that alliances increase trade by 66% on average. The effects of military alliances are dynamic and heterogeneous. They depend to a large extent on the type of alliance and the economic size of partners. An instrumental variable strategy and an event study confirm the causal interpretation of the results. Investigating the mechanism behind the impacts of military alliances, we demonstrate that alliances increase trade by reducing international insecurity. Moreover, employing the full scope of our theoretical model, a general equilibrium analysis shows that the growth in trade generated by military alliances brings substantial welfare gains for signatories and losses for non-aligned countries.

Keywords

Military Alliances, Trade, International Insecurity, Conflict, Geoeconomics, Structural Gravity, General Equilibrium, Welfare.

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F1, F5.

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Centre d'études prospectives
et d'informations internationales
20, avenue de Ségur
TSA 10726
75334 Paris Cedex 07

contact@cepii.fr
www.cepii.fr – @CEPII_Paris
Press contact: presse@cepii.fr

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Sovereign Gravity: The Military Alliance Effect on Trade[1]

Matteo Neri--Lainé*

1. Introduction

Since 2000, the number of major conflicts has quadrupled worldwide to involve more than 130 countries,[2] while recent geopolitical tensions continue to push the world toward a possible "de-globalization" path (Caldara and Iacoviello, 2022; Clayton et al., 2024; Goldberg and Reed, 2023; Grossman et al., 2023). This massive increase in international insecurity can severely disrupt trade. The vast majority of trade costs are not associated with direct policy instruments, but with hidden transaction costs (Anderson and Van Wincoop, 2004). A significant proportion of these hidden transaction costs have directly to do with the insecurity of trade (Anderson and Marcouiller, 2002; Mohr and Trebesch, 2025). In particular, armed conflicts, through the risky environment of destruction and expropriation they involve, induce remarkable trade costs (Glick and Taylor, 2010; Thoenig, 2024; Mayer et al., 2025).

This paper examines one way of reducing trade insecurity: *the military alliances*. These international agreements are specifically designed to reduce insecurity among their members. They are based on two pillars: (1) enforcement of military cooperation policies, and (2) international security as a way to promote trade.[3] Many alliances exist such as the North Atlantic Treaty Organization (NATO), the Treaty

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*CEPII, 20 avenue de Ségur 75334 Paris (matteo.neri-laine@cepii.fr)

[2] Authors calculation based on geocoded UCDP project data on conflict events (Sundberg and Melander, 2013).

[3] "An alliance is a formal contingent commitment by two or more states to some future action. The action involved could entail almost anything—detailed military planning, consultation during a crisis, or a promise by one state to abstain from an upcoming war. [...] empirical studies have developed a consensus that the operationalization of the alliance variable depends on two factors. First, alliance members have to be independent nation-members of the international system (for example, so-called alliances between international terrorist organizations do not qualify), and second, a treaty text has to exist that identifies a military commitment that is defensive, a neutrality arrangement, or an "understanding" such as an entente," (Gibler, 2008). Details on alliances' content are provided in section 11.

on Collective Security and the Arab-Maghreb Union. However, the *Pax Mongolica* is an iconic example of such an alliance. In the 13th and 14th centuries, this set of treaties[4] ensured the security and development of trade in Eurasia. The end of the agreement saw a huge increase in conflicts and a sharp drop in trade; enough to prompt Europeans to take an unprecedented step in search of new trade roads (Findlay and O'Rourke, 2009). There are essentially two categories of alliance: weak alliances – reducing the probability of open conflict between signatories – and defence pacts – enforcing collective and centralised management of members' security (Gibler, 2008). Their depth of military cooperation is significantly different, as are their expected effects on insecurity and trade.

Our study combines a detailed empirical analysis in reduced form of the causal effect of alliances on trade and its mechanism, with a quantitative general equilibrium approach that further develop the interdependence between insecurity and trade and allow for counter-factual analyzes and conclusions on the economic welfare impact of alliances. First, we develop a quantitative model of international insecurity and trade. Within an economy characterized by a structural gravity model of trade covering heterogeneous firms, based on Arkolakis et al. (2012); Chaney (2008), and where agents either produce tradable goods or engage in conflict to expropriate them (Couttenier et al., 2024a; Dal Bó and Dal Bó, 2011), we endogenize the risk of expropriation faced by trading firms and isolate the costs of international insecurity. By reducing this risk, military alliances directly increase trade between partners. From this framework, we derive the gravity equation and general equilibrium on which our empirical work is based.

The empirical analysis combines the Correlate of War database, built on the massive and meticulous work by Gibler (2008) to document active military alliances, with the IMF[5] DOTS data and the United Nations Comtrade data on international trade (Head and Mayer, 2021). We perform a structural gravity approach using a panel of 31,811 country pairs covering the period from 1960 to 2012. We estimate the effects of military alliances on bilateral trade. Taking exporter-year, importer-year and exporter-importer fixed effects, our specifications focus on the within-country-pair variation of military alliances. Our set of fixed effects ensures that we properly control for multilateral resistance terms, market access and structural interstate relationships (Behrens et al., 2012; Feenstra, 2015; Redding and Venables, 2004). In addition, we control for Regional Trade Agreements (RTAs). The spread of RTAs and alliances over our period is highly distinct.[6] Yet, since we are investigating the specific effect of alliances, it is important to control for the standard agreements designed to affect trade. In line with the literature on the trade impact of international insecurity – whose estimate ranges from -35% to -85% (Glick and Taylor, 2010; Martin et al., 2008b; Thoenig, 2024) – we find that, on average, enforcing a military alliance increases bilateral trade by 66%, which is equivalent to a tariff reduction of 13.7%.[7] This result is robust to a wide range of consistency checks, including additional controls (tariffs, depth of RTAs, Cold War, etc.), but also to

[4]The Pax Mongolica was a set of treaties between the former Mongol empire states – the Golden Horde (Western Steppe), the Yuan Empire (China), the Ilkhanat (Persia) and the Chagatai Khanate (Eastern Steppe) – the Italian republics and the Russian duchies (Findlay and O'Rourke, 2009).

[5]IMF: International Monetary Fund.

[6]See graph .8 in appendices.

[7]Equivalence is made with the estimated trade elasticity in our sample $\theta = 3.38$.

other estimation techniques preventing potential bias (intranational trade, negative weights, asymptotic bias, etc.). Nonetheless, the effects of alliances are highly heterogeneous. They are sensitive to the nature of the treaty and the economic size of the partners. Furthermore, the theoretical and empirical analysis of the mechanisms of alliances show that their effect on trade strongly depends on the initial exposure to international insecurity as well. Thus, only defense pacts have a significant effect, while small country pairs, highly exposed to international insecurity, drive the sizable estimated average effects.

We carefully investigate the endogeneity of military alliances. Using an instrumental variable strategy supported by a plausible exogeneity test based on Conley et al. (2012), we confirm the causal interpretation of our results. We give a particular attention to the dynamic effect of alliances. Alliances signatures may be driven by past changes in international relations and require time to be fully enforced. Developing a Differenced Average Treatment on the Treated (DATT) approach based on Couch and Placzek (2010), we address the pre-trend issue and show that from the year following the signature, alliances have a stable persistent positive effect on bilateral trade.

Then, we turn to analyzing the mechanism by which military alliances affect bilateral trade. We directly test whether alliances increase trade by reducing international insecurity. A first potential source of insecurity that alliances may address is the risk of conflict between members. However, we show that this channel does not apply. Indeed, modern conflicts are in the extremely large majority related to fights against non-state actors (terrorism, civil wars, piracy, armed factions). Retrieving data on conflict events from the geocoded UCDP project, we construct a extensive measures of country-pairs' effective security cooperation and insecurity including conflicts with non-state actors. Using a two-stage strategy and considering the heterogeneity of alliance treaties, we show that: (i) defence pacts strongly increase the operational security cooperation between members, (ii) defence pacts sharply reduce bilateral insecurity, and (iii) by reducing insecurity, they significantly increase bilateral trade. This explains the effects of defence pacts on trade as a whole. Therefore, in line with our theory framework, our results strongly support both the validity and prevalence of the international insecurity mechanism. Furthermore, by investigating the margins of this mechanism, we demonstrate that the defence pacts' effect is driven by both the reduction in bilateral insecurity's intensity and the decrease in the members' risk of facing such issues. This analysis allow us to precisely identify each component that define the elasticity of trade with respect to international insecurity and alliances.

In the last part of the paper, we investigate the welfare effect of alliances. We develop a general equilibrium analysis built on our quantitative model. In keeping with Arkolakis et al. (2012), we derive the welfare system from our theoretical model, pointing up the endogenous role of insecurity costs. Then, using the properties of the PPML estimator, we solve this system and perform a counterfactual analysis for 2012 in which all alliances are ended. This enables us to draw conclusions about the impacts of military alliances on real revenue – our measure of welfare. Military alliances bring their members substantial welfare gains. Interestingly, our results show that neutral countries experience a marked welfare cost at the same time. Moreover, through scenario analysis, we demonstrate the considerable welfare ramifications of reshaping the military alliance network in a context of geopolitical fragmentation including East-West tensions, the United States withdrawal from its alliance treaties, and the strengthening of bloc logic.

Literature: As pointed out by Clayton et al. (2025) and Mohr and Trebesch (2025), the analysis of the link between international insecurity and trade lies at the core of the booming field of geo-economics. In this literature, a primary strand of papers focuses on the evaluation of the direct impact of insecurity on trade, using different conflict-related phenomena. Among them, Blomberg and Hess (2006); Martin et al. (2008a) show that common exposure to violence reduces bilateral trade, a figure that increases to 35-40% in the case of civil war and persists over time. Sandkamp et al. (2022) determine that each additional maritime piracy incident reduces bilateral trade by 0.1%. Korovkin and Makarin (2023); Rohner et al. (2013); Yu et al. (2015) exhibit the importance of conflict signals in shaping international trade costs. Martin et al. (2008b) show that military interstate disputes reduce bilateral trade by 38% on average. Glick and Taylor (2010) demonstrate the overall negative impact of war on trade. They show that major interstate conflicts reduce trade by 85% between enemies and by 13% between belligerents and neutral countries, with a significant lasting effect in peacetime. Bonfatti and Brey (2024) document the major trade disruption induced by World War One in the specific case of the British-Indian relation and its structural economic consequences.

Although alliances present themselves as the political to international insecurity and its negative impact in trade, few previous papers have analyzed them. Those that do are restricted to the Cold War period, find heterogeneous results and lack theoretical grounding. Drawing on the Tinbergen (1962) gravity equation, Mansfield and Bronson (1997) find a positive correlation between trade and alliances using a panel regression covering the 1960-1990 period. They conclude that an alliance increases trade by 20%. Taking a similar approach, Long (2003) estimates for the 1885-1990 period that defence pacts are associated with 37% higher trade flows, while weak alliances have no statistically significant effect. Our paper aims at filling this gap in the literature by identifying the causal effect of alliances on trade and investigating the mechanism behind this impact. In doing so, we evaluate a critical policy and its conditions of efficiency, but also deepen the understanding of the role of geopolitical determinants and international security cooperation in shaping global trade.

More recently, the literature has evolved toward quantitative models. In production network analyzes applied to India and Ukraine, respectively, Couttenier et al. (2024b) and Korovkin et al. (2025) show that conflict induces significant economic damages through firms' input-output connections. In their work, Alekseev and Xinjue (2025) examine optimal trade policy by linking security and trade considerations within a quantitative general equilibrium framework. They conceptualize national security as an externality and focus specifically on dual-use goods located in strategically important sectors. Introducing interstate conflict risk into a conventional general equilibrium model of trade, Thoenig (2024) and Mayer et al. (2025) highlight the major interplays between interstate wars, diplomatic negotiations, and trade. In a complementary framework, Couttenier et al. (2024a) develop a quantitative spatial model of trade and violence and describe how wealth appropriation drives the spatial diffusion of armed group conflicts. Building on these recent advances in the literature, we investigate the welfare effect of the growth in trade induced by alliances. Within a new framework that further integrates the endogenous link between trade and international insecurity, we show that the enforcement of an alliance brings substantial welfare gains for signatories, but losses for non-aligned countries, while several scenarios describe the significant impact of changes in the network of alliances.

The paper is organized as follows. Section 2 describes the theoretical framework. Section 3 presents the data used in the analysis and some descriptive evidence. Section 4 investigates the effects of military alliances on bilateral trade, the sensitivity of our baseline results and heterogeneous effects. Section 5 addresses potential endogeneity concerns. Section 6 investigates the dynamic effect of alliances. Section 7 studies the mechanism through which alliances affect trade. Section 8 develops the general equilibrium analysis and draws conclusions about the economic welfare impact of military alliances. Lastly, section 9 presents a short conclusion.

2. Theoretical framework: international insecurity and trade

When two countries sign an alliance, they enforce bilateral security cooperation policies (Gibler, 2008) (see appendix 11 for details and examples). In so doing, they improve security between partners. In other words, by reducing insecurity costs, alliances are supposed to increase trade. Below, we present a quantitative model of international insecurity and trade. In line with Couttenier et al. (2024a); Dal Bó and Dal Bó (2011), we set-up an economy facing violent expropriation from armed groups determined by rent-seeking behaviors and opportunity costs (Berman et al., 2017). Focusing on the country-pair level, we endogenize the risk of expropriation faced by trading firms, derive the insecurity costs, and then combine these with a structural gravity model of trade with heterogeneous firms from Arkolakis et al. (2012); Chaney (2008); Melitz (2003). Within this framework, we outline the resulting gravity equation augmented by international insecurity and the theoretical composition of the elasticity of trade to alliances. Building on this foundation, we detail in the subsequent section 8 the general equilibrium structure that characterizes this economy.[8]

2.1. International insecurity

2.1.1. Set-up

In our economy, multiple armed groups, denoted as $g \in G$, fight to expropriate wealth produced and exchanged from an origin i to a destination j. In doing so, they generate a level of violence that determines (i) the probability that a country-pair is effectively exposed to violent attacks, and (ii) the share of trade flows that armed groups are able to capture in the event of such exposure.

For each country-pair ij, each group produces violence $v_{ij,g}$ by combining fighters from origins i, j, and undefined sources k following the decreasing returns to scale technology:

$$v_{ij} = \frac{\psi_{ij,g}}{s_{ij}} (l_i^{\nu_o} \cdot l_j^{\nu_d} \cdot l_k^{\nu_k})^r \tag{1}$$

[8]Details on the model's derivation and its extensions with fixed insecurity costs, bilateral trade-elasticities and a risk of interstate wars are detailed in the appendices (Section 12).

where $\psi_{ij,g}$ is the fighting efficiency of the group, capturing its skills, weaponry, as well as its knowledge and distance relative to the battlefields specific to the country-pair, and $s_{ij} \geq 1$ is the exogenous security parameter. s_{ij} reflects the capacity of states to secure trade by mitigating the impact of each violent attack. From the perspective of an armed group, this acts as a variable cost. $0 \leq \nu \leq 1$ captures the complementarity between fighters l, and $0 < r < 1$ represents the decreasing returns, as the armed group starts by hiring the most productive fighters. Implicitly, we assume that each group needs at least some fighters from i and j to be able to attack the country-pair's trade, but we fix no assumption on the level of complementarity.

The total revenue R^v_{ij} from expropriating goods traded from i to j is defined by the level of trade flows X_{ij}, determined by the gravity structure below, and the probability of a traded product being expropriated $I_{ij} = V_{ij}/\overline{V}_{ij}$, where $V_{ij} = \sum_g v_{ij,g}$ is the aggregated violence generated by armed groups toward the pair ij, and $\overline{V}_{ij}$ the level of violence that would be required to capture the total bilateral trade. We assume that violence can be directly quantified in terms of the value of expropriated trade, such as $\overline{V}_{ij} = X_{ij}$. Therefore, as countries trade a large number of products, I_{ij} is interpretable as a share, leading to:

$$R^v_{ij} = V_{ij} = X_{ij} I_{ij} \tag{2}$$

However, workers are not forced to become fighters and can choose to keep working and receive the wage w. As in Couttenier et al. (2024a), there is perfect competition on the violence market. The income from looting trade is totally redistributed among fighters depending on their marginal productivity. Therefore, workers join a group to attack ij flows as long as it can furnish a marginal revenue from expropriation that is superior or equal to the wage augmented (or reduced) by a stochastic motivation (or aversion) parameter μ drawn for each pair ij, which captures whether workers are prompt to fighting or averse. Thus, setting the group's total fighting force $L_{ij,g} = l^{\nu_o}_{i,g} \cdot l^{\nu_d}_{j,g} \cdot l^{\nu_k}_{k,g}$ and the marginal violence cost $c_{ij,g} = \left(\frac{w_i}{\nu_o r}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d r}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k r}\right)^{\nu_k r} \frac{s_{ij}}{\psi_{ij,g}}$,[9] to maximize its violence production on ij, the armed group must hire fighters such that:

$$\frac{\partial R^v_{ij,g} \mu_{ij}}{\partial L_{ij,g}} = c_{ij,g} \tag{3}$$

2.1.2. International violence equilibrium

Considering equations (1), (2), and (3), and denoting $\Psi_{ij} = \sum_g \psi_{ij,g}$ we can express the probability of expropriation as:

$$I_{ij} = \underbrace{s_{ij}^{-\frac{1+r}{1-r}} \Psi_{ij}^{\frac{1+r}{1-r}}}_{A} \underbrace{\left[\frac{X_{ij}^{\frac{r-1}{r}} \mu_{ij} r}{\left(\frac{w_i}{\nu_o r}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d r}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k r}\right)^{\nu_k r}} \right]^{\frac{r}{1-r}}}_{B} \tag{4}$$

The first term (A) exhibits the armed groups' military efficiency, and the second (B) captures the trade-off between (potential) expropriation returns and peaceful work. There, s_{ij} reduces I_{ij} with an elasticity $-\frac{1+r}{1-r}$, determined by the decreasing returns

[9] c_{ij} is derived from the cobb-douglas production function in equation 1.

of the violence production function. Given $r < 1$, the comparative statics also reveal that an increase in trade flows or in wages reduces the intensity of violence. This influence of economic parameters on violence will have to be carefully considered in empirical analysis, as it suggests potential reverse causality. Additionally, it underlines the relevance of a general equilibrium approach to derive the effect of military alliances without ignoring this interplay between economic and violence parameters.

Furthermore, the armed group face an exogenous violence threshold $\underline{V}_{ij}$, specific to each country-pair, which represents the natural capacity of international trade to absorb violence before any expropriation takes place, due to factors such geography transport technology and organizational complexity. Thus for the armed groups to successfully loot, they must generate aggregated violence exceeding $\underline{V}_{ij}$; otherwise, no attack occurs and no conflict is observed.[10] Formally, the armed groups' motivation μ_{ij} must satisfy:

$$\mu_{ij} > (\frac{\Psi_{ij}}{s_{ij}})^{\frac{1+r}{r}} \underline{V}_{ij}^{\frac{1-r}{r}} \frac{\left(\frac{w_i}{\nu_o r}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d r}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k r}\right)^{\nu_k r}}{r} \tag{5}$$

Firms make pricing decisions while knowing they operate in an insecure environment. Although they cannot observe μ_{ij} directly, they know its distribution and form expectations ex ante. We model μ_{ij} as following a Pareto distribution $(\underline{\mu}/\mu)^{\delta}$, where $\underline{\mu}$ represents minimum possible motivation. By setting $\underline{\mu} < 1$ we incorporate a preference for peace. A higher δ, denotes a greater concentration of motivation parameters in the peaceful segment of the distribution. In other words, we assume that workers tend to value peaceful activities more, but may have, for some specific country-pairs, a exogenous willingness to fight.[11] Integrating the distribution of μ with equation (5) yields E_{ij} the probability that a country-pair encounters insecurity:

$$E_{ij} = s_{ij}^{-\delta\frac{(1+r)}{r}} \Psi_{ij}^{\delta\frac{(1+r)}{r}} \underline{V}_{ij}^{-\delta\frac{1-r}{r}} \left[\frac{\left(\frac{w_i}{\nu_o r}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d r}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k r}\right)^{\nu_k r}}{r}\right]^{-\delta} \tag{6}$$

The security cost s_{ij} reduces E_{ij} with an elasticity of $-\delta\frac{1+r}{r}$, determined by the shape of the motivation parameter distribution and the decreasing returns of the violence production function. Furthermore, wages reduce the insecurity risk by raising peace returns. However bilateral trade has no direct impact on the extensive margin of insecurity.

2.1.3. International insecurity cost

Therefore, from the perspective of a firm, trade between countries i and j bears a country-pair specific variable cost reflecting the international insecurity.[12] This cost captures the risk of exports being expropriated when sold in country j from country

[10] We assume no cooperation between armed groups when making their violence production choices.
[11] For simplicity, we assume no maximum motivation. This implies that at least one country-pair in the world will experience complete expropriation of bilateral trade for at least one period.
[12] As discussed by Martin et al. (2008b); Thoenig (2024), there may exist country-specific insecurity costs, especially if conflict harms local productivity. However, alliances are international treaties which focus on reducing the probability of conflict between the members and developing security cooperation policies for common purposes. They do not aim to reduce the global insecurity of a country, but the

i. It is composed of two dimensions: first, the yearly country-pair's probability of facing international insecurity (E_{ij}), which we call the extensive margin of international insecurity, and second, knowing the country-pair ij is exposed to international insecurity (i.e., $E_{ij} = 1$), the probability of a traded product being expropriated (I_{ij}), which we call the intensive margin of international insecurity. I_{ij} is equivalent to the share of products that do not reach their destination in case of insecurity.[13] Thus, when a firm exports, it has the probability E_{ij} of facing the marginal cost $1/1 - I_{ij}$. Firms trading a number of units of their variety over several periods internalize this risk, which can be translated to a traditional iceberg trade cost τ, but sensitive to insecurity with $\tau_{s,ij} = \frac{1}{1-E_{ij}I_{ij}}$.[14]

Military alliances enhance security by improving bilateral military cooperation, thereby increasing the efficiency with which i and j jointly protect their trade and reduce violence. Within this framework, this enhancement can occurs through an increase in the security cost s_{ij}, thereby reducing the bilateral insecurity cost $\tau_{s,ij}$ through both its intensive and extensive margins.[15] The insecurity costs $\tau_{s,ij}$ can be seamlessly integrated into a structural gravity model of trade, enabling us to derive the elasticity of trade with respect to alliances and complete the general equilibrium structure of our theoretical model.

2.2. Trade Equilibrium

We mobilize the standard structural gravity model of trade with heterogeneous firms from Chaney (2008); Helpman et al. (2008). In this economy, firms face different trade costs, including the variable cost related to international insecurity $\tau_{s,ij}$. We present below the essential elements while the full trade equilibrium is derived in the appendix section 12.

Within this monopolistic competition framework with a Constant Elasticity of Substitution demand function, the price function is defined by:

$$p_{ij}(\alpha) = \frac{\sigma}{\sigma - 1} w_i T_{n,ij} \alpha \tag{7}$$

where σ is the elasticity of substitution, w_i is the wage in country i, α is the firm's marginal cost (i.e., the inverse of productivity γ). $T_{n,ij} = \Pi^n \tau_{n,ij}$ is a product of

insecurity which concerns signatories (see appendix section 11). Therefore, we should expect such a risk of multilateral insecurity to be held constant. Yet, we further discuss the potential role of multilateral insecurity in the appendix section 13. Notably, we confirm that alliances do not affect trade through this channel.

[13]Note that firms do not exactly observe I_{ij} as expressed in equation 4, since they do not know the true value of μ_{ij} but only its expected value $\tilde{\mu}_{ij} = \delta/(\delta - 1)\underline{\mu}$.

[14]We can also interpret the reduction of the expropriation probability as a lower cost of insurance. In the case of an insurance market, a firm can pay insurance which, in exchange for a contribution equal to the share $\tau_{In,ij}$ of the value of each insured exported product, will provide the amount p (the price) for each expropriated product. Thus, in exchange for a variable cost $\tau_{In,ij}$, the firm obtains the guarantee that the exported products will be sold at the price p. Given that we are in a Melitz (2003) monopolistic competition case, firms face an increasing-returns-to-scale technology due to the presence of fixed costs and are price setters. Therefore, the firm chooses the lower price between $p_{ij}(\alpha) = \frac{\sigma}{\sigma-1} w_i \tau_{s,ij} \alpha$ and $p_{ij}(\alpha) = \frac{\sigma}{\sigma-1} w_i \tau_{In,ij} \alpha$. Firms only take out insurance policies that will ensure $\tau_{In,ij} \leq \tau_{s,ij}$. So, when the probability of expropriation decreases, there is a reduction in $\tau_{In,ij}$. Even in the presence of an insurance market, military alliances reduce bilateral insecurity costs.

[15]The empirical section 7 thoroughly examines the validity and prevalence of these margins, with our results corroborating the relevance of our theoretical framework.

variable trade costs with n the n-th potential source, including $\tau_{s,ij}$, the variable insecurity cost, but also all variable trade costs sensitive to other parameters (geography, standard trade policies, institutions, etc.). By increasing their price, firms internalize the insecurity costs. This supplementary markup finances the production of goods that replace looted ones in case of realized insecurity, thereby maintaining market equilibrium. Thus, in such a framework, any reduction in bilateral insecurity structurally reduces exporting firms' prices. Similarly, the consumer price index is given by:

$$\Phi_j = \left(\sum_l N_l \overline{\alpha}_l^{-\theta} w_l^{-\theta} T_{n,lj}^{-\theta} F_{n \neq s,ij}^{-\left[\frac{\theta}{\sigma-1}-1\right]} \right)^{-\frac{1}{\theta}} \tag{8}$$

By combining equations (7) and (8) and the Pareto distribution of firms' productivity, we can derive at the aggregated level the following structural gravity equation outlying the insecurity trade costs ($\tau_{s,ij}$):

$$X_{ij} = N_i \overline{\alpha}_i^{-\theta} w_i^{-\theta} \frac{X_j}{\Phi_j^{-\theta}} \tau_{s,ij}^{-\theta} T_{n \neq s,ij}^{-\theta} F_{n \neq s,ij}^{-\left[\frac{\theta}{\sigma-1}-1\right]} \tag{9}$$

X_{ij} is the total trade from country i to country j, N_i, the number of firms in the exporting country, $\overline{\alpha}_i$, the maximum marginal cost of country i's technology, and w_i the wage in country i's economy. X_j is the total revenue of country j, and Φ_j, the importer's multilateral resistance term, while $T_{n \neq s,ij}$ and $F_{n \neq s,ij}$ are respectively the variable and fixed trade costs sets insensitive to insecurity.[16] Like other trade costs, insecurity costs ($\tau_{s,ij}$) have a negative elasticity.[17] Hence, by reducing the insecurity costs, the enforcement of a military alliance between countries i and j increases bilateral trade (X_{ij}) with the theoretical expression of the (semi-)elasticity of trade toward military alliances:

$$\varepsilon_{All.}(X_{ij}) = \theta \star \underbrace{\frac{E_{ij} I_{ij}}{1 - E_{ij} I_{ij}}}_{A} \star \left[\underbrace{\delta \frac{1+r}{r} \frac{\partial ln(s_{ij})}{\partial All.}}_{B} + \underbrace{\frac{1+r}{1-r} \frac{\partial ln(s_{ij})}{\partial All.}}_{C} \right] > 0 \tag{10}$$

This expression underscores the crucial role of the trade elasticity (θ), which should account for the majority of the effect, and the direct impact of alliances through states' security cooperation on the extensive and intensive margins of international insecurity, as respectively captured by (B) and (C). Additionally, the remaining terms (A) suggests that alliances have a more substantial effect on bilateral trade when the country-pairs' probability of facing insecurity (E_{ij}) and the intensity of insecurity (I_{ij}) are high. Given equations (4) and (6), this implies that alliances are theoretically more effective when countries initially have a low s_{ij}. This underscores a potential selection in signatory countries, as the country-pairs that stand to benefit the most from alliances are those that initially have bad security conditions. This issue will need to be carefully addressed in the empirical analysis.[18] On the other hand, the

[16] See section C for the model extension with fixed insecurity costs.

[17] Note also that despite our assumption that all trade costs of the same nature (variable vs fixed) have the same elasticity, this does not mean that the model assumes that all policies have the same trade elasticity. Indeed, we do not assume that all trade costs are sensitive to the same policies or to the same extent.

[18] See section 6.

role of economic parameters in shaping the alliance elasticity through initial insecurity costs is more complex and depends on the values of δ and r. To properly account for this, a general equilibrium approach will be necessary.[19]

3. Data

The structure of the dataset is a country-pair panel. Our unit of observation, therefore, is a given exporter-importer-year (ijt) combination. We study how variations in the ally status of the dyad affect bilateral trade.

3.1. Data description

Alliances data.– We use information on military alliances for each ijt from the Correlate of War project (Gibler, 2008). From 1816 to 2012, we have information on whether a given country pair are allies and, if so, the nature of the treaty. We can divide military alliances into two categories: weak alliances, which focus mainly on military cooperation to guarantee peace between signatories, and defence pacts, which enforce military cooperation to protect members from common threats and achieve common strategic objectives[20] (Long, 2003; Gibler, 2008). From 1960 to 2012, our baseline period of analysis, the majority of military alliances were defence pacts. Although, many of them were enforced throughout the entire period, in our sample the number of defence pacts contributing to the within variation – i.e. whose status changes over the period – is largely superior to weak alliances (see table 1). For each country pair, we define ALL_{ijt}, a dummy variable which equals 1 if country i and j are allies at time t and 0 otherwise.

Insecurity and military cooperation data.– We collect data on conflict events from the geocoded UCDP project (Sundberg and Melander, 2013) to construct our measures of military cooperation and bilateral insecurity. The initial observation unit is an event. Information is available starting in 1989 with the year provided for each event. This project also has the advantage of identifying the belligerents (and co-belligerents) in each conflict event. In the large majority, observed events are related to conflicts between states and non-state organized actors (terrorism, civil wars, piracy, armed factions). We organize the information to create a dummy taking the value one if the country-pair cooperates militarily (i.e. is belligerent) in the event. Summing this dummy at the country-pair-year level, we obtain a continuous measure of bilateral military cooperation. By summing observations of conflict events, excluding the country-pair's cooperative events, we observe country-year exposure to insecurity.

Trade data.– International trade data are retrieved from the International Monetary Fund DOTS data and the United Nation Comtrade data based on the work of Head and Mayer (2021).[21] We extract bilateral trade in current dollars between the 188

[19] See section 8.

[20] See section 11 for more information about military alliance treaties and examples.

[21] As the UN source is better at dealing with re-exports, Comtrade is used as the main source for bilateral trade when available, while DOTS is used as the second choice. We use importers' declarations which include costs, insurance and fret.

available countries from 1960 to 2018.[22] Zero trade flows are observed, and self-trade is computed as the country's production minus its total export value. Self-trade is essential to the general equilibrium analysis performed in the last part of the paper. In the reduced-form analysis, we exclude it to maintain a more restrictive framework by focusing on alliances' trade creation rather than allowing for substitution from internal to external trade (Dai et al., 2014; Larch et al., 2025). Nonetheless, a robustness check with intra-national flows is discussed below. As alliances deal with security and sovereignty matters, the independence of countries is crucial to the identification. Overseas territories, which are never independent in our time period, are simply dropped. Prior to 1993, some countries, such as the former member nations of the USSR and Yugoslavia, are not recognized (or reported) as independent trade partners by the UN. These countries provide an interesting contribution to the post-cold-war changes in the alliances network. Therefore, for those countries before 1993, we complement our trade dataset with trade flow estimates from the CEPII CHELEM base (de Saint-Vaulry, 2008).[23]

Other data.– Information on Regional Trade Agreements (RTAs) and the standard gravity variable, such as distance, Gross Domestic Product (GDP), population, common language and religion, are retrieved from the CEPII's Gravity database (Head et al., 2010). Data on RTAs include preferential trade agreements, free trade agreements, customs unions and other less common forms of agreements. We round them out with RTA legally enforceable provisions from the Content of Deep Trade Agreements database (Hofmann et al., 2017). Finally, information on tariffs is retrieved from the World Integrated Trade Solution, which combines data from UNCTAD TRAINS[24] and the World Trade Organization.

3.2. Descriptive statistics

We observe a panel of 31,811 country-pairs from 1960 to 2012. In our dataset, 12% of worldwide trade (in value) come under the umbrella of alliances:[25] 157 countries are signatories to these treaties and 2,819 pairs are affected by one, including 1,635 making a switch during our period (cf. table 1).

In figure 1, the map of the world displays the number of alliances per country during our time-frame. As can be observed, alliances are heterogeneously distributed across countries. No clear correlation between level of economic development and being signatories to such treaties is observed. Intermediary or low-income countries are not excluded from the worldwide alliance system – South American countries have signed more alliances than any European countries, while Africa and Asia present a wide range of involvement. In figure 2, the same exercise is replicated with the number of switches in alliance per country. Countries contributing to the switches are well dispersed around the globe, providing a good range of treated economies and international relationships.

A simple density graph (cf. figure 3) displays a positive correlation between bilateral trade and military alliances. The distribution of country-pair trade flows with military

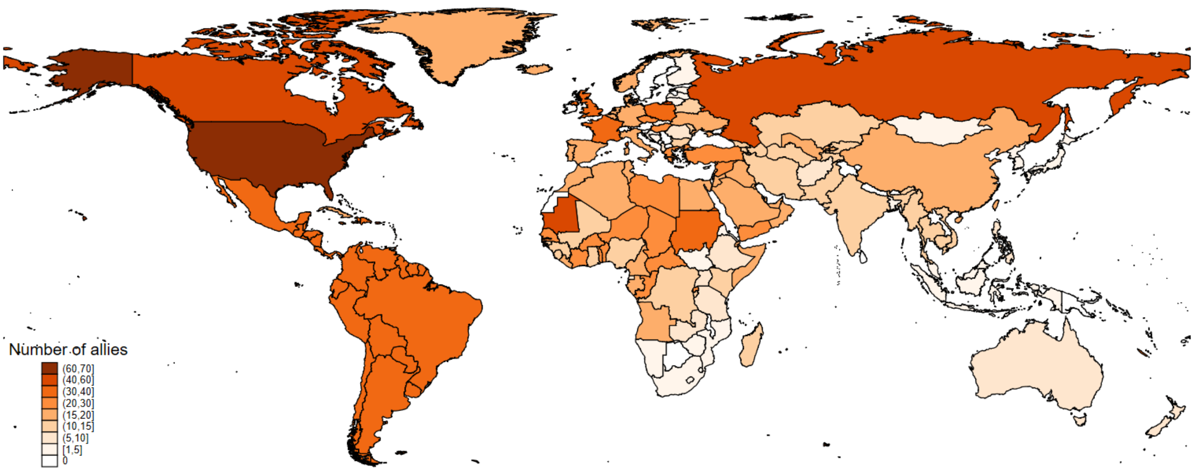
[22] The full list of countries is presented in appendix table .14.
[23] We confirm the robustness of our baseline results to the exclusion of CHELEM data in section 4.2.
[24] United Nations Conference on Trade and Development Trade Analysis Information System.
[25] For comparison, 25% is under the umbrella of a trade agreement.

Table 1 – Alliances, treated and untreated countries

	Alliances	Defence pacts	Weak alliances
Countries treated	157	136	101
Countries never treated	31	51	87
Country-pairs treated	2,819	2,459	633
Country-pairs with a switch	1,635	1,411	560

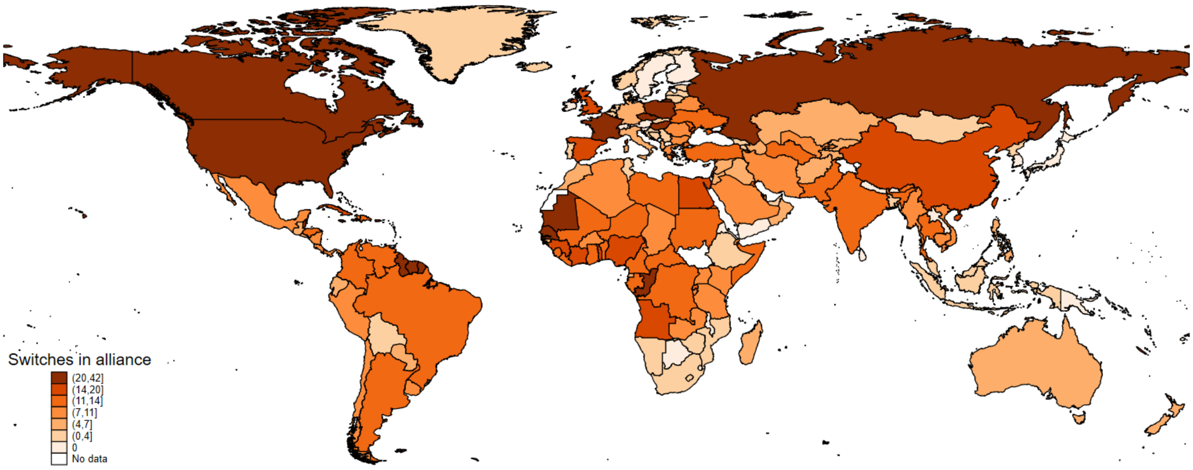
Note: Author's calculation. We count each exporter-importer observation as a country-pair. All alliances are symmetric. Ex: *157 countries of our sample have an active alliance with at least one partner for at least one year in our panel.*

Figure 1 – Number of alliances by country, 1960-2012 (COW data)



Note: alliances are counted at country-pair level; 70 means that the country has been allied with 70 other countries from 1960 to 2012; white areas are where no alliance has been observed.

Figure 2 – Sample switches in alliance by country

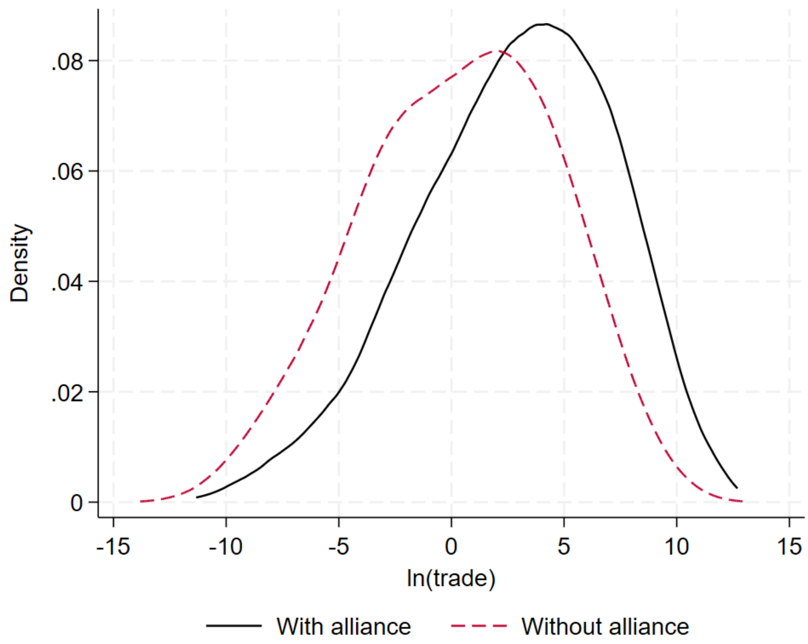


Note: Alliance switches are counted at country-pair level; 42 means that the country has signed or terminated a military alliance with 42 other countries from 1960 to 2012; white areas are countries excluded from our final sample.

alliances lies more to the right than the distribution without, indicating a significantly higher average level of trade for country pairs with a military alliance than without.

As shown by Vicard (2012), the signature of RTAs is linked to the risk of interstate conflict. Yet, the correlation between alliance enforcement and trade does not seem to be very dependent on the existence of RTAs. Figure 4 presents a further two density graphs. Graph 4a, displays export values depending on whether the pair has an alliance without an RTA, both or no agreement. Graph 4b reproduces graph 3 but with export values conditional on RTAs (i.e. trade unexplained by RTAs). Both graphs present interesting evidence that, irrespective of the existence of an RTA, enforcement of an alliance is positively correlated with bilateral trade.

Figure 3 – Export values and alliances



Note: The K-density graph compiles exporter-importer trade for the latest year of available data (2012). It displays the distribution of country-pair trade depending on the presence or the absence of an alliance.

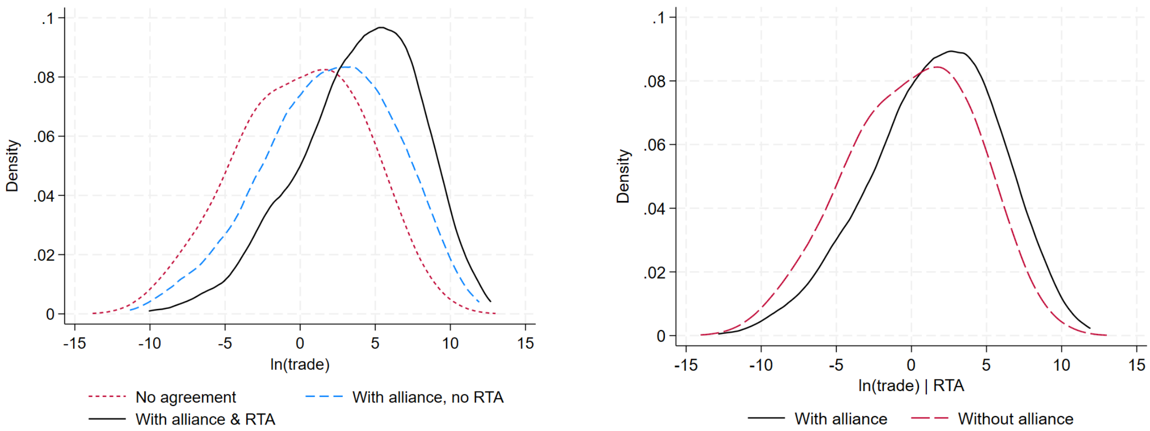
4. Identification strategy

Before mobilizing the full potential of the general equilibrium of our quantitative framework, we need to precisely estimate and understand the impact of alliances on trade in reduced form. Following our theoretical discussion, the relationship between military alliances and trade can be estimated using a structural gravity model. Accordingly, our baseline specification is as follows:

$$X_{ijt} = exp(\beta_1 ALL_{ijt} + \beta_2 RTA_{ijt} + \lambda_{it} + \lambda_{jt} + \lambda_{ij}) * \epsilon_{ijt} \quad (11)$$

Our interest variable ALL_{ijt} is a dummy taking the value one if there is an alliance between country i and j at time t and zero otherwise. RTA_{ijt} is coded the same way as alliances, but for regional trade agreements. Alliances and RTAs may exist

Figure 4 – Export values, alliances and RTAs



(a) Export values **(b) Export values conditional on RTAs**

Note: K-density graphs compile exporter-importer trade for latest year of available data (2012). Graph (a) displays the distribution of country-pair trade depending on the presence or the absence of an alliance, with or without a Regional Trade Agreement. Graph (b) displays the distribution of country-pair trade unexplained by Regional Trade Agreements depending on the presence or the absence of an alliance.

concurrently. Hence, we need to control for RTAs to capture any specific trade agreement effect between i and j.

λ_{it} and λ_{jt} the exporter-year and importer-year fixed effects. They capture the country, year and country-year-specific variables such as economic size and multilateral resistance terms (Baier and Bergstrand, 2007; Feenstra, 2015; Redding and Venables, 2004).[26] We also include exporter-importer fixed effects (λ_{ij}) to capture any omitted variables due to structural relations between countries such as distance, common language and colonial past. Military alliances active throughout the period are also captured. We hence estimate the within-effects of military alliances (i.e. country pair changes in status).[27]

Military alliances are expected to impact on all sectors by reducing insecurity costs. Yet, military alliances can also be associated with arms supply contracts. We therefore exclude the arms sector from the bilateral trade variable X_{ijt} to make sure that what is measured is a trade cost reduction and not a contract effect.

The reverse causality argument is unlikely to bias our baseline estimation. An alliance is not an economic treaty, but a long-lasting military pact with heavy political constraints. Therefore, to find a pair-specific export shock affecting the signature of a military alliance is a remote possibility. Nonetheless, we test alternative specifications and address residual endogeneity concerns in a further section.

[26] With this strategy, we focus on the bilateral effect of alliances (see the theoretical discussion in section 2). Any effect of alliances on trade through a reduction in multilateral insecurity costs are captured by the country-year fixed effects.

[27] We use a Poisson Pseudo Maximum Likelihood (PPML) estimator to retain a non-linear specification and address heteroscedasticity. In this way, we take into account zero trade observations and avoid the biases caused by a combination of log-linearisation and heteroscedasticity (Silva and Tenreyro, 2006). In addition, standard-errors are clustered at exporter-importer level.

4.1. Baseline Results

Table 2 reports the baseline results. The dependent variable is the trade from country i to country j in year t. The effect of military alliances on bilateral trade is positive and significant. Enforcing a military alliance increases bilateral trade by 66% on average. By contrast, the average effect of RTAs is 19%.[28] Translating the effects of alliances into tariff-equivalent variations under the standard trade elasticity calibration of $\theta = 3.38$[29] returns a tariff reduction of 13.7%. This equivalence appears reasonable given that we are dealing with a treatment assumed to have a sizeable impact on bilateral insecurity.[30] In subsequent sections, we are careful to test the robustness of this result and focus on understanding the heterogeneity and mechanism behind it.

Table 2 – Trade and military alliances

Estimator:	PPML
Dependent variable:	Bilateral trade
Variables	(1)
Alliance	0.507^a
	(0.102)
RTA	0.173^a
	(0.033)
Exporter x Year FE	yes
Importer x Year FE	yes
Dyadic FE	yes
No. observ.	901,325

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; Dependent variable is trade from country i to country j at time t in millions of current dollars. Standard errors clustered at country-pair level are in parentheses. a, b and c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

4.2. Sensitivity analysis

This section proposes a battery of robustness checks for our baseline results.

4.2.1. Data sensitivity checks

Alternative data and extended Panel.– We test the sensitivity of our results to alternative datasets and extended panels. First, we reproduce our baseline while excluding

[28]Recently, Larch and Yotov (2024) reviewed estimated effects of RTAs in the literature depending on estimation strategies. They show that in structural gravity with PPML estimator, RTAs' coefficient should be around 0.14. With a coefficient of 0.17, our RTA estimate is in line with this general result.

[29]We directly estimate trade elasticity by including tariffs in the standard structural gravity estimation – see appendix table .27. The coefficient of $ln(1 + tariffs)_{ijt}$ is directly interpretable as the trade elasticity(Anderson et al., 2018; Head and Mayer, 2014).

[30]In the literature, the negative effect of bilateral insecurity on trade is estimated between -35% and -80% depending on the proxy (Martin et al., 2008b; Glick and Taylor, 2010). This assumption is directly treated (and confirmed) in section 7.

CHELEM trade data. Thus, we use only DOTS and Comtrade trade data from Head and Mayer (2021), while former eastern bloc countries that are not recognized as independent over the whole period are excluded before 1993. Results reported in the appendix table .15 column 1 confirm the robustness of our approach. Then, in column 2, we replicate this exercise by using only DOTS data while starting our panel in 1948. Again, our conclusions are not affected. By mobilizing the Correlate of War trade database (Keshk, 2017; Barbieri et al., 2009), we further extend our panel from 53 to 143 years. Yet there are costs involved. From 1948, COW data rely on DOTS. From 1870 to 1947, they rely on historical reports which come with missing information or lower precision. Furthermore, over such a long time span, the notion of independent state has strongly evolved which makes alliances less comparable over time and limits the sample to 29,334 country pairs only. Additionally, while using the historical COW data, we cannot control for RTAs as we do not observe them before 1948. We report the results in table .15 column 3. We still observe a clear positive and significant effect of alliances on trade. After 2012, our panel is limited by alliances data. We proceed to an additional sensitivity test by extending our panel until 2018. We complete our sample using Alliance Treaty Obligations and Provisions (ATOP) data (Leeds et al., 2002). ATOP has a larger time-coverage than the Correlate of War alliances data. Yet, ATOP is less precise and does not provide clear information about the content of treaties. Results are displayed in column 4. The alliance coefficient is poorly affected by this additional panel extension.

Arm sector exclusion.– Negotiations for the signature of an alliance may be associated with a side-contract on arms selling, even if alliances do not incorporate such provisions in their text (Alekseev and Xinjue, 2025). This could result in an increase in trade between signatories, at least from one partner to the other, and may induce an omitted variable bias. These side-contracts, by definition, are not observable. To address this issue, we reproduce our baseline estimation while excluding arms sector trade from aggregated trade flows. The latter is retrieved from the CEPII CHELEM data, which limits our sample of countries.[31] We first present the results of the estimation with this smaller sample in table .16 column 1, and then excluding the arms sector trade in column 2. The effect of alliances on bilateral trade remains unchanged. Indeed, even though a contract on arms may be large in value, they are rare and represent a very small part of international trade, which is largely insufficient to drive any effect of military alliances on aggregated bilateral trade.

Intra-national trade flows.– Focusing on the trade creation effect of alliances, the baseline estimation considers international trade flows only. To test the sensitivity of our results to the inclusion of the potential effect of alliances through trade diversion from intra-national flows to international ones, we replicate the baseline estimation including self-trade (Dai et al., 2014).[32] Additionally, we follow Bergstrand et al. (2015) and control for the globalization trend by interacting the year with a dummy variable that takes the value one for all intranational flows, and zero for international

[31] Alternatively, we could use BACI data, also from the CEPII (Gaulier and Zignago, 2010); however, this would induce a very strong limitation in the time-span, excluding most of the within-variation in country-pairs' alliances.

[32] Since CHELEM does not include self-trade, countries that are former member nations of the USSR, Yugoslavia, and Czechoslovakia are excluded before 1993.

ones.[33] Results are displayed in table .16 column 3. As expected, allowing for trade diversion from intra- to inter-national flows increases the estimated effect of alliances.

4.2.2. Additional controls for trade costs

Tariffs– We investigate the robustness of our results to the inclusion of tariffs. The tariff variable is defined as the log of the ad valorem exporter-importer-time average tariff rate plus one. The results of this sensitivity test are reported in table .16 column 4 to 6. The tariff coefficient is negative and significant. This additional control variable does not reveal any omitted variable bias. The lower coefficient of the alliance variable is merely the outcome of the considerable reduction in the time-frame and the country-pairs sample for our panel dictated by tariff data availability. To overcome this lack of country-pair-within variation due to the sample size, we include within-country trade flows – see column 7. This strongly increases alliances' coefficient as well as its precision. In addition, controlling for common GATT membership has no effect.[34]

Colonies– For most country pairs, colonial linkages result from a long-past relationship and are captured by the country-pair fixed effects. However, as our data cover a very long time span, some countries obtained their independence during our period of interest. This induces a variation in the current colonial link that the fixed effects do not capture. Furthermore, alliances may be signed in response to decolonization to maintain strong military cooperation between the partners despite the end of the colonial relationship. To address this potential omitted bias, we introduce a control dummy variable that takes the value one if the country pair is currently in a colonial relation and zero otherwise. We display the results in table .16 column 8. The estimated impact of alliances is not affected.

RTA depth– In the baseline estimation, dummy variable RTA_{ijt} for the presence of an RTA between exporter and importer. This ensures that the coefficient of ALL_{ijt} is not biased by concomitant variations in RTAs and alliances. Yet, this method does not control for changes in RTA depth, which may be correlated with conflict related variables (Vicard, 2012). To address this point, we proxy RTA depth by the number of provisions in each agreement. We then introduce this new variable into our baseline estimation. We drop country-pair-year observations where an RTA is observed, but not its depth. Results are displayed in table .16 columns 9-10. We keep the RTA_{ijt} dummy in column one. Its coefficient is not empirically interpretable since it corresponds to a fictive empty RTA (with no provision). In the second column, RTA_{ijt} is dropped. In both cases, the coefficient of ALL_{ijt} is barely affected. Furthermore, given that a substantial proportion of the countries in our sample are European, we include a control for common membership in the European Union in .16 column 11.[35] This does not affect our conclusions.

Distance and economic development.– Geographic distance and long-term differ-

[33]Using a continuous variable for the year or a set of dummy variables does not affect our results.
[34]We introduced a dummy variable taking value one if both country i and j are members of the GATT. The alliance coefficient and standard error are unaffected by this additional control.
[35]The multilateral effect of being a member of the European union is captured the exporter-year and importer-year fixed effects.

ences in economic development are already captured by the country-pair fixed effect. Yet, both bilateral trade and signatures of alliance treaties could be affected by regionalisation or globalisation, i.e. by variations in transport costs and differences in economic development over time. Therefore, we build $ln(distance_{ij}) * year_t$ as an interaction variable between the distance and the year,[36] and $ln(|\frac{GDP_{it}}{Pop_{it}} - \frac{GDP_{jt}}{Pop_{jt}}|)$ as the log of the difference in per capita GDP in absolute value between exporter and importer. We include these variables in the baseline estimation. Results are reported in table .16 column 12. Their coefficients are weak, while the military alliance coefficient remains largely significant.

4.2.3. Alternative estimators

Asymptotic bias.– Table .17 presents the corrected FE-PPML estimation developed by Weidner and Zylkin (2021). The military alliance coefficient is affected by a small negative bias of the order of -0.011, while the associated standard error is slightly underestimated. Once the correction is applied, the alliance coefficient remains highly significant and very similar to the baseline.

Negative weights.– The baseline strategy is similar to a fixed-effects difference-in-differences estimation. However, the effects of military alliances could be dynamic.[37] In this case, a different effect would be found depending on the duration of the treaty, where the baseline coefficient would represent the average. Moreover, the effects of military alliances on trade could also be heterogeneous across time and country pairs.[38] Therefore, our results could suffer from negative-weight biases (De Chaisemartin and d'Haultfoeuille, 2020). To address these econometric considerations, we regress equation (11) using the Nagengast and Yotov (2025); Wooldridge (2023)'s negative-weights robust PPML estimator. The estimation is detailed in Appendix Section 14. It concludes that signing an alliance increases bilateral trade from 40% to 70%. Since the baseline results are the average of the effects of military alliances over time, the estimated effect of 60% is consistent with the observed dynamic and robust to the negative weights bias. Furthermore, we reproduce the estimation while using De Chaisemartin and d'Haultfoeuille (2024)'s negative-weight robust linear estimator, which confirms our results.

4.3. The heterogeneous effect of alliances

4.3.1. Heterogeneity of alliance treaties

There can be two types of alliances: *the weak alliances*[39] and *the defence pacts*. This distinction is based on the particularity of defence pact security cooperation policies (Gibler, 2008). In a nutshell, defence pacts are the only alliances designed to protect members from (common) external threats (see appendix section 11 for more details). We do not consider this distinction in the baseline. Yet, because of this fundamental treaty difference, we might expect defence pacts to have more of an effect on trade than weak alliances. Long (2003) provides a test of this

[36]For ease of coefficient interpretation, the year variable is equal to the year minus 1959.
[37]We properly discuss the dynamic effect of alliances in Section 6.
[38]We extensively discuss the heterogeneous effect of alliances in the following section 4.3.
[39]Non-aggression pacts, neutrality pacts and ententes.

difference using a non-structural gravity approach, concluding that only defence pacts are positively correlated with trade. In this section, we investigate whether the difference in alliance treaty categories produces heterogeneous effects, estimating within-effects using a structural gravity model.

We decompose the alliance variable into: i) a dummy taking the value one if there is an alliance with a defence pact between i and j at time t, and ii) another dummy taking the value one if there is an alliance without a defence pact between i and j at time t. Then, we replicate our baseline estimation. The results are reported in appendix table .18 column 1. Defence pacts increase bilateral trade by 100%, while the weak alliance coefficient is not statistically significant. This shows that a high level of military cooperation policies is required for alliances to affect trade. Moreover, the fact that defence pacts account for the majority of alliances explains the intensity of our baseline result – the latter is driven by the effect of very deep agreements. Conclusions are robust to the Cold War and the particularities of international relations during this period. A full discussion about the Cold War is provided in appendix section 15. In addition, we test whether our results are driven by the largest defence pact in our sample – NATO. We create a specific dummy variable for the treaty and retain the defence pact dummy variable for the others.[40] The estimation results presented in table .18 column 2 confirm our conclusions.[41]

4.3.2. Bilateral elasticities

In line with standard gravity theory, trade cost elasticities – including insecurity cost's one – are constant in our model (Head and Mayer, 2014).[42] Yet, recent literature has shown that the trade elasticity is decreasing with the value of bilateral trade (Bergstrand and Clance, 2025; Bas et al., 2017; Carrère et al., 2020; Chen and Novy, 2022). As developed in section 2, military alliances are expected to affect trade by reducing trade costs' sensitive to insecurity. Therefore, this section investigates whether the effects of military alliances on bilateral trade are concerned by bilateral trade elasticities.

In keeping with Bergstrand et al. (2025), we use an expectile approach in an Asymmetric Poisson Maximum Likelihood (APPML) estimator (Efron, 1992). This estimator is essentially a PPML estimator in which observations receive different weights depending on whether they are above or below the estimated expectile. It follows the identification strategy of bilateral trade elasticities developed by Carrère et al. (2020) using a Method of Moments-Quantile Regression estimator (Machado and Silva, 2019), but adapts it to a non-linear setting and retains the quality of the PPML estimator. Thus, for a range of expectiles e from 0.01 to 0.99, we replicate our baseline estimation such as :

$$X_{ijt} = exp(\beta(e)_1 ALL_{ijt} + \beta(e)_2 RTA_{ijt} + \lambda(e)_{it} + \lambda(e)_{jt} + \lambda(e)_{ij}) * \epsilon(e)_{ijt} \quad (12)$$

[40] Thus, in this estimation, the defence pact variable takes the value 0 if $NATO = 1$.

[41] In keeping with the definition of military alliances given by Gibler (2008), some recent NATO members (post-2003) are considered to belong to the international organisation, but not the alliance. We test the validity of our estimation including all NATO members in the alliance system. Results are barely affected.

[42] In equation 3, trade elasticities are determined by θ, the Pareto shape parameter of the productivity distribution which is assumed to be constant across country-pairs.

where X_{ijt} is the bilateral trade,[43] ALL_{ijt} and RTA_{ijt} our standard alliances and trade agreement dummy variables, and λ_{it}, λ_{jt} and λ_{ij} the three-way fixed effects.[44] The obtained ALL_{ijt} coefficients, with 95% confidence intervals, are graphically displayed in figure 5. Similarly to the conclusions drawn by Carrère et al. (2020) with respect to distance, and Bergstrand et al. (2025) with respect to economic integration agreements, the alliance coefficients are decreasing in the value of trade.[45]

Two main conclusions are drawn from these results. First, the effect of military alliances on trade depends negatively on the value of bilateral flows. This implies that small country-pairs benefit the most from the signature of a military alliance. Second, military alliance coefficients behave in the same way as variables that clearly affect trade through trade costs. This points to an alliance effect through a trade cost reduction mechanism. In appendix section D, we discuss the consistency of the bilateral trade elasticities with our theoretical framework and provide an extension of our gravity model.

5. Endogeneity

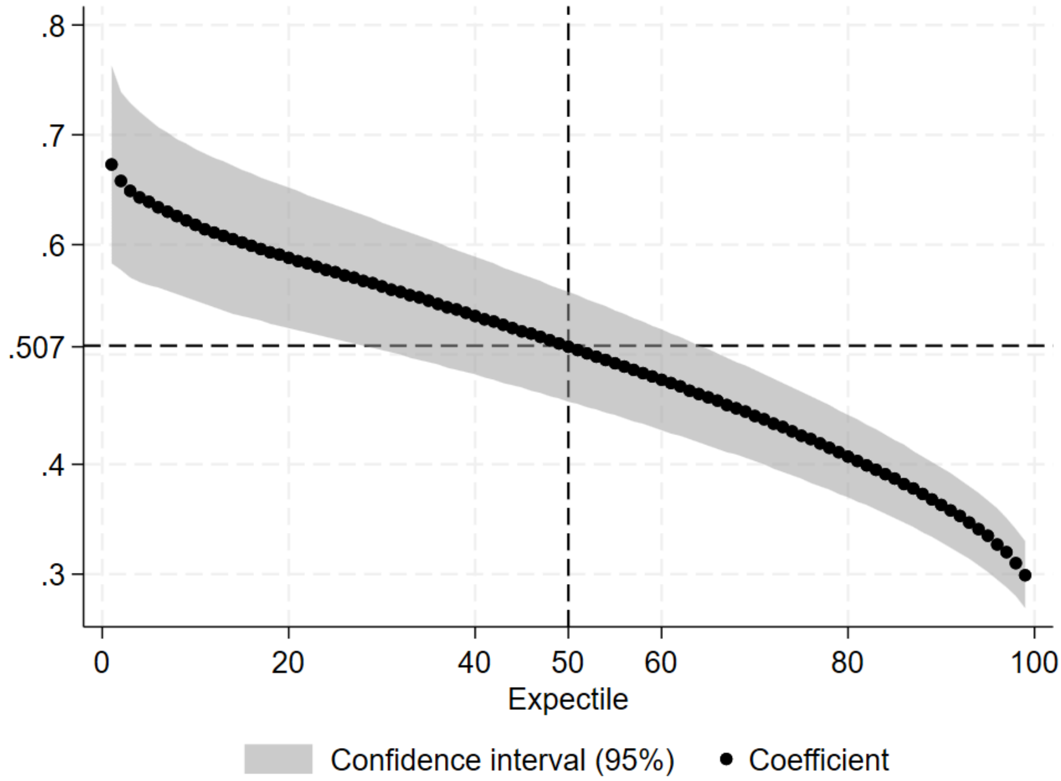
This section takes the identification of the causal effects of military alliances on trade a step further. Indeed, we still need to address potential reverse causality (a trade shock affecting the alliance signature decision) and country-pair-time varying omitted variables (such as a bilateral geopolitical shock). For this purpose, we develop an instrumental variable approach based on common outside alliances. The intuition behind this is the domino-like spread of international agreements, as tested for RTAs or regionalism by Baldwin and Jaimovich (2012). Common allies present similar military interests and the inability of one country in the pair to use its alliances in a conflict against the other. Therefore, if countries i and j have many allies in common, it is highly probable they will develop an alliance together, while in partial equilibrium (i.e. controlling for aggregated prices, output and expenditures) the change in bilateral insecurity costs with external partners should not directly affect the trade inside the pair. We want to avoid capturing the inverse relation: an increase of the common outside alliances because of the signature of an alliance between countries i and j. Therefore, we ignore variations in common outside alliances while

[43] Novy (2013) employ an alternative strategy based on interactions with defined intervals. They demonstrate through a Monte Carlo simulation that with such an estimation approach, it is crucial to define these intervals using predicted values of trade to avoid correlations with the error term. However, to identify heterogeneous effects by expectile, the APPML estimator proposed by Bergstrand et al. (2025) relies on the assumption that errors are not independent of the explanatory variables. Precisely, it assumes a constant conditional mean of errors, but that the distribution of errors is affected by the explanatory variables in a complex way, notably due to heteroskedasticity. With this estimator, constraining errors to be independent of explanatory variables by using the predicted values of trade as the dependent variable, on which the conditional expectiles are defined, would mechanically result in identical estimated coefficients for each expectile.

[44] Fixed effects are allowed to vary across the distribution (Bergstrand et al., 2025).

[45] We observe the same distortion when including self-trade. Additionally, another way to test the presence of bilateral trade elasticities is to change the weight of observations in our baseline by using import share as the dependent variable. Doing so, we increase the weight of observations with small trade flows (Sotelo, 2019). We report the results in appendix table .16 column 13. In line with our findings, we observe higher coefficients for both alliances and RTAs. Furthermore, adding in our baseline an interaction between ALL_{ijt} and the country-pair *predicted* trade (Chen and Novy, 2022), we also observe a negative correlation between the alliance effect and the relative importance of X_{ij}.

Figure 5 – Expectile estimates of alliances



Note: APPML estimation of the impact of alliances on trade with expectiles from 0.01 to 0.99. We include importer-year, exporter-year and exporter-importer fixed effects. Standard errors are clustered at the exporter-importer-year level.

countries i and j are allied.[46] Additionally, we exclude also from the sum the alliance between country-pair ij – the country-pair of interest. Thus, we can write the instrumental variable as follows:

$$IV_{ijt} = \begin{cases} \sum\limits_{k \neq i,j;t_{all}} (ALL_{ikt_{all}} * ALL_{kjt_{all}}), \text{ if } \exists t_{all}, t > t_{all} \ \& \ ALL_{ijt} = 1 \\ \\ \sum\limits_{k \neq i,j;t} (ALL_{ikt} * ALL_{kjt}), \text{ otherwise} \end{cases} \tag{13}$$

We use an OLS/PPML two-stage approach to keep the IV strategy comparable with the baseline and prevent log-linearisation under heteroscedasticity from biasing our estimates (Silva and Tenreyro, 2006). In the first stage, we use OLS to estimate the effect of the IV on the probability of signing an alliance. The predicted probability is used to compute the instrumented alliances. Then, we estimate with a PPML the effect of the instrumented alliances on bilateral trade. In the second stage, clustered standard-errors are bootstrapped.[47] Results are reported in table 3. The (instrumented) military alliance coefficient is strongly positive and significant.[48] Therefore,

[46]Formally, as long as countries i and j are allies, we set the value of the sum of their common outside alliances at the year of signature t_{all}

[47]Bootstrapping not only the second stage but the whole process does not affect results.

[48]We observe a higher coefficient compared with the baseline results. This is due to alliance selection

the IV estimation confirms the causal interpretation of the effects of military alliances on trade.[49]

Using a non-linear second-stage estimator may induce consistency issues. Lin and Wooldridge (2019) recommend a control-function approach to address this. Instead of using alliances' predicted probabilities, we include first-stage residuals as control. Results, reported in appendix table .20, confirm the OLS/PPML two-stage conclusions. In addition, the control-function approach allows testing the baseline's sensitivity to omitted variable concerns. The coefficient of the first-stage residuals is directly interpretable as the omitted variable bias addressed by the IV. Interestingly, focusing on defence pacts (column 2), the residuals' coefficient is significantly smaller, suggesting that defence pacts are less concerned by omitted variable issues than weak alliances. [50]

5.1. IV validity

The IV approach is based on the assumption of non-violation of the exclusion restriction. The common outside alliances can impact country i's trade flows to j only through enforcement of an alliance. If, as discussed the theoretical section 2, in partial equilibrium alliances affect trade only through a reduction in bilateral insecurity costs, our IV should respect this restriction. Yet, in a logic of geopolitical alignment on international scene, the signature of an alliance may lead to a variation in trade costs with non-signatory partners. To qualitatively test it, we create two dummies: $ALL^{out}_{i,-j,t}$ and $ALL^{out}_{-i,jt}$. $ALL^{out}_{i,-j,t}$ takes value 1 if the exporter has signed an alliance with any country other than j (i.e. an outsider) and zero otherwise. Similarly, $ALL^{out}_{-i,jt}$ takes value 1 if the importer has signed an alliance with any country other than i. Both $ALL^{out}_{i,-j,t}$ and $ALL^{out}_{-i,jt}$ can be estimated in the presence of exporter-year, importer-year and country-pair fixed effects since they are country-pair-year specific (Dai et al., 2014). Both dummies are introduced in equation (11) estimated by a PPML. We report the results in appendix table .21.[51] $ALL^{out}_{i,-j,t}$'s and $ALL^{out}_{-i,jt}$'s coefficients are not significantly different from zero. So, on average, signing an alliance with an outsider does not affect trade flows from country i to j.[52]

induced by the IV. By targeting alliances included in an international network, we mechanically select defence pacts, which tends to increase coefficient (see section 4.3.1). Reduction in second-stage standard errors results simply from bootstrapping.

[49]Supplementary sensitivity tests are performed on the IV results. Results are robust to the inclusion of an interaction variable between distance (in log) and year, which controls for the globalisation dynamic. To avoid potential biases due to RTA endogeneity, we also run an estimation in which we instrument them by common outside RTAs ($\sum_{k\neq i,j;t} RTA_{ikt} * RTA_{kjt}$). Additionally, we checked the sensitivity of the IV when controlling for the cold-war as described in the appendix section 15. The instrumented alliance coefficient is poorly affected. We replicated the IV excluding CHELEM data and including intre-country flows. As for the baseline (see section 4, this increases the estimated impact of alliances as we capture the effect of substitution from intra- to inter-national trade. We provide a 2SLS estimation in appendix table .19. The alliance coefficient is still positive and significant. Yet, the OLS and 2SLS gravity estimations induce biased coefficients and standard errors – due to log-linearisation under heteroscedasticity (Silva and Tenreyro, 2006) – and observation weights different to PPML (Sotelo, 2019).

[50]Furthermore, coefficients of instrumented alliances and defence pacts are very similar, which supports that defence pacts drive the estimated causal effect on trade.

[51]We run the same estimation in column two, but focusing on defence pacts.

[52]Our time frame include the Cold-War. During this period because strong geopolitical *blocs* of countries existed, signing an alliance with a country of on bloc may reduce trade with members of

This result points to the validity of the instrument's exogeneity assumption.

Furthermore, we perform a *plausible exogeneity test* proposed by Conley et al. (2012). The approach aims at supporting the validity of our results even in the presence of a reasonable deviation from perfect alignment with the exclusion restriction assumption. We relax the assumption by allowing for ν, the correlation between the instrumental variable (common outside alliances) and errors, to deviate from zero. We then test whether the estimate of the instrumented variable (ALL_{ijt}) is robust to such a deviation from the exclusion restriction.

The union of confidence interval method calls first for setting the minimum (or maximum) value ν can take. To approximate this, we regress bilateral trade on the endogenous variable (ALL_{ijt}) and the instrumental variable (common outside alliances) with our standard set of fixed effects and controls. The coefficient associated with the IV represents an approximation of the degree of deviation from the exclusion restriction (Kippersluis and Rietveld, 2018). We obtain a small non-significant coefficient (-0.003). We then plug this degree of deviation into the plausible exogeneity test. In this way, we obtain the estimation of the (instrumented) alliance coefficient's upper and lower bounds under the relaxation of the exclusion restriction (see table 4).[53] The interval [0.354 ; 0.538] does not contain zero. Thus, we can safely argue that military alliances have an unambiguous positive causal effect on bilateral trade.

6. The dynamic effect of alliances

So far, we have focused on the within-average effect of alliances. However, alliances may require time to be fully effective and increase bilateral trade dynamically. Applying a simple event study approach on our baseline does not permit to identify the dynamic effect of alliances in the absence of pre-trend (see graph .9 in appendix). Therefore, we develop in this section a Differenced Average Treatment on the Treated (DATT) approach based on Couch and Placzek (2010). In the light of the results in section 4.3.1, we choose to increase the precision of the analysis by focusing on defence pacts. Therefore, we decompose variable ALL_{ijt} into *defence pacts* and *weak alliances*. Then, we estimate the defence pact DATT, using weak alliances as a control variable.

The observation of a pre-trend in the simple event-study suggests the presence of a selection bias. To address this issue, we perform dynamic propensity score matching on a staggered sample.[54] We define the propensity score $p(x_{ijt})_t$ as the likelihood of signing a defence pact conditional on a set of standard observable gravity variables and military expenditures. The propensity score is estimated for each separate year from 1967 to 2012. In this way, depending on the year, the variables are allowed

the other one. We further discuss this issue in the appendix section 15. We show that in this specific context such a reduction in trade applies, but also that it the Differenced Average Treatment on the Treated approach we develop in a further section (6) perfectly addresses this issue.

[53] The Conley et al. (2012) estimator is based on the 2SLS estimator. We therefore have to log-linearise the gravity equation. We use the inverse hyperbolic sine transformation of trade to capture zero values. As discussed previously, log-linearisation under heteroscedasticity could bias the alliance coefficient. Nevertheless, estimated bounds are consistent with the OLS/PPML two-stage estimation which addresses this bias.

[54] This implies that previously treated country-pairs can never be part of the control group.

to affect $p(x_{ijt})_t$ differently. Each treated country-pair observation is matched on $p(x_{ijt})_t$ with an untreated country-pair. A country-pair with no defence pact, but having had one in the past is never used as a control observation. We obtain a set of country-pair-year observations matched on $p(x_{ijt})_t$.[55]

In keeping with Couch and Placzek (2010), we estimate the equation:

$$X_{ijt} = exp(\sum_{k>k'} \delta^k D^k_{ijt} + \beta_2 Weak.ALL_{ijt} + \beta_3 RTA_{ijt} + \lambda_{it} + \lambda_{jt} + \lambda_{ij}) * \epsilon_{ijt} \quad (14)$$

k' must be a year or period prior to the year of signature of a defence pact between countries i and j. D^k_{ijt} is a dummy variable equal to 1 if t is the k^{th} year after (or the k^{th} year before if -k) the signature of a defence pact between countries i and j. $Weak.ALL_{ijt}$ and RTA_{ijt} are dummy variables controlling respectively for the presence of a weak alliance and an RTA between countries i and j at time t. λ_{it}, λ_{jt} and λ_{ij} are respectively exporter-year, importer-year and exporter-importer fixed-effects. We use a PPML estimator.

The DATT compares the difference in bilateral trade between years k and k' for a country-pair signing a defence pact during our period, indicated by $D_{ij} = 1$, to the difference in bilateral trade between years k and k' for a country-pair with no defence pact, indicated by $D_{ij} = 0$. The expected difference between the year-to-year difference in trade is estimated for the set of treated country-pairs relative to the matched set of non-treated pairs (Couch and Placzek, 2010).

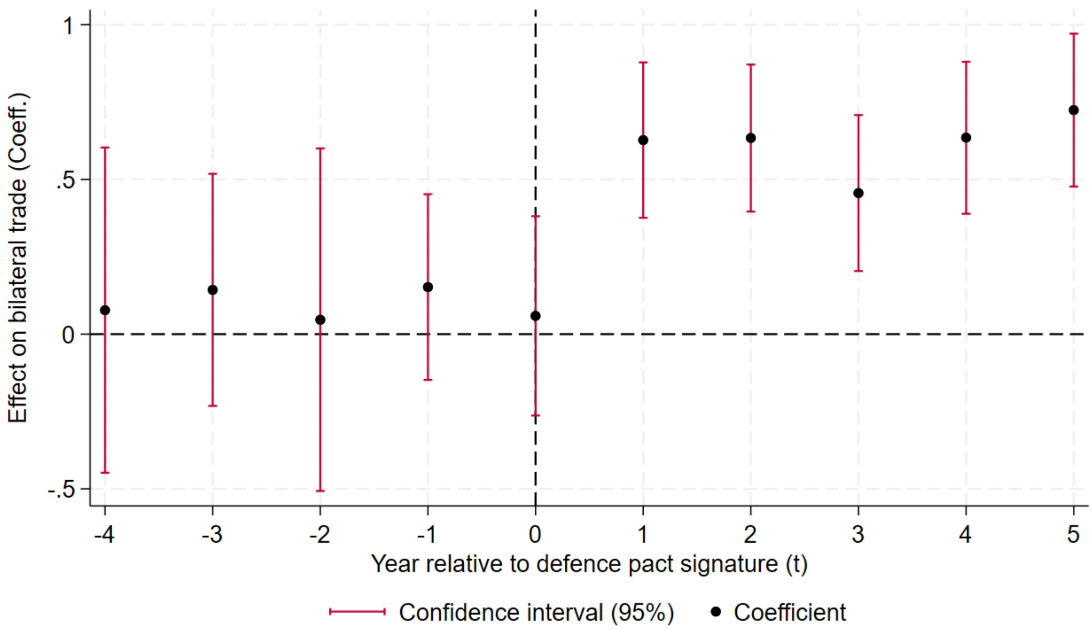
The results of the DATT estimation are graphically represented in figure 6. More details are provided in appendix table .22. t_{def} is the date of the defence pact's signature. We choose $k' <= t_{def} - 5$. So, all k are estimated in comparison to $k' <= t_{def} - 5$ (the natural trend). From the year following the treaty's signature, the defence pact has a positive and significant effect on trade from i to j. In the following periods, the effect keeps strong and positive. Given that t_{def} the date of signature and not of enforcement, this short one-year delay can be interpreted as the time of adjustment required for the defence pact to become effective and fully operational. For $k >= t_{def} + 5$ (the treated trend), the average estimated effect confirms our previous results: following their signature, defence pacts increase bilateral trade by 106%.[56] Moreover, for any $k < t_{def}$, we obtain a weak and insignificant coefficient. Therefore, the measured effect for any $k >= t_{def}$ is independent of any pre-trend.[57] Thus, in the light of our results, we can safely conclude that the defence pacts have an unambiguous persistent, positive and causal effect on trade.

[55]We evaluate the extent to which the matched treated and control groups are similar. We consider the standardised difference in means (B) and the variance ratio (R). To conclude that the groups are comparable, B must be inferior to 0.25, and R between 0.5 and 2 (Rubin, 2001; Stuart and Rubin, 2008). After matching, we obtain $B = 2\% < 25\%$ and $0.5 < R = 0.98 < 2$. Thus, in the set of matched observations, the control and treated groups are well balanced. We tested the sensitivity of our DATT results with alternative propensity score computations. See the appendix section 16 for details.

[56]Since the data set is staggered, the DATT estimates only the entry effect (switches from 0 to 1). In previous estimation strategies, both entry and exit are considered.

[57]DATT results are also robust to the cold war. See the full discussion on the cold war in section 15.

Figure 6 – Dynamic effect of defence pacts on bilateral trade (DATT)



Note: Figure plots results of the DATT estimation of the defence pacts' effect on bilateral trade. Every time k is compared to $k' <= t_{def} - 5$. The last period includes $k >= t_{def} + 5$. Estimator is PPML. Standard errors are clustered at the country-pair-year level. Results are robust to two-way exporter and importer clustering.

7. From alliances to trade: the mechanism

This section analyzes the mechanism behind the positive effect of alliances on trade.[58] As discussed in the theoretical section 2, alliances should affect trade by reducing the international insecurity between members. In our model, international insecurity is defined by the expropriation risk $E_{ij}I_{ij}$. However, this risk is not directly observable in the data. International insecurity needs therefore to be proxied and its empirical nature discussed. Formally, we examine the role of interstate conflicts, geopolitical tensions, exposure to conflict events – with a particular focus on non-state actors – and military cooperation. Finally, we disentangle the alliance mechanism across the intensive and extensive margins of insecurity.

The first source of insecurity that alliances address is the risk of conflict between signatories.[59] Yet, several pieces of evidence support that this channel does not apply. First, in section 4.3.1, we show that the alliances focusing on reducing the probability of conflict between signatories (i.e. the weak alliances) have no impact on bilateral trade. Second, in data, interstate conflicts are rare in our panel. Therefore, we do not observe that interstate conflicts are the counterparts of the absence of an

[58]Most previous empirical papers focusing on the link between military alliances and trade consider that alliances affect trade because signatories are more inclined to reduce tariffs or sign RTAs with their allies (Long, 2003; Long and Leeds, 2006; Mansfield and Bronson, 1997). Yet, our baseline estimation includes RTAs as a control variable, while our analysis shows that our baseline results are barely sensitive to the inclusion of tariffs and RTA depth (see section 4). Therefore, this mechanism is excluded.
[59]See treaties description in appendix section 11.

alliance.[60] Extending the risk of conflict in the country pair to geopolitical tensions, we estimate the effect of defence pacts on the common United Nations votes of the country-pair.[61] Results are reported in the appendix table .23. Defence pacts' effect is extremely low (+2%), as well as weak alliances' one.[62] This supports that alliances do not increase trade by reducing the probability of conflict between signatories.

Nevertheless, defence pacts' content is not limited to the reduction of interstate conflicts between members. These alliances are designed to enforce deeper security cooperation aimed at addressing any source of insecurity that concerns both signatories. Indeed, as we can observe in the data, conflict events are, in the extremely large majority, related to fights against non-state organized actors (terrorism, civil wars, piracy, armed factions).[63] Taking into account the complexity of conflicts, we therefore use a broader measure of bilateral insecurity:

$$INS_{ijt} = \sum(conflict\_event_{it}) * \sum(conflict\_event_{jt}) \quad (15)$$

the interacted country-time sums of conflict events between i and j.[64]

We use two-stage estimations to look at the effect of defence pacts on trade by means of the variation of INS_{ijt} they enforce. The set of fixed effects is the same as in the baseline. This implies that the independent level of insecurity of country j or in country j at time t are controlled which ensures that we capture only the country-pair specific variation of INS_{ijt}. For interpretation reasons, we use the inverse hyperbolic sine transformation of INS_{ijt}.[65] Due to data limitations with respect to conflict events, we use a sub-sample starting in 1989. The results are displayed in table 5.[66] Column 1 presents the defence pact dummy variable. To further address possible endogeneity, we replace it in column 2 with common outside defence pacts.[67]

In the first-stage estimations, we observe a strong negative effect of defence pacts on bilateral insecurity. In column 1, we estimate that the enforcement of a defence pact reduces bilateral insecurity by 63%. Then, in the second-stage results, we observe

[60] Using the Military Interstate Dispute database from the Correlate of War project (Palmer et al., 2022) , we find in our sample only 160 observations (exporter-importer-time) with an active war. Following (Martin et al., 2008b) by including lower magnitude conflicts (starting at simple display of force), we find only 3,297 exporter-importer-time observations with an active interstate conflict – 1,109 happening while an alliance is active. Performing a logit estimation with our full set of fixed effects, we do not observe any significant effect of alliances or defense pacts on the probability of interstate conflict. This result is consistent with the findings of Martin et al. (2008b) and Vicard (2012).

[61] For this purpose we use the United Nations General Assembly Voting Data from Voeten (2013).

[62] We estimate the effect of alliances on common UN votes at the country-pair-time level. The dependant variable being a count we use a PPML estimator. Since we want to capture the degree of geopolitical convergence, the dependant variable includes only expressed votes while we control for abstention. In column (2) we use our instrumental variable. This does not affect our conclusions.

[63] Using UCDP data – see section 3 – between 1989 and 2012 we observe 120.029 conflict events.

[64] Military cooperation events capture a reduction in insecurity rather than an increase. They therefore need to be excluded for an accurate measurement of bilateral insecurity.

[65] We test different functional forms. This does not affect the robustness of our results. In addition, given that on average $INS_{ijt} = 81,864$, we are not exposed to approximation errors using the inverse hyperbolic sine transformation (Bellemare and Wichman, 2020).

[66] As in section 5, we use a two-stage OLS/PPML estimator to prevent log-linearisation under heteroscedasticity from biasing our results (Lin and Wooldridge, 2019; Silva and Tenreyro, 2006). The control-function approach provides similar results.

[67] We construct this variable in the same way as the IV in section 5 but restricting it to defence pacts.

in both specifications that the reduction in bilateral insecurity enforced by defence pacts (or common outside defence pacts) has a significant positive effect.[68] Thus, we estimate that, by reducing bilateral insecurity, defence pacts raise trade by 46%. In this sub-sample, this is equivalent to almost 100% of the total defence pact effect.

Alternatively, we test the insecurity mechanism estimating the effect of defence pacts on trade through the variation of $\sum coop.mil.ev._{ijt}$, the sum of the country-pair's cooperative military events. Contrary to INS_{ijt}, this does not directly target insecurity, but the enforcement of the military cooperation that reduces insecurity. Yet, we identify a purely bilateral variation.[69] We report the two-stage estimations in appendix table .24.[70] Results strongly support both the validity and prevalence of the insecurity mechanism: by signing defence pacts, members sharply increase their effective security cooperation which ensures an important reduction in country-pairs insecurity and leads to an increase in trade between signatories.

7.1. Margins of international insecurity

As outlined in the theoretical section 2, international insecurity is composed of two distinct margins. Following our model, alliances are expected to decrease the probability of country-pairs facing international insecurity (the extensive margin), as well as the intensity of the insecurity that country-pairs experience (the intensive margin). To empirically examine the contribution of each margin, we proceed in two distinct estimations. Specifically, we estimate the effect of alliances on a binary variable that takes the value one if our measure of bilateral insecurity (see eq. 7) is positive, thereby capturing the extensive margin. Then, we re-estimate the effect of alliances on bilateral insecurity, as in table 5's first stage, but capture the intensive margin by excluding all exporter-importer-year observations with null bilateral insecurity. We report results in the appendix table .25. As previously, we focus on defence pacts. They decrease the yearly probability of bilateral insecurity by 64%[71] and significantly reduce the intensity of insecurity when it occurs by 21%. Thus, in line with our theoretical framework, our empirical analysis confirms that the effect of alliances goes through both margins of international insecurity.

Given that in this sub-sample the elasticity of trade with respect to defence pacts, denoted as $\varepsilon_{Def.}(X_ij)$, is estimated at 0.381 (i.e. 46%),[72] we can now calibrate its components based on its theoretical expression (eq.10). In our theoretical model, insecurity costs are defined by $\tau_{ij}(s) = \frac{1}{1-E_{ij}I_{ij}}$, where E_{ij} represents the extensive margin of international insecurity and I_{ij} the intensive margin. The elasticity of trade with respect to $\tau_{ij}(s)$ is $\theta = 3.38$,[73] the elasticities of E_{ij} and I_{ij} with respect to defence pacts are estimated at -1.025 and -0.24, in the absence of defence

[68] The bilateral insecurity coefficient is negative since it expresses the effect of a *rise* in insecurity.

[69] Precisely, for each event we observe in the data which countries are cooperating militarily as belligerents in the conflict.

[70] $\sum coop.mil.ev._{ijt}$ measures the opposite of INS_{ijt}. Therefore, the second-stage coefficient is positive: defence pacts make for a sharp increase in military cooperation, which makes for a sharp increase in trade.

[71] In the appendix table .26, we performed a robustness check with a linear probability model which allow for exporter-year and importer-year fixed effects. Results are consistent.

[72] Our baseline analysis begins in 1960, while our estimations utilizing conflict event data starts in 1989. We replicated estimation 1 from appendix table .18 using this sub-sample.

[73] See appendix table .27 for estimation details.

pactwhile I_{ij} is held constant while $E_{ij} = 0.148$.[74] Consequently, the elasticity of trade with respect to defence pacts, based on the international insecurity mechanism, is defined as follows:

$$\begin{aligned}\varepsilon_{Def.}(X_{ij}) &= \theta \star \frac{E_{ij} I_{ij}}{1 - E_{ij} I_{ij}} \star \left[\delta \frac{1+r}{r} \frac{\partial ln(s_{ij})}{\partial All.} + \frac{1+r}{1-r} \frac{\partial ln(s_{ij})}{\partial All.}\right] \\ &= 3.38 \star \frac{0.148 \star 0.553}{1 - 0.148 \star 0.553} \star [1.025 + 0.24] \\ &= 0.381\end{aligned}$$

This calibration exercise underlines two important conclusions. First, the intensity of bilateral insecurity is substantial. With $I_{ij} = 0.553$, this means that, in the event of international conflict, a traded product is 55.3% likely to be expropriated. Second, the risk of country-pairs facing such insecurity, as captured by the extensive margin, is much lower but still non-negligible. Overall, alliances lead to a substantial reduction in trade costs, which explains their significant impact on bilateral trade. This also underscores that, in their absence, the world would be much more insecure – an aspect we explore with counterfactuals in the following section dedicated to the general equilibrium approach.

8. General equilibrium and welfare implications

We investigated so far the direct effect of alliances on trade. In this section, we complete our analysis by considering the General Equilibrium (GE) impact – i.e. allowing for changes in aggregated prices, output, wages and expenditures – and derive the welfare gains from alliances.[75] Following the theoretical model presented in section 2 and detailed in section 12, we can characterize the GE in seven equations:

Trade equilibrium:

$$X_{ij} = N_i \overline{\alpha}_i^{-\theta} w_i^{-\theta} \frac{X_j}{\Phi_j^{-\theta}} \tau_{s,ij}^{-\theta} T_{n \neq s,ij}^{-\theta} F_{n \neq s,ij}^{-[\frac{\theta}{\sigma-1}-1]} \tag{16}$$

$$\Pi_i^{-\theta} = \sum_j \frac{\tau_{s,ij}^{-\theta} T_{n \neq s,ij}^{-\theta} F_{n \neq s,ij}^{-[\frac{\theta}{\sigma-1}-1]}}{\Phi_j^{-\theta}} X_j \tag{17}$$

$$\Phi_j^{-\theta} = \sum_i \frac{\tau_{s,ij}^{-\theta} f_{s,ij}^{-[\frac{\theta}{\sigma-1}-1]} T_{n \neq s,ij}^{-\theta} F_{n \neq s,ij}^{-[\frac{\theta}{\sigma-1}-1]}}{\Pi_i^{-\theta}} Y_i \tag{18}$$

$$\overline{\alpha}_i w_i = \left(\frac{Y_i}{\Pi_i^{-\theta} N_i}\right)^{-\frac{1}{\theta}} \tag{19}$$

Insecurity equilibrium:

[74] We find from the logit and the Lpm estimations that the signature of a defence pact reduces E_{ij} by 64% which corresponds to 9.5pp. Combining those results, this implies that on average, before the signature of a defence pact $E_{ij} = 0.148$.

[75] Note that in this exercise we focus on the gains from the cooperation induced by alliances. In our baseline estimation, military expenditures were captured by fixed effects, while in the general equilibrium they are hold constant.

$$\tau_{s,ij} = \frac{1}{1 - E_{ij} I_{ij}} \tag{20}$$

$$I_{ij} = s_{ij}^{-\frac{1+r}{1-r}} \Psi_{ij}^{\frac{1+r}{1-r}} \left[\frac{X_{ij}^{\frac{r-1}{r}} \mu_{ij} r}{\left(\frac{w_i}{\nu_o}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k}\right)^{\nu_k r}} \right]^{\frac{r}{1-r}} \tag{21}$$

$$E_{ij} = s_{ij}^{-\delta \frac{(1+r)}{r}} \Psi_{ij}^{\delta \frac{(1+r)}{r}} \underline{V}_{ij}^{-\delta \frac{1-r}{r}} \left[\frac{\left(\frac{w_i}{\nu_o}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k}\right)^{\nu_k r}}{r} \right]^{-\delta} \tag{22}$$

Equation (16) is the structural gravity relation. Π_i and Φ_j are respectively the outward and inward multilateral resistance terms.[76] Y_i is country i's total output and $\overline{\alpha}_i w_i$ the maximum factory gate price – the marginal cost at the lowest productivity to which a firm can draw in country i. Equation (20) is the international insecurity cost, with E_{ij} the extensive margin and I_{ij} the intensive margin of insecurity as presented in section 2.

In this frame, in keeping with Arkolakis et al. (2012), we can summarize the welfare effect of a change in insecurity costs due to military alliance enforcement in a few parameters. Welfare is defined as the real revenue ($\frac{Y}{\Phi}$).[77] Thus, any change in welfare follows the equality:

$$dln(W_j) = dln(Y_j) - dln(\Phi_j) \tag{23}$$

Military alliances contend with bilateral and reciprocal shocks on variable and fixed trade costs sensitive to insecurity. Based on such shocks, we can desegregate country j changes in welfare as follows:

$$dln(W_j) = dln(w_j) - \sum_{i=1}^{n} \psi_{ij} \left[dln(w_i) + dln(\tau_{s,ij})) \right] \tag{24}$$

Therefore, welfare changes induced by military alliances can be derived from a system of a few parameters: initial trade shares (ψ_{ij}), wages (w_j and w_i) and insecurity costs ($\tau_{s,ij}$).

8.1. GE Empirical application

This General Equilibrium system can be solved using the Anderson and Yotov (2016) methodology and its extension in Anderson et al. (2018) which we adapt to bilateral insecurity. We construct a counterfactual global economy in which no alliance exist - i.e. with the level of international insecurity that would apply in the absence of alliance. By comparing the counterfactual level of trade and real revenues with the baseline, we can assess the GE gains (or losses) in trade and welfare of countries from the observed network of alliances.[78]

[76] Π_i in eq.17 is obtained by replacing in eq.16 $N_i \overline{\alpha}_i^{-\theta} w_i^{-\theta} = \frac{Y_i}{\Pi_i^{-\theta}}$, which is derived from the market clearance: $Y_i = \sum_j X_{ij}$.

[77] Implicitly, we focus on the welfare of peaceful agents, as, following Couttenier et al. (2024a), the trade equilibrium considers looted goods as a pure loss. More details are given in section 12.

[78] In our empirical analysis, some countries that are members of NATO as an international organization are not considered as members of an alliances in Gibler and Wolford (2006) on which our data rely. This concerns mainly Baltic countries. In the counter-factual exercises, we assume that these countries are also members of the defense pact. This does not affect the results of the reduced form estimation.

We first estimate the partial equilibrium (eq. 16)[79] to capture military alliance elasticity and estimates of bilateral trade costs.[80]We develop our analysis for the year 2012 – the last year in our baseline panel. To retrieve baseline multilateral resistance, we estimate the gravity equation for 2012 imposing bilateral trade costs and elasticities from the previous step.[81] We define our first counterfactual as the absence of alliance. To obtain the counterfactual multilateral resistance terms, we again estimate the constrained gravity equation setting $ALL_{ijt} = 0$. We then determine the endogenous change in insecurity $\tau_{s,ij}$ based on equations 20 to 22,[82] as well as in output and expenditures: $\widetilde{X_i^c} = \frac{\tilde{w_i^c}}{\tilde{w_i}} X_i$ and $\widetilde{Y_i^c} = \frac{\tilde{w_i^c}}{\tilde{w_i}} Y_i$. The Change in wage ($\frac{\tilde{w_i^c}}{\tilde{w_i}}$) is captured directly by changes in maximum factory gate prices (eq. 12).[83] The calibration of trade elasticity θ plays a crucial role in the estimation of both prices and welfare. Including tariffs in the standard structural gravity estimation, we directly estimate $\theta = 3.38$.[84] Finally, we can quantify the General Equilibrium effect of military alliances enforced in 2012 as the percentage difference between the baseline and the counterfactual.[85]

8.2. Results

Results per country are reported in table 6.[86] Military alliances improve signatories' trade and welfare, while non-members experience losses. GE effects highly depend on countries' import penetration. The biggest winners in terms of welfare also see sharp increases in their trade, but not the largest ones. These countries are small with military alliances with many close partners, such as Latvia (13.38%), Slovenia (+11.85%) and Slovakia (+11.38%). We then find a mix of developed and middle-income countries also intensively involved in military alliance treaties, such as Hungary (+8.12%), Canada (8.70%), Denmark (+8.08%), Iceland (7.97%), Guatemala (6.14%), Mexico (+5.86%) and Belarus (5.25%). Military alliances are less impactful for large economies, but still bring non-negligible welfare gains: Great Britain (+5.22%), France (+5.22%), Germany (+4.49%) and the USA (+3.04%). On the other hand, the biggest losers are small countries excluded from alliance treaties whose close

[79]Intranational trade flows are included. See section 4.2 for details on this specification and comparison with our baseline.

[80]Time-varying trade costs are derived from controls, while time-invariant trade costs are captured by country-pair fixed effects. Some exporter-importer fixed effects are dropped due to convergence issues. These missing effects are replaced by regressing for 2012 the estimates of exporter-importer fixed effects on gravity variables and country fixed effects.

[81]Using a PPML estimator, we can directly recover empirical expressions of the multilateral resistance terms (Fally, 2015). Yet to solve the system, we need to normalize one of the multilateral resistances. We choose to normalise Germany's importer multilateral resistance term so that $\widetilde{\Phi_0} = 1$. Therefore we can derive country i's and j's multilateral resistance from $\widetilde{\Pi_i} = (\frac{Y_i X_0}{exp(\widetilde{\lambda_i})})^{-\frac{1}{\theta}}$ and $\widetilde{\Phi_j} = (\frac{X_j}{X_0 exp(\widetilde{\lambda_j})})^{-\frac{1}{\theta}}$, with $\widetilde{\lambda}$ the estimated exporter/importer fixed effect.

[82]Details about the calibration of parameters which determine international insecurity are given in the appendix section 18.

[83]Given that $\overline{\alpha}$ and N_i are fixed, we have $\frac{\tilde{w_i^c}}{\tilde{w_i}} = (\frac{exp(\widetilde{\lambda_i})^c X_0}{exp(\widetilde{\lambda_i}) X_0^c})^{-\frac{1}{\theta}}$. Variations in expenditures and outputs trigger new changes in multilateral resistance, which impacts outputs and expenditures and so forth. Translating these variations into changes in trade, we iterate the estimation process until maximum prices converge.

[84]The results of the trade elasticity estimation are reported in table .27. For robustness reasons, we also perform the general equilibrium analysis using two alternative calibrations of θ. In keeping with Head et al. (2014) and Melitz and Redding (2013) we calibrated $\theta = 4.25$, and in keeping with Anderson et al. (2018) $\theta = 6$. Mechanically, the higher θ, the smaller the welfare variations. Nonetheless, our conclusions are robust to these alternative calibrations of θ.

[85]Changes in trade and welfare are simply: $\frac{X_j}{X_j^c} = \frac{\sum_j X_{ij} - \sum_j \widetilde{X_{ij}^c}}{\sum_j \widetilde{X_{ij}^c}}$ and $\frac{W_j}{W_j^c} = \frac{Y_j/\widetilde{\Phi_j} - \widetilde{Y_j^c}/\widetilde{\Phi_j^c}}{\widetilde{Y_j^c}/\widetilde{\Phi_j^c}}$.

[86]Minor additional sensitivity checks are performed. We also differentiate between defence pacts and weak alliances, removing only defence pacts. In both checks, results are barely affected.

partners have signed multiple ones. Here, we can cite Austria (-2.23%), Sweden (-1.86%), Switzerland (-1.59%), North-Macedonia (-1.54%) and Mauritius (-1.07%). These negative effects are the consequence of a general equilibrium trade diversion mechanism, as alliances increase the price competition for non-members.[87] In addition, our results are robust to the inclusion of heterogeneous alliance and trade elasticities.[88]

8.3. Scenarios analysis

International tensions have been exacerbated in recent years. As stark geopolitical dispute emerge and the US and China exacerbate their hegemonic pressure, armed groups exert a constant, major threat to international security and trade. In these times of trouble, alliances may serve as a central tool for states, leading to a significant reshaping of the international network of security cooperation. Therefore, using our general equilibrium approach, this section examines the implications for countries' welfare in the event of significant disruptions within the alliance network amidst this geopolitically complex era.

8.3.1. NATO and the East

The war in Ukraine has brought conflict back to Europe with new threats and strategic interests that are shaking the post-Cold War balance. In this context, the future may bring a substantial reshaping of military alliances, especially among European countries. We first explore three simple scenarios: i) the expansion of NATO to neutral European countries and partner nations as defined by NATO *Partnership for Peace* program, ii) NATO breaking with Eastern countries, and iii) the creation of a new Eastern bloc around a Sino-Russian bloc.[89] Extending the network of alliances, the first scenario induces a pure reduction in international insecurity. On the contrary, the second scenario captures a pure increase in insecurity, while the third scenario assumes a mix of bilateral insecurity changes.

Results per country are presented in the appendix tables .30 to .32. Despite the assumed important change in the alliance network, any scenario's GE effect is insufficient to induce a major impact on large or unconcerned economies. For countries like the US, France, UK and Germany, maintaining NATO in the East or expanding the treaty to their closest partners

[87] Note that losers may experience (very small) gains in trade. This is the result of an increase in their inward and outward multilateral resistance terms associated with a drop in their factory gate prices. The increase in expenditure by winners causes non-signatory countries to see trade diverted from their internal market to the winners. This diversion offsets (or overcomes) the decrease in their trade due to the fall in output.

[88] We showed in section 4.3.2 that, given that trade elasticities are not constant, alliances have a country-pair specific effect. We adjust our GE analysis to include bilateral trade elasticities. We adopt Neri-Lainé (2025) approach. We allow trade, wage and aggregated demand elasticities to be country-pair specific and to endogenously change with the value of bilateral trade. Theoretically, the above-presented GE structure and welfare system still hold, with some adjustments in the gravity equation. Bilateral elasticities are derived from a gravity expectile estimation with intra-country trade. For consistency with our standard GE, we assume that the average trade elasticity equals the price index elasticity, such as $-\overline{\theta} = 1 - \sigma = -3.38$. Alternatively, we followed (Head and Mayer, 2014) and set $1 - \sigma = 5$. We present the new GE results in appendix table .29. Overall, the introduction of bilateral elasticities temper the welfare variations, especially for large economies. We may observe more different outcomes for specific economies, as the bilateral-elasticities GE is more sensitive to trade diversion and the composition of trade costs. Nonetheless, our conclusions are barely affected.

[89] We assume that i) Armenia, Austria, Azerbaijan, Finland, Georgia, Kazakhstan, Kirghistan, Moldova, Sweden, Switzerland, Tajikistan, Ukraine and Uzbekistan integrate NATO (Ireland, Serbia and Malta are excluded due to missing internal trade in 2012), ii) Albania, Belarus, Bulgaria, China, Estonia, Hungary, Iran, Lithuania, Latvia, Moldova, Pakistan, Poland, Romania, Russia, Syria and Turkey leave NATO (if member) or terminate any military alliance with its members, and iii) that after leaving NATO, they form one common military alliance together.

has noticeable, but not major economic outcomes. Furthermore the changes in the GE trade diversion are weak and poorly affect neutral economies. On the other hand, for countries targeted as potential switchers, the choice to switch would have drastic repercussions. Leaving NATO would severely reduce their real revenue, which a new Eastern bloc could temper but not offset. Moreover, for still-neutral countries – especially in Europe – joining NATO (i.e. the closest and largest alliance network) would bring remarkable welfare gains. For example, Ukraine would increase its real revenue by 3.29%,[90] Armenia by 3.11%, Moldova by 8.62%, Finland by 9.35%, Sweden by 13.67% and Switzerland by 14.86%.

8.3.2. US withdrawal scenario

The involvement of the United States of America in military alliances may have been questioned in recent years, or used to exert diplomatic pressure, particularly on European partners, as the recent Greenland crisis catalyzes. In this debate, the real-revenue consequences of a US withdrawal could play a significant role. To investigate this, we employ the same scenario analysis method as before. Within our general equilibrium framework, we consider a counterfactual scenario in which the US has terminated all its alliances. This scenario is more parsimonious than the previous ones, and we should expect more targeted impacts.

The results are presented in the appendix table .33. Under such a withdrawal, US welfare would decrease by 3.29%. The impact on partner countries is diverse. Economies that are strongly integrated with the US would experience major losses, such as Canada (-8.50%), Mexico (-7.51%) or Dominica (-5.36%). Nevertheless, other US' European partners would be weakly impacted. Especially when comparing their losses to those of the US, they are largely inferior (approximately 5 times less on average). Furthermore, countries that are not US allies would no longer suffer from trade diversion and would experience slight gains, like Israel (+0.46%) or Lesotho (+0.72%). Thus, if the US chose to withdraw from the alliance network, the most negatively affected countries would be the closest US partners and the US itself.

8.3.3. A new geopolitically fragmented world

This final counterfactual scenario aims to analyze the welfare consequences of a new global geopolitical fragmentation through military alliances by integrating different elements from the previous scenarios. Formally, we combine: i) the withdrawal of the US from any alliance, ii) the centralization of NATO around Europe and its expansion toward neutral European countries and members of the *Partnership for Peace*, and iii) the consolidation of the Sino-Russian bloc along with a complete rupture of its members' alliances with Western or NATO countries. In such a setting, where changes in alliance connections are numerous and represent more of a reshaping than a clear expansion or contraction of the network, the global and country-specific consequences on welfare are not trivial.

We present the detailed welfare gains of each country in the appendix table .34. At the global level, there would not be a large welfare shock: on average, countries would lose 0.01% of welfare, or 0.55% when weighted by population. However, there is significant dispersion in these outcomes. The United States, by canceling all alliances, would still experience a strong welfare loss (-3.68%), pulling its close partners such as Canada (-8.66%) and Mexico (-7.93%) down with it. Conversely, the Sino-Russian bloc would not see significant changes, except for Russia (-1.64%). This bloc is already well-structured with little room to intensify internal alliance connections. However, Russia has inherited several alliances from the Cold War thaw with important European countries such as France and Germany, whose rupture

[90] Note that these welfare gains do not capture the effect of a peace agreement between Russia and Ukraine.

would have a direct negative impact on its welfare.[91] In this scenario, European countries and their allies emerge as the winning bloc. Small countries close to Europe would still gain significantly from joining NATO (from +3% to +16%). Meanwhile, major European economies, whose trade diversion capacities are significant and military cooperation with the Sino-Russian bloc already low, would use this NATO expansion to compensate for the welfare costs of global fragmentation. Thus, some European countries like Germany (+0.61%) would experience slight gains, while others, like France (-0.24%), would see minor losses.

Overall, this scenario of global alliance fragmentation highlights a key contrast. Isolationist or bloc-oriented strategies of hegemonic powers are either ineffective when initial alliance connections are few, as for China, or very costly for both the hegemon and its close partners when integration is deep, as for the United States. Furthermore, it confirms security cooperation as the best option for economic welfare and Europe's dense alliance network as a capable buffer to absorb or overcome strong external pressures.

9. Conclusion

This paper provides a systematic analysis of the military alliances' economic impact. We develop a quantitative model of international insecurity and trade, demonstrating how alliances enhance bilateral trade by mitigating insecurity risks between country pairs. Taking a structural gravity approach, we provide empirical evidence of military alliances' strong positive causal effects on bilateral trade. Namely, our baseline specification shows that the enforcement of a military alliance engenders an increase of 60%. We perform numerous sensitivity tests and show that results are robust to a variety of alternative specifications. However, this average effect is highly heterogeneous across country pairs, depending on the nature of the treaties and the economic size of partners. Furthermore, an instrumental variable approach and a DATT approach confirm the causal interpretation of our results. We confirm the validity and prevalence of the insecurity mechanism: military alliances increase trade by reducing bilateral insecurity. Finally, based on our theoretical framework, we perform a general equilibrium analysis to quantify the welfare effect of alliances. Building a counterfactual for 2012, we show that intensive involvement in the signature of military alliances brings significant trade related welfare gains while being neutral induces marked losses. We then analyze different scenarios to demonstrate that reshaping the military alliance network in response to global geopolitical fragmentation could have considerable welfare ramifications on the concerned economies.

Our findings have important scientific and policy implications. First, they point up the need to consider the specific role of security and international military relations to understand trade and globalization. Second, they show the efficiency of military alliances, particularly defence pacts, at guaranteeing the safety and inter-state cooperation required for economic agents to trade. That opens an interesting research agenda. The important macro-economic effect of alliances calls for a better understanding of the micro-level dynamic. This questions the heterogeneity in the exposure to insecurity among sectors and firms, as well as the capacity of international security cooperation policies to address its complexity. Nonetheless, the unambiguous welfare gains that alliances bring their members should give policymakers strong incentives to promote the signature of such treaties. Although some may fear that they create relations of domination between nations, our findings suggest on the contrary that they strongly rely on international cooperation and bring more favorable welfare gains to small economies.

[91] Note that this counterfactual does not include the recent trade sanctions on Russia (Crozet and Hinz, 2020; Egorov et al., 2025). Including them would mechanically reduce the initial trade dependence of Russia toward European countries and temper the welfare impact of canceling the alliances signed with these countries.

Table 3 – Alliances and bilateral trade, IV

Dependent variable:	Trade
Second stage	(1)
Estimator:	PPML
Instrument variable:	Common out. alliances
Alliance	0.744^a
	(0.035)
RTA	0.192^a
	(0.011)
Exporter x Year FE	yes
Importer x Year FE	yes
Dyadic FE	yes
No. observ.	901,325
First-stage	
Estimator:	OLS
Instrumented variable:	Alliance
Common out. alliances	0.047^a
	(0.003)
RTA	0.029^a
	(0.006)
Exporter x Year FE	yes
Importer x Year FE	yes
Dyadic FE	yes
No. observ.	902,281
KPW F-stat	198
KPW LM-stat	27

Note: OLS, Ordinary Least Squares; FE, Fixed effects. Dependent variable is the trade from country i to country j at time t in millions of current dollars. Standard errors clustered at the exporter and importer levels are in parentheses. Second-stage standard errors are bootstrapped. a, b and c denote significantly different from 0 at the 1%, 5% and 10% level, respectively.

Table 4 – Plausible exogeneity test

Dep. var: trade	*Union of Confidence Interval estimations*		
Instrumented var.	ν	Min	Max
	-0.003	95% CI	95% CI
Alliance		0.354	0.538

Note: UCI based on the IV's ν coefficient from a regression of trade on interest variables and the IV. Standard errors are clustered at the origin and destination levels.

Table 5 – The bilateral insecurity reduction

Second stage	(1)	(2)
Estimator:	PPML	
Dependent variable:	Trade	
Bilateral insecurity	-0.382[a]	-0.439[a]
	(0.070)	(0.090)
Weak alliance	-0.094	-0.166
	(0.152)	(0.144)
RTA	0.052[b]	0.054[b]
	(0.025)	(0.025)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	550,686	550,192
First-stage		
Estimator:	OLS	
Dependent variable:	Bilateral insecurity	
Defence pact	-1.000[a]	
	(0.100)	
Common out. def. pacts		-0.047[a]
		(0.006)
Weak alliances	-0.467[a]	-0.307[c]
	(0.174)	(0.170)
RTA	-0.205[a]	-0.223[a]
	(0.035)	(0.035)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	552,033	551,539

Note: OLS, Ordinary Least Square; PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects. The panel starts in 1989. Common defence pacts sum all external partners for which country i and j both have a defence pact. Robust standard errors clustered at country-pair level are in parentheses. Second-stage standard errors are bootstrapped. a, b and c denote significantly different from 0 at the 1%, 5% and 10% level, respectively

Table 6 – GE trade and welfare gains from alliances (2012)

Country	Trade	Real revenues	Country	Trade	Real revenues	Country	Trade	Real revenues
AFG	47.62	7.20	AGO	-1.54	0.31	ALB	65.54	7.15
ARE	2.40	1.04	ARG	26.20	1.71	ARM	27.09	2.74
AUS	2.85	1.35	AUT	-0.59	-2.23	AZE	9.29	1.21
BDI	14.61	3.11	BEN	4.93	1.08	BFA	9.15	2.27
BGD	-0.12	0.55	BGR	44.91	6.75	BHR	11.75	2.19
BIH	5.17	-0.14	BLR	52.66	5.25	BLZ	16.89	8.53
BOL	38.18	3.15	BRA	17.48	0.86	BRB	21.83	9.16
BRN	-0.63	0.44	BWA	-0.69	-0.06	CAF	3.45	1.37
CAN	37.02	8.70	CHE	-1.02	-1.59	CHL	17.15	4.09
CHN	2.07	0.90	CIV	5.83	1.45	CMR	0.55	-0.10
COG	2.04	2.40	COL	37.83	1.59	CPV	-2.13	-0.61
CUB	-3.22	-0.44	CZE	32.56	6.80	DEU	23.45	4.49
DNK	22.28	8.08	DOM	64.65	6.66	DZA	-0.12	-0.08
ECU	30.61	3.43	EGY	-2.06	0.09	ERI	1.41	-0.12
ESP	34.55	3.15	EST	13.11	9.30	ETH	-1.38	0.43
FIN	3.31	0.26	FJI	-2.06	0.07	FRA	32.93	5.22
GAB	4.45	2.26	GBR	32.82	5.22	GEO	17.51	3.30
GHA	4.00	1.30	GMB	3.33	1.14	GRC	42.96	4.03
GTM	53.88	6.14	HRV	48.13	7.47	HTI	57.08	3.52
HUN	27.80	8.12	IDN	-1.01	0.48	IND	-1.64	0.59
IRN	4.89	0.06	IRQ	2.81	1.15	ISL	30.00	7.97
ISR	-1.44	-0.78	ITA	27.12	3.15	JAM	42.50	7.86
JOR	21.77	3.54	JPN	6.40	0.89	KAZ	19.71	4.09
KEN	7.94	-0.05	KGZ	86.39	9.05	KHM	-0.33	-0.14
KOR	4.12	1.20	KWT	1.06	0.80	LAO	-0.75	0.81
LBN	23.69	1.51	LBR	2.79	1.21	LBY	1.93	-0.31
LCA	19.15	8.69	LKA	-1.16	-0.11	LSO	-0.84	-0.40
LTU	26.71	7.85	LVA	19.74	13.38	MAR	3.47	0.49
MDA	27.87	5.97	MDG	-1.32	0.11	MDV	-0.56	0.46
MEX	34.66	5.86	MKD	-2.43	-1.54	MMR	-0.83	0.90
MNG	5.83	2.91	MOZ	-0.60	0.18	MUS	-1.86	-1.07
MWI	-0.61	0.36	MYS	-1.20	-0.04	NAM	-0.71	0.17
NER	9.34	1.91	NGA	0.57	0.34	NIC	33.68	6.15
NOR	25.84	3.56	NPL	-1.46	0.70	NZL	-1.59	0.29
OMN	4.16	2.61	PAK	16.59	1.62	PER	24.75	2.42
PHL	5.27	1.84	PNG	-1.24	0.42	POL	50.93	3.91
PRT	41.59	5.86	PRY	47.52	4.71	QAT	1.11	0.85
ROU	37.97	4.47	RUS	21.82	1.57	RWA	19.68	4.32
SAU	0.86	0.55	SEN	6.08	1.16	SLV	60.16	7.49
SOM	48.83	2.31	SVK	23.74	11.38	SVN	27.62	11.85
SWE	-1.18	-1.86	SWZ	24.12	7.98	SYR	20.08	0.48
THA	-1.34	0.24	TJK	39.14	6.57	TON	-0.51	0.69
TTO	18.24	8.04	TUN	2.35	-0.34	TUR	38.51	3.08
TZA	4.49	0.73	UGA	18.65	2.54	UKR	25.21	3.76
URY	30.80	3.95	USA	51.17	3.04	UZB	44.46	3.71
VEN	30.37	1.13	VNM	-0.55	0.40	YEM	7.67	2.72
ZAF	-1.39	0.09	ZMB	0.00	0.66	ZWE	-0.83	0.21

Note: The real revenue is our measure of welfare. All numbers are percentage variations. Country code is ISO3.

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Appendix

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Appendix

11. Military alliance treaties

A. Overview

Military alliances are international treaties designed to develop international security cooperation policies. As defined by Gibler (2008) military alliances can be divided into four categories depending on the degree of restriction and involvement of signatories. First, the *military entente* implies a diplomatic exchange of information among members before taking any military decision. Second, the *neutrality pact* specifies that signatories must stay neutral in the event of a conflict involving one party to the pact. Third, the *non-aggression pact* states that signatories cannot declare war or engage in military action against treaty members. Fourth, the *defence pact* is where signatories agree on collective but centralised military management. It does not deny members' sovereignty, but enforces strong security cooperation in areas that matter to the signatory countries. Therefore, defence pacts reach a highly specific level of cooperation. While the first three categories of alliance mainly describe different international policies to keep peace between members, the defence pacts imply military cooperation to protect signatories from any common threats.

B. Defence pacts examples

The most famous defence pact is the *North Atlantic Treaty* (NATO). Signed on the fourth of April 1949 and still in force, it concerns most North American and Western European countries and was later expanded to a number of Eastern European nations. Created to ensure protection against the USSR and its satellites, it implies strong and centralised military cooperation. It was also designed with important economic and institutional objectives in mind such as economic collaboration, free institutions and stable well-being.[92] Yet, to pursue these objectives, the treaty specifies only military cooperation policies. Moreover, the ninth article includes the creation of a central council in charge of compliance with the alliance's constraints, organisation and objectives.

The *Treaty on Collective Security* (TCS) was signed by former USSR states in 1992 and is still in force. It was signed in recognition of the inability of the Commonwealth of Independent States to provide the required economic and commercial prosperity among members despite the tariff liberalisation it includes. The TCS aims to achieve members' trade objectives by enabling lasting stability and security throughout the region due to common and centralised management of military matters. It also specifies the creation of a collective security council in charge of defence decisions, armed forces coordination and the application of the treaty's purposes.

The *Joint Defense and Economic Cooperation Treaty* between the States of the Arab League was created in 1951 by Egypt, Lebanon, Saudi Arabia, Syria, Yemen Arab Republic and Iraq, and joined later by a number of Arab states. Even though the treaty has encountered problems due to internal tensions over members' relations with Israel, it is still in force and was reinvigorated following the USA intervention in Iraq. Once again, it concerns close military cooperation and the creation of a centralised council. It also contains explicit economic

[92] "Article 2. The Parties will contribute toward the further development of peaceful and friendly international relations by strengthening their free institutions, bringing about a better understanding of the principles upon which these institutions are founded, and promoting conditions of stability and well-being. They will seek to eliminate conflict in their international economic policies and will encourage economic collaboration between any or all of them."

and trade objectives and aims to favour the development and trade of signatory countries.[93] Moreover, to assist the first council, a second council in charge of economic issues was created. Yet, this council cannot propose or enforce standard trade liberalisation policies such as tariff reductions.

The *Defense Pact of the African and Malagasy Union* was signed in 1961 by twelve French-speaking sub-Saharan countries to protect themselves from both internal and external interference. Nonetheless, the pact did not last long since it was terminated in 1964. The core of the treaty was the enforcement of peace and stability in the region and military cooperation by members. Yet, it also introduced a mandatory contribution to the development of free institutions, well-being and economic collaboration. Similarly to the previous example, international security was also considered here as a necessity for economic development. Moreover, the treaty stipulated the creation of a central council to take decisions with a two-thirds majority of pact members regarding the alliance's procedures.

The last example of defence pact is the *Treaty Instituting the Arab-Maghreb Union*. It was signed in 1989 by North African and Arab countries and is still in effect today. The agreement covers common management of defence and stability matters, the creation of a presidential council to centralise decisions and a judicial body to ensure the legal enforcement of decisions. A striking point in our case is the explicit objective of trade liberalisation and free movement of persons, services, capital and goods.[94] The treaty's third article also includes a clear objective of common economic and industrial development for members.

C. Weaker alliances examples

A first example is the neutrality pact between Chile and Argentina called the *Treaty of Peace and Friendship between Chile and Argentina*. It was driven by increasing border disputes between the two states since 1970 and negotiations to settle them. It was finally signed in 1984 and is still in force today. It lays down military and economic objectives, especially maritime goals, and the establishment of a commission. Yet, contrary to a defence pact, it does not imply close cooperation between states but merely a frame to avoid armed conflicts and agree on each state's sovereignty.

The *Treaty of Peace, Friendship and Cooperation between India and the Soviet Union*, coded as a non-aggression pact, was signed in 1971 and was in effect until 1991. The treaty provides for respect for members' sovereignty and borders and an absence of interference in any domestic affairs. Moreover, it expresses the importance of economic cooperation and trade. Yet, it provides for no supra-national institution to be created. The agreement provides for a guarantee from participants, but neither centralised military cooperation nor the ambitions of a defence pact.

The *treaty of Friendship and Co-operation between France and Russia*, an entente pact, was signed by Francois Mitterrand and Boris Yeltsin in 1992. It is still in force today without any objection having ever been raised by either state. The main goal of the agreement is to ensure immediate consultation between signatories in the event of security issues or important diplomatic decisions. It also stipulates institutional and economic objectives such

[93]"Article 7. In order to fulfil the aims of this Treaty and to bring about security and prosperity in Arab countries and in an effort to raise the standard of life therein, the contracting States undertake to collaborate for the development of their economic conditions, the exploitation of their natural resources, the exchange of their respective agricultural and industrial products, and generally to organise and coordinate their economic activities and to conclude the necessary inter-Arab agreements to realise such aims."

[94]"Article Two. The Union aims at:(...) - Working gradually towards achieving free movement of persons and transfer of services, goods and capital among them."

as the development of the manufacturing sectors, the promotion of democratic institutions and the facilitation of the movement of capital, persons and goods. Yet, there is no further military cooperation, no guarantee of peace, and no supra-national institution to ensure the application of the treaty.

12. Theoretical model

A. Deriving endogenous insecurity

In this appendix section, we detail the derivation of the endogenous insecurity from the framework presented in section 2.1.

Intensive margin I_{ij} (equation 4).

From equations (1), (2) and (3) we have the condition:

$$\frac{\partial R^{v}_{ij,g}\mu_{ij}}{\partial L_{ij,g}} = \frac{\partial X_{ij} v_{ij,g} \overline{V}_{ij}^{-1} \mu_{ij}}{\partial v_{ij,g}} \frac{\partial v_{ij,g}}{\partial L_{ij,g}} = c_{ij,g} \tag{25}$$

Therefore, the level of $L_{ij,g}$ that respect this condition – i.e., the maximum level of $L_{ij,g}$ the armed group can reach – is defined by

$$L_{ij,g} = \left(\frac{X_{ij}\psi_{ij,g}\mu_{ij} r}{c_{ij,g}\overline{V}_{ij}}\right)^{\frac{1}{1-r}} \tag{26}$$

Knowing that $I_{ij} = V_{ij}/\overline{V}_{ij}$, with $V_{ij} = \sum_g v_{ij,g}$ $\overline{V} = X_{ij}$, the intensive margin can been written as

$$I_{ij} = \frac{\sum_g \psi_{ij,g} L^{r}_{ij,g}}{s_{ij} X_{ij}} = \left(\frac{X_{ij}^{r-1}\mu_{ij}^{r} r^{r}}{s_{ij}}\right)^{\frac{1}{1-r}} \sum_g \left(\frac{\psi_{ij,g}^{\frac{1}{r}}}{c_{ij,g}}\right)^{\frac{r}{1-r}} \tag{27}$$

Finally, as $c_{ij} = \left(\frac{w_i}{\nu_o r}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d r}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k r}\right)^{\nu_k r} \frac{s_{ij}}{\psi_{ij,g}}$, and denoting $\Psi_{ij} = \sum_g \psi_{ij,g}$ we find equation (4) :

$$I_{ij} = s_{ij}^{-\frac{1+r}{1-r}} \Psi^{\frac{1+r}{1-r}} \left[\frac{X_{ij}^{\frac{r-1}{r}} \mu_{ij} r}{\left(\frac{w_i}{\nu_o r}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d r}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k r}\right)^{\nu_k r}}\right]^{\frac{r}{1-r}} \tag{28}$$

Extensive margin E_{ij} (equation 6). Formally, E_{ij} is the probability that armed groups generate a total level of violence that overcomes the country-pairs violence threshold $\underline{V}_{ij}$ such as:

$$E_{ij} = P(V_{ij} > \underline{V}_{ij}) \tag{29}$$

or, knowing that $V_{ij} = I_{ij}\overline{V}_{ij}$ and the expression I_{ij} at the equilibrium (eq. 4), we can write :

$$E_{ij} = P\left[\left(\frac{\Psi_{ij}}{s_{ij}}\right)^{\frac{1+r}{1-r}} \left[\frac{\mu_{ij} r}{\left(\frac{w_i}{\nu_o r}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d r}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k r}\right)^{\nu_k r}}\right]^{\frac{r}{1-r}} > \underline{V}_{ij}\right] \tag{30}$$

The stochastic parameter is μ_{ij}. E_{ij} is therefore the probability the armed group draw a motivation parameter μ ensures a sufficiently high level of violence, or formally :

$$E_{ij} = P\left[\mu_{ij} > \left(\frac{s_{ij}}{\Psi_{ij}}\right)^{\frac{1+r}{r}} \underline{V}_{ij}^{\frac{1-r}{r}} \frac{\left(\frac{w_i}{\nu_o r}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d r}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k r}\right)^{\nu_k r}}{r}\right] \tag{31}$$

Assuming that μ follows a Pareto distribution $(\underline{\mu}/\mu)^{\delta}$, we can give an exact expression to this probability and find equation (6) :

$$E_{ij} = s_{ij}^{-\delta\frac{(1+r)}{r}} \Psi_{ij}^{\delta\frac{(1+r)}{r}} \underline{V}_{ij}^{-\delta\frac{1-r}{r}} \left[\frac{\left(\frac{w_i}{\nu_o r}\right)^{\nu_o r} \left(\frac{w_j}{\nu_d r}\right)^{\nu_d r} \left(\frac{w_k}{\nu_k r}\right)^{\nu_k r}}{r} \right]^{-\delta} \tag{32}$$

B. Trade model

We start with a constant elasticity of substitution utility function. Consumers in each country maximise their utility by consuming $q(\omega)$ units of each differentiated good ω, noted by the following function:

$$U = [\int_{\Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega]^{\frac{\sigma}{\sigma-1}} \tag{33}$$

where q is the consumed quantity, and σ the elasticity of substitution between two varieties of goods. After maximisation under the revenue constraint, we can define the consumed quantity for a specific variety as:

$$q(\omega) = p(\omega)^{-\sigma} X(\int_{\Omega} p_{\omega'}^{1-\sigma})^{\frac{\sigma-1}{1-\sigma}} \tag{34}$$

and firm ω's revenue:

$$x(\omega) = X_j(\frac{p(\omega)}{P_j})^{1-\sigma} \tag{35}$$

where $x(\omega) = q(\omega)p(\omega)$, X_j the total revenue of country j, and $P_j = \left(\int_{\Omega} p_{\omega''}^{1-\sigma}\right)^{\frac{1}{1-\sigma}}$ the Dixit-Stiglitz price index. Thus, the total consumed value in country j of goods variety ω can be understood as the share of the country's total revenue allocated to the consumption of variety ω. We follow Couttenier et al. (2024a) and assume that trade decisions are made only based on the peaceful economy. For firms and workers, looted goods are therefore considered as a pure loss. Fighters' revenues from looting is not re-injected in the peaceful economy, but used through self-consumption of loot or exchanged between armed groups or fighters on a parallel market.

Next, we consider firm productivity level γ such that marginal cost $\alpha = 1/\gamma$. In keeping with Helpman et al. (2008), we assume that the distribution of firm productivity γ in each country follows a Pareto distribution G with:

$$G_i(\alpha) = (\alpha^{\theta} - \underline{\alpha}^{\theta})/(\overline{\alpha}_i^{\theta} - \underline{\alpha}^{\theta}) = \frac{\alpha^{\theta}}{\overline{\alpha}_i^{\theta}} \tag{36}$$

where θ is the parameter determining the shape of the distribution, $\alpha = \frac{1}{\gamma}$ the firm's marginal cost, $\overline{\alpha}_i$ the maximum marginal cost (or minimum productivity) to produce in country i, and $\underline{\alpha}$ the minimum marginal cost (or maximum productivity). Therefore, naming N the number of firms and considering solely trade from country i to country j we have:

$$x_{ij}(\alpha) = X_j(\frac{p(\alpha)}{(\sum_l N_l \int_0^{\alpha_{lj}^*} p_{lj}(\alpha)^{1-\sigma} dG(\alpha))^{\frac{1}{1-\sigma}}})^{1-\sigma} \tag{37}$$

Firms present monopolistic competition and a CES demand function. Therefore, by introducing insecurity costs – discussed in section 2 – and other sorts of trade costs, we obtain the following price and profit functions for each variety:

$$p_{ij}(\alpha) = \frac{\sigma}{\sigma-1} w_i T_{n,ij} \alpha \tag{38}$$

$$\pi_{ij} = (\frac{x_{ij}(\alpha)}{\sigma}) - F_{n,ij} \quad (39)$$

where $T_{n,ij} = \Pi^n \tau_{n,ij}$ is a product of variable trade costs with n the n potential source of iceberg costs, including $\tau_{s,ij}$ the insecurity cost, but also all variable trade costs sensitive to other parameters (geography, standard trade policies, institutions, etc.)., and $F_{n \neq s,ij}$ a vector of fixed trade costs insensitive to insecurity that firms have to pay to enter country j from i.

Once all trade from i to j have been aggregated, taking into account equations (22) and (23), and setting $\underline{\alpha} = 0$ for solving issues[95], we can define total trade from i to j:

$$X_{ij} = X_j \frac{N_i w_i^{1-\sigma} H_{ij} T_{n,ij}^{1-\sigma}}{\sum_l N_l w_l^{1-\sigma} H_{lj} T_{n,lj}^{1-\sigma}} \quad (40)$$

where H is defined as in Helpman et al. (2008):

$$H_{ij} = \int_0^{\alpha_{ij}^*} \alpha^{1-\sigma} dG(\alpha) \quad (41)$$

α_{ij}^* is by definition the level of productivity for which the profit from exporting, π_{ij}, is zero:

$$\pi_{ij} = (\frac{x_{ij}(\alpha^*)}{\sigma}) - F_{n \neq s,ij} = 0 \quad (42)$$

where:

$$\alpha^* = (\sigma - 1)\sigma^{\frac{\sigma}{\sigma-1}} (\frac{X_j}{P_l' F_{n \neq s,ij}})^{\frac{1}{\sigma-1}} \frac{1}{w_i T_{n,ij}} \quad (43)$$

with index price

$$P_l' = \sum_l N_l \int_0^{\alpha_{lj}^*} p_{lj}(\alpha)^{1-\sigma} dG(\alpha) \quad (44)$$

Once equation (27) is plugged into equation (25), we can develop V. Combined with equation (24), we obtain the following expression for bilateral trade:

$$X_{ij} = X_j \frac{N_i(\overline{\alpha}_i w_i)^{-\theta} T_{n,ij}^{-\theta} F_{n \neq s,ij}^{-[\frac{\theta}{\sigma-1}-1]}}{\sum_l N_l(\overline{\alpha}_l w_l)^{-\theta} T_{n,lj}^{-\theta} F_{n,lj}^{-[\frac{\theta}{\sigma-1}-1]}} \quad (45)$$

Finally, after defining the importer multilateral resistance term:

$$\Phi_j = (\sum_l N_l \overline{\alpha}_l^{-\theta} w_l^{-\theta} T_{n,lj}^{-\theta} F_{n \neq s,ij}^{-[\frac{\theta}{\sigma-1}-1]})^{-\frac{1}{\theta}} \quad (46)$$

we obtain the structural gravity equation:

$$X_{ij} = N_i \overline{\alpha}_i^{-\theta} w_i^{-\theta} \frac{X_j}{\Phi_j^{-\theta}} T_{n,ij}^{-\theta} F_{n \neq s,ij}^{-[\frac{\theta}{\sigma-1}-1]} \quad (47)$$

Or outlying insecurity costs from trade cost aggregates:

$$X_{ij} = N_i \overline{\alpha}_i^{-\theta} w_i^{-\theta} \frac{X_j}{\Phi_j^{-\theta}} \tau_{s,ij}^{-\theta} T_{n \neq s,ij}^{-\theta} F_{n \neq s,ij}^{-[\frac{\theta}{\sigma-1}-1]} \quad (48)$$

with $T_{n \neq s,ij}$ is the variable trade costs sets excluding insecurity costs $\tau_{s,ij}$.

95 This implies that we assume that there is always a firm that is productive enough to export at least a small amount.

C. Extension with fixed insecurity costs.

C.1. A fixed cost applied to arms groups

In our theoretical framework, military alliances affect trade by reducing the insecurity cost $\tau_{s,ij}$ through a specific security parameter s_{ij}, which from the perspective on an arm groups behaves as a variable cost imposed on violent actions. However, an alternative mechanism would be to increase the fixed violence threshold $\underline{V}_{ij}$, leading to a decrease of the country-pair's probability to face expropriation issues. Thus, the alliance elasticity would be define by :

$$\varepsilon_{All.}(X_{ij}) = \theta \star \frac{E_{ij}I_{ij}}{1 - E_{ij}I_{ij}} \star \left[\delta \frac{1-r}{r} \frac{\partial ln(\underline{V}_{ij})}{\partial All.}\right] > 0 \tag{49}$$

In this case, military alliances only affect the extensive margin of insecurity, as $\underline{V}_{ij}$ has no influence on the violence production function. Nevertheless, we demonstrate in section 7.1 that both the intensive and extensive margins of insecurity are impacted by the signing of an alliance. This supports the idea that the military cooperation enforced by these treaties reduces international insecurity through s_{ij}, as outlined in our theoretical framework, rather than through $\underline{V}_{ij}$.

C.2. A fixed cost applied to firms

In the standard model, we assume that insecurity costs are equivalent to an expropriation risk which can be model as a variable trade cost. Yet, insecurity costs may also be related to barriers inducing a fixed cost (controls, procedures and information requirements).[96]

We introduce insecurity barriers in our model. Firms need to address expensive procedures and information requirements to lift these barriers and enter the foreign market. The higher the bilateral insecurity, the higher the barriers and therefore the higher the cost to lift them. This is directly interpretable as a fixed trade cost sensitive to insecurity: to enter the market, firms pay a cost that depends on the degree of bilateral insecurity but does not vary with the exported quantity. So it does not affect the price function, but directly affects profit:

$$\pi_{ij} = \left(\frac{x_{ij}(\alpha)}{\sigma}\right) - F_{n,ij} \tag{50}$$

$x_{ij}(\alpha)$ is the firm's revenue function and $F_{n,ij}$ a vector of fixed trade costs that firms have to pay to enter country j from i, including $f_{s,ij}$, the fixed insecurity cost derived from insecurity barriers, but also all fixed trade costs sensitive to other sources n. If the market entry cost decreases, the firm's profit increases. When firms switch from negative profit to positive profit, they start exporting, which increases the number of varieties sold from i to j.

Therefore, we can derive at aggregated level the following structural gravity equation outlying the insecurity trade costs $\tau_{s,ij}$ and $f_{s,ij}$:

$$X_{ij} = N_i \overline{\alpha}_i^{-\theta} w_i^{-\theta} \frac{X_j}{\Phi_j^{-\theta}} \tau_{s,ij}^{-\theta} f_{s,ij}^{-[\frac{\theta}{\sigma-1}-1]} T_{n\neq s,ij}^{-\theta} F_{n\neq s,ij}^{-[\frac{\theta}{\sigma-1}-1]} \tag{51}$$

X_{ij} is the total trade from country i to country j, N_i, the number of firms in the exporting country, $\overline{\alpha}_i$, the maximum marginal cost of country i's technology, and w_i the wage in country i's economy. X_j is the total revenue of country j, and Φ_j, the importer's multilateral resistance term, while $T_{n\neq s,ij}$ and $F_{n\neq s,ij}$ are respectively the variable and fixed trade costs sets, but excluding the insecurity costs. Again, like other trade costs, insecurity costs ($\tau_{s,ij}$

[96] See Amodio et al. (2021) for an illustration of security barriers imposed on trade in the case of Israel.

and $f_{s,ij}$) have negative elasticities.[97] Hence, by reducing both variable and fixed insecurity costs, the enforcement of a military alliance between countries i and j increases bilateral trade X_{ij}.

D. Extension with bilateral trade elasticities

A way to deal theoretically with the constant trade elasticity issue is to rule out the CES assumption in favour of other utility functions consistent with the idea of sub-convex gravity (Mrázová and Neary, 2017; Mrázová et al., 2021). However, such approach has large cost in tractability and possibilities of application to quantitative general equilibrium analyzes. Therefore, we rely on an alternative approach integrating bilateral elasticities in a general Melitz (2003) model through a supply side mechanism, as detailed in a parallel work (Neri-Lainé, 2025).

As in our standard trade model, we use a standard CES utility function. Therefore, deriving the consumer's utility maximization problem, aggregated trade from country i to country j writes as in equation 40 :

$$X_{ij} = X_j \frac{N_i w_i^{1-\sigma} H_{ij} T_{n,ij}^{1-\sigma}}{\sum_l N_l w_l^{1-\sigma} H_{lj} T_{n,lj}^{1-\sigma}} \tag{52}$$

However, the the extensive margin index introduced by Helpman et al. (2008) is now defined by $H_{ij} = \int_0^{\alpha^*} \alpha^{1-\sigma} dG_{ij}$, where G_{ij} is the (bilateral) distribution of productivity $\zeta = 1/\alpha$ among firms and α^*_{ij} the marginal-cost cutoff such as:

$$\alpha^*_{ij} = (\sigma^{\frac{\sigma}{\sigma-1}}(\sigma-1))(\frac{X_j}{\Phi_j^{1-\sigma}})^{\frac{1}{\sigma-1}} F_{n,ij}^{\frac{1}{1-\sigma}} (w_i T_{n,ij})^{-1} \tag{53}$$

with Φ_j the ideal price index defined by :

$$\Phi_j = (\sum_l N_l (w_l \tau_{lj})^{1-\sigma} H_{lj})^{\frac{1}{1-\sigma}} \tag{54}$$

Formally, we assume that firms located in country i draw a productivity for each destination j based on distribution G_{ij} whose shape $\theta_{ij} = dln(G_{ij})/dln(\alpha)$ is country-pair specific.

This bilateral distortion can be interpreted as a production technology designed to match specific markets. Origin dependency simply introduce differences in countries' technological level (Falvey et al., 2006), while destination dependency implies sub-varieties. Each firm still has a monopoly on its variety. Yet, because of destination market restrictions or preferences, firms must adapt their production process, ending with a sub-variety sold only in its specific destination market. Overall, the global production technology is not uniformed but designed to match the characteristics of specific sub-varieties, considering both the destination requirements but also the origin technological characteristics. In the well documented case of bilateral elasticties negatively correlated with the value of trade (Bergstrand and Clance, 2025; Bergstrand et al., 2025; Carrère et al., 2020; Chen and Novy, 2022), the distortion therefore translates a technology developed to have higher probability of being highly productive on the largest markets.

In this setting, H_{ij} can be expressed as:

$$H_{ij} = \frac{\gamma_{ij} + \sigma - 1}{\gamma_{ij}} (\alpha^*_{ij})^{1-\sigma} G_{ij}(\alpha^*_{ij}) \tag{55}$$

[97] These elasticities depend both on θ, the Pareto shape parameter of the firms' productivity distribution. Yet, fixed trade cost elasticity also depends on σ, the elasticity of substitution. Here, we assume $\theta > \sigma - 1$. Otherwise, fixed trade costs elasticity is positive.

where, $\gamma_{ij} = dln(H_{ij})/dln(\alpha_{ij}*)$ the extensive margin elasticity. For simplicity, we apply this distortion to a standard Pareto distribution, which lead us to the new gravity equation:

$$X_{ij} = \frac{Y_i}{\Pi_i^{1-\sigma}} \frac{X_j}{\Phi_j^{1-\sigma}} \overline{\alpha}_i^{-\theta_{ij}} \frac{\theta_{ij}}{\theta_{ij}+1-\sigma} (\frac{\sigma^{\frac{\sigma}{1-\sigma}}}{\sigma-1})^{-\theta_{ij}+\sigma-1} w_i^{-\theta_{ij}+\sigma-1} (\frac{X_j}{\Phi_j^{1-\sigma}})^{\frac{\theta_{ij}+1-\sigma}{\sigma-1}} T_{n,ij}^{-\theta_{ij}} F_{n,ij}^{-[\frac{\theta_{ij}}{\sigma-1}-1]} \tag{56}$$

E. Interstate conflicts: a diplomatic game of negotiation

In this section, we present a summarized version of the game of diplomatic negotiation from Martin et al. (2008b); Thoenig (2024). In this framework, war and peace are set on a diplomatic agreement under asymmetric information. As long as leaders find an agreement peace is maintain. Otherwise an interstate war arises. At the beginning of the negotiation, the leader of each country $k \in \{ij\}$ announces its utility cost of war from war utilities in peace and war:

$$\widetilde{UCW}_k = lnC_k(peace) - lnC_k(war) + v_k - \tilde{u}_k \tag{57}$$

where C is the real consumption determined by the trade equilibrium below, v the exogenous geopolitical attractiveness of peace (or war) and $\tilde{u}_k$ a random variable which uncertainty about military capacity and immaterial cost of war. $\tilde{u}_k$ is only observed by the declaring leader, leading to asymmetric information an uncertainty. We follow (Thoenig, 2024) by assuming that $\tilde{u}_i$ and $\tilde{u}_j$ are jointly uniformly distributed over a triangle in R^2 with a shape that implies a negative correlation between the two variables. The domain of variation of $\tilde{u}_k$ is therefore $[0; 3\eta/4]$ where η is a positive parameter measuring the extent of informational asymmetry.

As long as the $\widetilde{UCW}_i + \widetilde{UCW}_j > 0$, announcements are compatible and the negotiation can result to a utility transfer in order to maintain peace. However, under asymmetric information, leaders mechanically have incentives to under-declare their utility cost of war, at the risk of violating the compatibility condition and starting a war. In this setting, we can therefore denote the probability of successful negotiation

$$s_{ij} = \begin{cases} \frac{1}{\eta^2} \times \left[OCW_i + OCW_j + v_i + v_j\right]^2 & \text{for } OCW_i + OCW_j + v_i + v_j < \eta \\ 1 & \text{for } OCW_i + OCW_j + v_i + v_j \geq \eta. \end{cases} \tag{58}$$

with $OCW_i = lnC_k(peace) - lnC_k(war)$ the opportunity cost of war. In case of failure, an interstate conflict occurs which induces a probability I_{ij}^w of products to be destroyed or expropriated when traded between belligerents.[98] Following Thoenig (2024) approximation procedure, we can express s_{ij} such as:

$$s_{ij} = \begin{cases} \frac{1}{\eta^2} \times \left[\frac{1}{1-I_{ij}^w}(\pi_{ij} + \pi_{ji}) + v_i + v_j\right]^2 & \text{for } \frac{1}{1-I_{ij}^w}(\pi_{ij} + \pi_{ji}) + v_i + v_j < \eta \\ 1 & \text{for } \frac{1}{1-I_{ij}^w}(\pi_{ij} + \pi_{ji}) + v_i + v_j \geq \eta. \end{cases} \tag{59}$$

[98] Thoenig (2024) also include a loss in productivity. For simplification, we assume that modern interstate conflict have too low intensity to induce direct damages on the productive structure. Indeed, in our data, detailed in section 3, only 0.05% of the yearly observations of interstate conflicts are open wars, while the large majority is simple display of force without effective aggression. We further discuss and test this channel in the appendix section 13 and show that alliances do not affect trade through changes in exporter's marginal cost. Additionally, the risk of interstate war with third countries, and its reduction, may also induce a supplementary bilateral trade cost capturing the trade disruption between i and j induced by a conflict with country $k \neq \{i, j\}$. We also exclude this element from the model for simplification reasons and show in section 5 that it does not empirically applies to military alliances whose focus is purely bilateral.

and the insecurity cost from the risk of interstate conflict:

$$\tau_{ij}^{w} = \begin{cases} 1 + \left(1 - \frac{1}{\eta^2} \times \left[\frac{1}{1-I_{ij}^{w}}(\pi_{ij} + \pi_{ji}) + v_i + v_j\right]^2\right)\left(\frac{1}{1-I_{ij}^{w}} - 1\right) & \text{for } \frac{1}{1-I_{ij}^{w}}(\pi_{ij} + \pi_{ji}) + v_i + v_j < \eta \\ 1 & \text{for } \frac{1}{1-I_{ij}^{w}}(\pi_{ij} + \pi_{ji}) + v_i + v_j \geq \eta. \end{cases} \tag{60}$$

Military alliances, by facilitating information sharing and trust between would improve diplomatic negotiations in this model by lowering the level of uncertainty η. However, empirically we do not find any evidence of such a mechanism, which suggests that (i) those treaties are not sufficiently constraining to really affect negotiations, (ii) the cost of war is already to high compared to the level of uncertainty which makes the peaceful outcome certain.

13. Multilateral insecurity

In section 7, we showed that alliances strongly increase trade by reducing bilateral insecurity. Yet, we may expect alliances to also induce multilateral changes in insecurity. In keeping with (Martin et al., 2008b), we can define multilateral insecurity as a exporter-specific marginal cost $\tau_{s,i}$ leading to the price function:

$$p_{ij}(\alpha) = \frac{\sigma}{\sigma - 1} w_i \tau_{s,i} \tau_{s,ij} T_{n \neq s,ij} \alpha \tag{61}$$

and, deriving our model,[99] to the gravity equation:

$$X_{ij} = N_i \overline{\alpha}_i^{-\theta} w_i^{-\theta} \tau_{s,i}^{-\theta} \frac{X_j}{\Phi_j^{-\theta}} \tau_{s,ij}^{-\theta} T_{n \neq s,ij}^{-\theta} F_{n \neq s,ij}^{-[\frac{\theta}{\sigma-1} - 1]} \tag{62}$$

In this framework, alliances could increase bilateral trade X_{ij} by reducing the bilateral insecurity cost $\tau_{s,ij}$ and the multilateral one $\tau_{s,i}$. In our baseline estimation, any change in $\tau_{s,i}$ are captured by the exporter-time fixed effects. Alliances are therefore restricted to affect trade only through bilateral insecurity. Then, in the General Equilibrium approach, we implement a bilateral insecurity shock resulting from alliances, and, under several assumptions,[100] allow multilateral insecurity to adjust. These methods consider the existence of multilateral insecurity, but do not permit to observe whether they are affected by alliances.

To address this issue, we estimate below the alliances' effect on trade allowing for changes in both bilateral and multilateral insecurity. In order to allow for a change in multilateral insecurity, we cannot include exporter-time fixed effects.[101] However, this may cause omitted variable bias, since changes in the exporter output or price-index may influence the exporter's willingness to sign alliances. Therefore, we use the instrumental variable detailed in section 5. As the first stage is linear (OLS) while the second stage is not (PPML), we follow (Lin and Wooldridge, 2019) and use a control function approach. We present the results in table .7. First-stage coefficients are not affected by the absence of exporter-time fixed effect.[102] Furthermore, using the *plausible exogeneity test* proposed by Conley et al. (2012), we confirm that the IV still sufficiently respect the exclusion restriction (see table .8). Finally, in the second stage, alliances' coefficient is very weakly affected, while capturing a reduction

[99] see the appendix section 12 for details)

[100] Mainly, we do not need to disentangle multilateral insecurity from other marginal costs, but must assume that multilateral insecurity changes are ether redistributed in revenues or compensated by a proportional change in wage.

[101] Changes in bilateral insecurity can also affect the exporter price index. Removing the exporter-time fixed effects we also allow alliances to affect trade through this channel.

[102] See table .20 for comparison.

in multilateral insecurity should have increased the estimated elasticity. This supports that alliances' impact is purely bilateral.

Table .7 – Allowing for bilateral and multilateral insecurity changes

Dependent variable:	trade	trade
Second stage		
Estimator:	PPML	
Alliance	0.667^a	
	(0.040)	
RTA	0.149^a	
	(0.012)	
First stage residuals	-0.157^a	
	(0.059)	
Exporter x Year FE	no	
Importer x Year FE	yes	
Dyadic FE	yes	
No. observ.	901,338	
First-stage		
Estimator:	OLS	
Dependent variable:	Alliance	
Common out. alliances	0.046^a	
	(0.003)	
RTA	0.028^a	
	(0.006)	
Exporter x Year FE	no	
Importer x Year FE	yes	
Dyadic FE	yes	
No. observ.	902,286	
KPW F-stat	192	
KPW LM-stat	24	

Note: OLS, Ordinary Least Squares; PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects. Dependent variable is trade from country i to country j at time t in millions of current dollars. Standard errors clustered at the exporter and importer levels are in parentheses. Second-stage standard errors are bootstrapped. a, b and c denote significantly different from 0 at the 1%, 5% and 10% level, respectively.

Table .8 – Plausible exogeneity test, multilateral insecurity

Dep var: trade	*Union of Confidence Interval estimations*		
Instrumented var.	ν -0.021	Min 95% CI	Max 95% CI
Alliance		0.402	0.988

Note: UCI based on the IV's ν coefficient from a regression of trade on interest variables and the IV. We use importer-time and exporter-importer fixed effects. Exporter-time are not included to allow for changes in multilateral insecurity.

14. Two-way (robust) fixed effects estimations

As pointed up by De Chaisemartin and d'Haultfoeuille (2020), heterogeneous treatments or treatment effects over time and groups may return false results in the case of two-way fixed effects estimations. Comparing groups (here country-pairs) that are not treated at the same time or that experience different outcomes following the treatment could cause negative weights in the (bias) ATE. The estimator developed by De Chaisemartin and d'Haultfoeuille (2020) is sufficient to deal with this bias. But, because we want to address the effect's dynamic, we use the later estimator developed by De Chaisemartin and d'Haultfoeuille (2024), which provides event study results.

The intuition behind this estimation is that avoiding these negative weights entails a comparison of the first-time switchers' t-1 to t+l outcome evolution with the t-1 to t+l outcome evolution of country-pairs whose treatment has hitherto remained stable; with t the treatment time and l the event time. Our panel is balanced, so we estimate the treatment effect from positive switchers (i.e. alliance signatures):

$$\delta_l = \frac{DID_{+,l}}{DID^D_{+,l}} \tag{63}$$

where:

$$\begin{aligned} DID_{+,l} = & \sum_{g:D_{g,1}=0,t_g<T_u-l} \frac{N_{g,t_g+l}\beta^{t_g+l}}{N^1_l} \quad * \\ & \left[(Y_{g,t_g+l} - Y_{g,t_g-1}) - \sum_{g:D_{g',1}=0,t_{g'}t_{g'}>t_g+l} \frac{N_{g',t+l}}{N^u_{t_g+l}} (Y_{g',t_g+l} - Y_{g',t_g-1}) \right] \end{aligned} \tag{64}$$

and

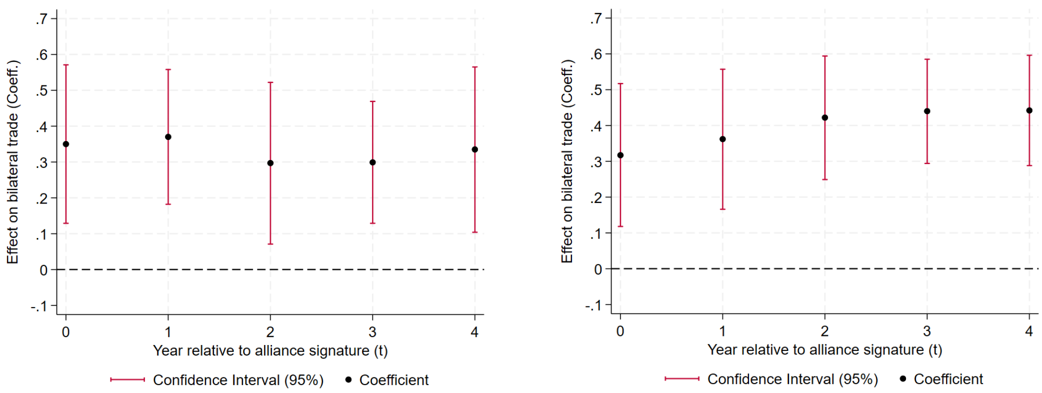
$$\begin{aligned} DID^D_{+,l} = & \sum_{g:D_{g,1}=0,t_g<T_u-l} \frac{N_{g,t_g+l}\beta^{t_g+l}}{N^1_l} \quad * \\ & \left[(D_{g,t_g+l} - D_{g,t_g-1}) - \sum_{g:D_{g',1}=0,t_{g'}t_{g'}>t_g+l} \frac{N_{g',t+l}}{N^u_{t_g+l}} (D_{g',t_g+l} - D_{g',t_g-1}) \right] \end{aligned} \tag{65}$$

with t_g the time of group g's treatment variation, $\beta \in (0,1]$ the planner's discount rate, D the treatment variation, T_u the last observed period with a group untreated since period 1, $N^1_l = \sum_{g:D_{g,1}=0,t_g<T_u-l} N_{g,t_g+l}\beta^{t_g+l}$ the discounted number of units in groups reaching l periods after their first treatment or before T_u, and Y the outcome – in our case trade. Yet, since ALL_{ijt} is a dummy variable, $DID^D_{+,l} = 1$. Therefore, we have:

$$\delta_l = DID_{+,l} \tag{66}$$

However, De Chaisemartin and d'Haultfoeuille (2024) estimator is linear which in a gravity setting may bias results (Silva and Tenreyro, 2006). Therefore, we perform an alternative two-way (robust) fixed effects approach developed by Nagengast and Yotov (2025); Wooldridge (2023) which allows for ppml estimator. The intuition is similar. By interacting each cohort with the post-treatment periods, it directly addresses the negative weights issue that may results from heterogeneous effects. Furthermore, as in our structural gravity baseline, this estimator allows for exporter-year and importer-year fixed effects. Yet, this intensive use of interaction variables imposes computations issues with large data-sets or large number of cohorts. To address this issue, we perform the two-way (robust) fixed effects ppml estimation on two different sub-samples : (i) a pos-Cold-War sample (i.e. after 1989) which represents the core period of our analysis, and (ii) a sub-set of countries with high quality trade data over the whole baseline period.[103] The results, displayed on graph .7 show a strong persistent effect and confirm the robustness of our identification strategy. Furthermore, we replicate these estimation with the more flexible De Chaisemartin and d'Haultfoeuille (2024) linear estimator in table .9. The results are similar to the ppml estimation and support our conclusions. Extending the estimation to the whole sample in this linear setting, we observe a decrease in coefficients' size. This decrease is mainly driven by the alliances signed in the 60s by South-American countries in reaction to local wars and geopolitical tensions. Combined with the structure of the estimator which ignores long term effects, it is particularly vulnerable to such short-term omitted variable and selection issues. Therefore, we carefully address these endogeneity bias in sections 5 and 6 with an instrumental variable strategy and a DATT estimation Couch and Placzek (2010).

Figure .7 – Two-way robust fixed effects estimation, PPML



(a) Post-Cold-War sample **(b) Countries sub-sample**

Note: Figures plots results of the two-way robust fixed effects estimation with PPML estimator and 95% confidence intervals. Dependant variable is bilateral trade. Exporter-year and importer-year fixed effects are included. Standard errors are clustered at the country-pair level. The Post-Cold-War sample excludes year before 1989. The Countries sub-sample conserve a sub-set of countries with high quality trade data based on the CHELEM selection.

15. The Cold War

How to define the Cold War and to what extent it can affect our estimation is not obvious. If we consider that the Cold War is a period structuring global country relationships, it is a time-level variable and is captured by our country-year fixed effects. If we define the Cold

[103] The sub-sample of countries is made follows the selection of CHELEM. Formally they are : Albania, Argentina, Australia, Austria, Belgium, Bangladesh, Bulgaria, Bosnia and Herzegovina, Belarus, Bolivia, Brazil, Bahrain, Canada, Switzerland, Chile, China, Ivory Coast, Cameroon, Colombia, Cyprus, Czech Republic, Germany, Denmark, Algeria, Ecuador, Egypt, Spain, Estonia, Finland, France, Gabon, United Kingdom, Greece, Croatia, Hungary, Indonesia, India, Ireland, Iceland, Israel, Italy, Japan, Kazakhstan, Kenya, Kyrgyzstan, South Korea, Libya, Sri Lanka, Lithuania, Luxembourg, Latvia, Morocco, Mexico, North Macedonia, Malta, Malaysia, Nigeria, Netherlands, Norway, New Zealand, Pakistan, Peru, Philippines, Poland, Portugal, Paraguay, Romania, Russia, Saudi Arabia, Singapore, Serbia, Slovakia, Slovenia, Sweden, Thailand, Tunisia, Turkey, Taiwan, Ukraine, Uruguay, United States, Venezuela, Vietnam.

Table .9 – Military alliances: Chaisemartin D'Haultfoeuille (2024) estimator

Dependent variable: Bilateral trade						
Post-Cold-War sample	t	t+1	t+2	t+3	t+4	t+5
Alliance's coeff	0.177[a]	0.295[a]	0.379[a]	0.393[a]	0.435[a]	0.493[a]
Standard error	(0.050)	(0.035)	(0.060)	(0.060)	(0.061)	(0.064)
RTA control	yes	yes	yes	yes	yes	yes
No. observ.	244,253	243,274	243,535	244,021	244,525	245,025
No. switchers	402	399	386	384	379	386
Countries sub-sample	t	t+1	t+2	t+3	t+4	t+5
Alliance's coeff	0.445[a]	0.599[a]	0.632[a]	0.730[a]	0.813[a]	0.797[a]
Standard error	(0.092)	(0.092)	(0.098)	(0.094)	(0.093)	(0.097)
RTA control	yes	yes	yes	yes	yes	yes
No. observ.	104,448	104,348	104,261	98,051	91,950	85,944
No. switchers	198	198	198	196	192	190
Full-sample	t	t+1	t+2	t+3	t+4	t+5
Alliance's coeff	0.055[b]	0.105[a]	0.157[a]	0.192[a]	0.189[a]	0.235[a]
Standard error	(0.026)	(0.030)	(0.035)	(0.028)	(0.040)	(0.041)
RTA control	yes	yes	yes	yes	yes	yes
No. observ.	474,880	448,682	447,655	435,871	424,684	425,058
No. switchers	984	949	862	767	738	760

Note: Dependent variable is the inverse hyperbolic sine transformation of trade from country i to country j at time t in millions of current dollars. t is the year of the pair's alliance signature. Standard errors clustered at country-pair level are in parentheses. a, b and c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

War as a period when countries were either capitalist or communist, it comes under the country-year level and once again is captured by our fixed effects. However, as shown in equation 10, the effect of signing an alliance on trade theoretically depends on the initial level of insecurity. Considering the Cold War as a latent conflict between the Western bloc and the Eastern bloc, initial military cooperation should be lower and insecurity higher, as well as the alliance elasticity between countries that are members of different blocs, compared to those within the same bloc.[104] Therefore, we include in our estimation a dummy variables taking the value one if country i is a member of one bloc (i.e. allied with US or USSR) and country j a member of the opposite bloc, and zero otherwise.[105]

In this case, we deal with highly specific heterogeneity in alliance effects. The Cold War variable is a particular case of a non-alliance relationship between countries i and j. In section 4.3.1, the defence pact coefficient is estimated compared with the average case of non-alliances. Yet, introducing the Cold War variable would exclude a case of "latent-conflict-non-alliance" from this average. Therefore, the non-alliance average would be closer to a neutral relationship. This could induce overestimated coefficients. The DATT estimation should address this issue. Using propensity score matching, the treated and control groups should be comparable in terms of bilateral diplomatic relationships. Controlling for the $Cold.war_{ijt}$ dummy, we estimate the defence pacts effect as in section 4.2 and with a DATT. The results are reported in table .22. In the standard estimation (column 1), controlling for the Cold

[104] We could also reason in terms of inter-state war risk. We discuss this theoretically in the appendix section E. However, we show empirically in section 7 that alliances do not impact trade by lowering the risk of interstate war.

[105] Formally, we compute : $Cold.War_{ijt} = \mathbb{1}_{(alliance_{i,USA,t}*alliance_{USSR,j,t})+(alliance_{i,USSR,t}*alliance_{USA,j,t})>0} * \mathbb{1}_{alliance_{i,USA,t}\neq alliance_{i,USSR,t}} * \mathbb{1}_{alliance_{USA,j,t}\neq alliance_{USSR,j,t}}$.

War reduces the defence pact coefficient. In the DATT estimation (column 2), variables of interest coefficients are not impacted while the Cold War's coefficient is non-significant. In both estimations, the defence pact effect on bilateral trade is estimated at 80% and is highly significant.[106]

Table .10 – Defence pacts and the Cold War

Estimator: PPML Dependent variable: Trade Variables	Standard three-way FE	DATT
Defence pact	0.646^a	
	(0.075)	
t-4		0.104
		(0.240)
t-3		0.181
		(0.207)
t-2		0.083
		(0.308)
t-1		0.184
		(0.158)
t		0.087
		(0.164)
t+1		0.648^a
		(0.130)
t+2		0.662^a
		(0.116)
t+3		0.478^a
		(0.167)
t+4		0.655^a
		(0.176)
>=t+5		0.746^a
		(0.180)
Weak Alliance	-0.005	0.122
	(0.160)	(0.171)
Cold War	-0.249^a	0.213
	(0.075)	(0.151)
RTA	0.154^a	0.255^a
	(0.023)	(0.092)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	901,325	38.625

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; DATT, Differenced Average Treatment on the Treated; Dependent variable is the trade from country i to country j at time t. In DATT, defence pact's signatory effect is estimated in comparison to $k' <= t - 5$. Robust standard errors are in parentheses; column (1) standard errors are clustered at country-pair level; column (2) standard errors are clustered at country-pair-year level. a, b and c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

[106] Additional tests by using interactions of alliances with dummy variables for the decades or capturing whether the country has signed an alliance with the US or USSR does not exhibit any significant heterogeneous effects.

16. Details on propensity scores

The baseline score is estimated with a logit based on GDPs (in log), common religion index, and military expenditures (in log). We use a dynamic sequential approach. Thus, we run a cross-section estimation of the probability of signing a defense pact for each year. This approach allows for different coefficients depending on the year, and therefore, different propensity score and country-pair matching. We present results for three distinct years in table .11 as well as the variables' mean in the matched treated and control groups.

We tested the sensitivity of our DATT results to alternative propensity score computations. First we replaced military expenditures by the Composite Index of National Capabilitie from the Correlate of war project. Second, we tested a more saturated model including the log of distance, common language, and European-Union membership. Third, we replicated our baseline score estimation in a non-sequential setting with a probit, while including the tota global trade by year. In all cases our conclusions remain unchanged. To assess the robustness of our DATT results to the matching design, we tested alternative specifications for the propensity score. The baseline estimation uses a logit model with GDP (log), a common religion index, and military expenditures (log). We first replaced military expenditures with the Composite Index of National Capabilities from the Correlates of War project. Next, we estimated a more saturated model by adding the log of distance, common language, and EU membership. Finally, we replicated the baseline estimation using a probit model in a non-sequential setting, including total global trade by year as an additional covariate. In all specifications, our conclusions remain unchanged.

Table .11 – Dynamic propensity score matching, some details

Estimator:	Logit			
Dependent variable:	Defence pact			
Variables	(1)	(2)	(3)	(4)
Year:	1960	1990	2012	Full panel
Exp. ln(GDP)	-0.277[b]	0.021	0.111[b]	0.016[a]
	(0.111)	(0.027)	(0.051)	(0.002)
Imp. ln(GDP)	-0.274[b]	0.023[a]	0.099[c]	0.010[a]
	(0.110)	(0.037)	(0.052)	(0.002)
Common religion	2.385[a]	2.421[a]	2.138[a]	1.261[a]
	(0.247)	(0.121)	(0.104)	(0.009)
Exp. ln(Mil. Expenditures)	0.560[a]	-0.120[a]	-0.127[a]	-0.028[a]
	(0.096)	(0.036)	(0.047)	(0.002)
Imp. ln(Mil. Expenditures)	0.561[a]	-0.114[a]	-0.116[b]	-0.021[a]
	(0.095)	(0.036)	(0.047)	(0.002)
Total yearly trade				0.026[a]
				(0.002)
No. observ.	11,062	11,503	18,221	663,141

Note: Dependent variable is the presence of a defense pact between countries i and j at time t. Standard errors are in parentheses. The PSM is estimated for each year from 1960 to 2012, respectively, as in columns (1) to (3). Column (4) reports the resulst of the non-sequential dynamic PSM estimation. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .12 – Propensity score matching, variables' mean

Variable	Psm base	Standard base
GDP exp. (ln)	23.53	23.77
GDP imp. (ln)	23.52	23.71
Common religion	0.35	0.18
Mil. expenditures exp. (ln)	13.00	13.25
Mil. expenditures imp. (ln)	13.98	13.20

17. Intensive and extensive margins of trade

In this section, we investigate through which margin of trade military alliances affect bilateral trade. We first estimate the effects of military alliances on bilateral trade conditional on positive flows from country i to j. (the intensive margin). Then, using a non-linear probability model (Kitazawa, 2012; Silva and Kemp, 2016), we estimate the effects of alliances on the probability of starting to export to a destination (the extensive margin).[107] Results are reported in appendix table .13. The intensive margin estimation results are reported in panel A of the table, while the extensive margin results are shown in panel B. First, alliances increase by 52.7% the bilateral trade of country-pairs that were already trade partners. Second, they increase by 3.3% country i's probability of starting to export to country j. Thus, military alliances affect bilateral trade in terms of both margins. This suggests the presence of heterogeneous effects depending on which margin applies to the country-pair.

18. GE calibration

In this section, we detail the calibration process for the general equilibrium model. For the trade equilibrium, the only parameter requiring calibration is the trade elasticity (θ). By incorporating tariffs into the standard structural gravity estimation, we directly estimate $\theta = 3.38$. The results of the estimation are presented in table .27. The international insecurity equilibrium, however, demands calibration of additional parameters that may be challenging to observe.

The first required parameter is the elasticity of trade with respect to military alliances, as defined by equation 10. We derive it directly from our baseline estimation including intra-country trade flows such as $\varepsilon_{all}(X_{ij}) = 0.659$ (see table .16, column 3). In the general equilibrium framework, bilateral trade impacts the intensive margin of insecurity with an elasticity of -1 (see Equation 21). Similarly, origin- and destination-specific wages affect both the intensive and extensive margins of insecurity with respective elasticities of $-\delta\nu_o r = -0.221$ and $-\frac{r}{1-r}\nu_o r = -0.609$ for the origin, and $-\delta\nu_d r = -0.234$ and $-\frac{r}{1-r}\nu_d r = -0.607$ for the destination (see Equations 21 and 22). The calibrated values of each elasticity are directly estimated. Within our theoretical framework, changes in GDP can be directly transposed into changes in wage (see section 8). Therefore, instead of using wage data, which would significantly limit the size of our sample and cause statistical power issues, we estimate the elasticities of both margins of insecurity using GDP (in logarithms) as the variable of interest. The estimation strategy then follows that for defense pacts, as detailed in section 7.1. The results are reported in table .28. Additionally, the elasticities of trade with respect to I_{ij} and E_{ij} are calibrated based on the results from Section 7.1, yielding $\varepsilon_{I_{ij}}(X_{ij}) = \varepsilon_{E_{ij}}(X_{ij}) = 0.301$.

[107] Given that the Logit estimator does not allow for intensive use of fixed effects, we use only country-pair and year fixed effects.

Table .13 – Extensive and intensive margins of trade

A: Intensive margin

Dependent variable:	$X_{ijt} \vert X_{ijt} > 0$
Estimator:	PPML
Alliance	0.423^a
	(0.094)
RTA	0.161^a
	(0.023)
Exporter x Year FE	yes
Importer x Year FE	yes
Dyadic FE	yes
No. observ.	829,951

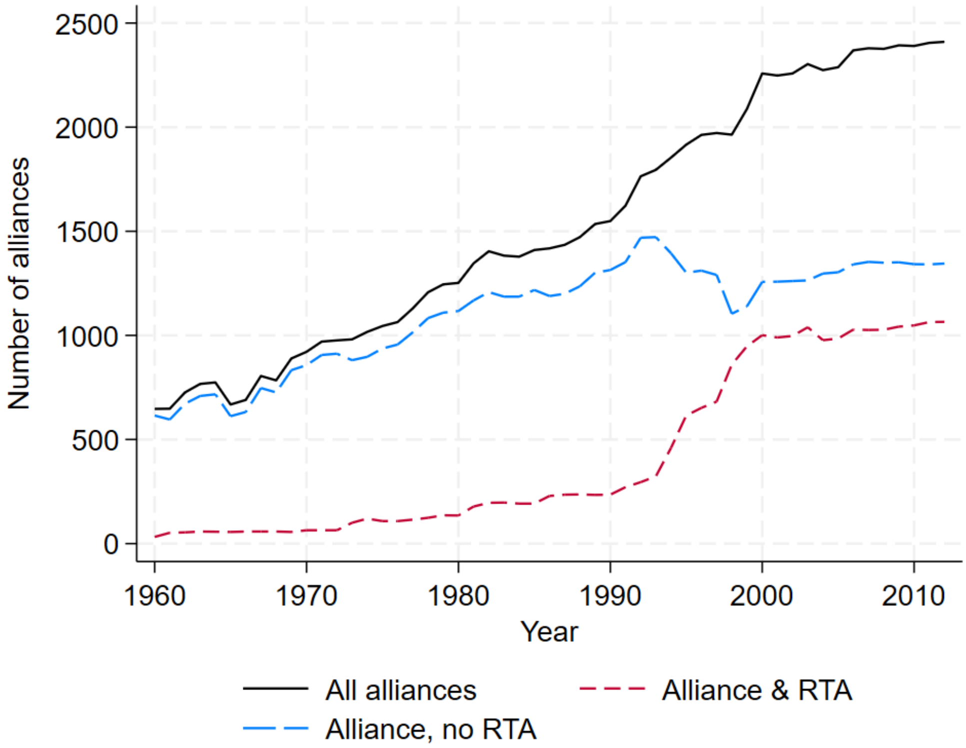
B: Extensive margin

Dependent variable:	Export dummy
Estimator:	Logit
Alliance	0.033^a
	(0.011)
RTA	0.021^b
	(0.009)
Year FE	yes
Dyadic FE	yes
No. observ.	359,057

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; Dependent variable is trade from country i to country j at time t without the zero observations and conditional to a positive value the previous year. Standard errors clustered at country-pair level are in parentheses. Coefficient of our Logit estimation can be directly interpreted as the elasticity. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

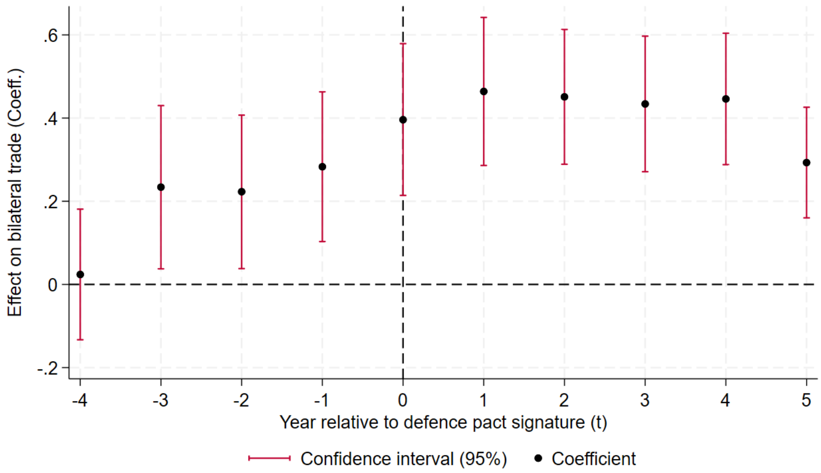
19. Supplementary tables and figures

Figure .8 – Alliances & RTAs, overlap



Note: The number of alliances counts each exporter-importer pair with an active alliance.

Figure .9 – Event study



Note: Figure plots results of the standard event study estimation of the defence pacts' effect on bilateral trade. Every time k is compared to $k' <= t_{def} - 5$. The last period includes $k >= t_{def} + 5$. Standard errors are clustered at the country-pair-year level.

Table .14 – List of countries

Afghanistan	Albania	Algeria	Angola	Antigua and Barbuda
Argentina	Armenia	Australia	Austria	Azerbaijan
Bahamas	Bahrain	Bangladesh	Barbados	Belarus
Belgium	Belize	Benin	Bhutan	Bolivia
Bosnia and Herzegovina	Botswana	Brazil	Brunei	Bulgaria
Burkina Faso	Burundi	Cabo Verde	Cambodia	Cameroon
Canada	Central African Republic	Chad	Chile	China
Colombia	Comoros	Congo (RDC)	Congo (Rep.)	Costa Rica
Côte d'Ivoire	Croatia	Cuba	Cyprus	Czechia
Denmark	Djibouti	Dominica	Dominican Rep.	Ecuador
Egypt	El Salvador	Equatorial Guinea	Eritrea	Estonia
Eswatini	Ethiopia	Fiji	Finland	France
Gabon	Gambia	Georgia	Germany	Ghana
Greece	Grenada	Guatemala	Guinea	Guinea-Bissau
Guyana	Haiti	Honduras	Hungary	Iceland
India	Indonesia	Iran	Iraq	Ireland
Israel	Italy	Jamaica	Japan	Jordan
Kazakhstan	Kenya	Kiribati	Kuwait	Kyrgyzstan
Laos	Latvia	Lebanon	Lesotho	Liberia
Libya	Lithuania	Luxembourg	Madagascar	Malawi
Malaysia	Maldives	Mali	Malta	Marshall Islands
Mauritania	Mauritius	Mexico	Micronesia	Moldova
Mongolia	Morocco	Mozambique	Myanmar	Namibia
Nauru	Nepal	Netherlands	New Zealand	Nicaragua
Niger	Nigeria	North Korea	North Macedonia	Norway
Oman	Pakistan	Palau	Panama	Papua New Guinea
Paraguay	Peru	Philippines	Poland	Portugal
Qatar	Romania	Russia	Rwanda	Saint Kitts and Nevis
Saint Lucia	St. Vincent & Grenadines	Samoa	San Marino	Sao Tome and Principe
Saudi Arabia	Senegal	Serbia	Seychelles	Sierra Leone
Singapore	Slovakia	Slovenia	Solomon Islands	Somalia
South Africa	South Korea	Spain	Sri Lanka	Sudan
Suriname	Sweden	Switzerland	Syria	Taiwan
Tajikistan	Tanzania	Thailand	Togo	Tonga
Trinidad and Tobago	Tunisia	Turkey	Turkmenistan	Tuvalu
Uganda	Ukraine	United Arab Emirates	United Kingdom	United States
Uruguay	Uzbekistan	Vanuatu	Venezuela	Vietnam
Yemen	Zambia	Zimbabwe		

Table .15 – Alternative data and sample

Period :	1960-2012	1948-2012	1870-2012	1960-2018
	(1)	(2)	(3)	(4)
Alliance	0.417[a]	0.433[a]	0.554[a]	0.368[a]
	(0.055)	(0.058)	(0.065)	(0.111)
RTA	0.119[a]	0.136[a]		0.112[a]
	(0.022)	(0.022)		(0.021)
Exporter x Year FE	yes	yes	yes	yes
Importer x Year FE	yes	yes	yes	yes
Dyadic FE	yes	yes	yes	yes
No. observ.	815,906	883,181	1,159,418	1,004,250

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; Dependent variable is the trade from country i to country j at time t in millions of current dollars. Standard errors clustered at country-pair level are in parentheses. Column (1) uses Head and Mayer (2021) trade data only while excluding, before 1991, eastern bloc countries that are not continuously sovereign from 1960 to 2012. Column (2) uses DOTS trade data. Column (3) extend the panel from 1870 by using trade data from the Correlate of War project. Column (4) extends alliance data to 2018. a, b and c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .16 – Trade and military alliances, robustness checks

Robustness check:	Arms sector exclusion		Intra. trade	Tariffs			Tariffs & Intra. trade	Colonial link	RTA depth		EU	Geo. and eco. dist.	Import shares
Period:	1967-2012		1960-2012	1996-2012			1996-2012	1960-2012	1960-2012		1960-2012	1960-2012	1960-2012
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Alliance	0.375^a	0.374^a	0.659^a	0.177^a	0.199^a	0.199^a	0.409^a	0.506^a	0.467^a	0.465^a	0.435^a	0.410^a	0.515^a
	(0.061)	(0.061)	(0.056)	(0.050)	(0.063)	(0.065)	(0.038)	(0.102)	(0.111)	(0.111)	(0.102)	(0.056)	(0.065)
RTA	0.096^a	0.096^a	0.156^a					0.173^a		-0.028	0.141^a	0.108^a	0.312^a
	(0.023)	(0.023)	(0.043)					(0.024)		(0.033)	(0.023)	(0.022)	(0.032)
Intra x Year			-0.033^a				-0.026^a						
			(0.003)				(0.003)						
ln(Tariffs+1)						-1.125^a	-1.968^a						
						(0.267)	(0.370)						
Colonial link								0.938^a					
								(0.208)					
RTA depth									0.012^a	0.013^a			
									(0.001)	(0.001)			
EU											0.327^a		
											(0.036)		
Diff. GDP per cap.												-0.009^b	
												(0.004)	
ln(Distance) x Year												-0.002^b	
												(0.001)	
Exporter x Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Importer x Year FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Dyadic FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
No. observ.	236,951	236,951	822,788	424,858	130,852	130,852	132,314	901,325	891,196	891,196	901,325	781,846	901,325

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; Dependent variable is trade from country i to country j at time t. Standard errors clustered at the country-pair level are in parentheses. Because of data limitation, several estimations are performed with a shorter panel or omitted observations/country-pairs. In column 2 we perform our baseline estimation on the same sub-sample as in column but excluding the arms sector from trade flows. In column 5 we perform the same regression as in column 4 but without observations whose bilateral average tariff is unknown. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .17 – Corrected three-way ppml estimation

Estimator: PPML Dependent variable: trade	
Variables	(1)
Alliance	0.519[a]
Corrected bias	-0.011
	(0.113)
RTA	0.179[a]
Corrected bias	-0.006
	(0.026)
Exporter x Year FE	yes
Importer x Year FE	yes
Dyadic FE	yes
No. observ.	901,325

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; Dependent variable is the trade from country i to country j at time t in millions of current dollars. Standard errors clustered at country-pair level are in parentheses. Coefficients are corrected from the asymptotic bias. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .18 – Trade and defence pacts

Estimator:	PPML	
Dependent variable:	Bilateral trade	
Variables	(1)	(2)
Defence pact	0.712[a]	0.667[a]
	(0.074)	(0.079)
Weak alliance	-0.004	-0.004
	(0.161)	(0.161)
RTA	0.156[a]	0.156[a]
	(0.023)	(0.023)
NATO		0.726[a]
		(0.071)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	901,325	901,325

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; Dependent variable is the trade from country i to country j at time t in millions of current dollars. Standard errors clustered at country-pair level are in parentheses. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .19 – Alliances and bilateral trade, 2SLS

Dependent variable: trade		
Second stage		
	(1)	(2)
Estimator:	OLS	2SLS
Instrument variable:	None	Common out. alliances
Alliance	0.541[a]	0.508[a]
	(0.043)	(0.109)
RTA	0.605[a]	0.608[a]
	(0.021)	(0.053)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	902,281	902,281
First-stage		
Instrumented variable:	None	Alliance
Common out. alliances		0.047[a]
		(0.003)
RTA		0.029[a]
		(0.006)
KPW rk F-stat:		198
KPW rk LM-stat:		27

Note: OLS, Ordinary Least Squares; 2SLS, Two-Stage Least Square; FE, Fixed effects; Dependent variable is the inverse hyperbolic sine transformation of the trade from country i to country j at time t in millions of current dollars. Standard errors clustered at country-pair levels (column 1) and at the importer and exporter levels (column 2) are in parentheses. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .20 – Alliances and bilateral trade, IV control function

Dependent variable: trade		
Second stage	(1)	(2)
Estimator:	PPML	PPML
Alliance	0.682[a]	
	(0.030)	
Defence pact		0.618[a]
		(0.035)
Weak alliance		-0.073[a]c
		(0.044)
RTA	0.167[a]	0.146[a]
	(0.010)	(0.010)
First stage residuals	-0.253[a]	-0.007[a]
	(0.049)	(0.045)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	901,325	900,059
First-stage		
Estimator:	OLS	OLS
Dependent variable:	Alliance	Defence pact
Common out. alliances	0.047[a]	0.046[a]
	(0.003)	(0.003)
Weak alliance		-0.145[a]
		(0.028)
RTA	0.029[a]	0.030[a]
	(0.006)	(0.007)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	902,281	901,015
KPW F-stat	199	211
KPW LM-stat	27	26

Note: OLS, Ordinary Least Squares; FE, Fixed effects. Dependent variable is the trade from country i to country j at time t in millions of current dollars. Standard errors clustered at the exporter and importer levels are in parentheses. Second-stage standard errors are bootstrapped. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .21 – Outside alliances

Estimator: PPML		
Dependent variable: Trade		
Variables	(1)	(2)
Alliance	0.509[a]	
	(0.103)	
Outside alliance(exp.)	0.032	
	(0.076)	
Outside alliance(imp.)	0.012	
	(0.084)	
Defence pact		0.723[a]
		(0.075)
Outside defence pact(exp.)		0.032
		(0.172)
Outside defence pact(imp.)		0.153
		(0.128)
Weak alliance		-0.011
		(0.169)
RTA	0.174[a]	0.156[a]
	(0.023)	(0.023)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	901,325	901,325

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects. Dependent variable is the trade from country i to country j at time t. Standard errors clustered at country-pair level are in parentheses. a, b and c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .22 – DATT

Estimator:	PPML	
Dependent variable:	Trade	
Variables	(1)	
t-4	0.077	
	(0.268)	
t-3	0.143	
	(0.191)	
t-2	0.046	
	(0.282)	
t-1	0.152	
	(0.153)	
t	0.059	
	(0.164)	
t+1	0.627[a]	
	(0.128)	
t+2	0.634[a]	
	(0.121)	
t+3	0.456[a]	
	(0.129)	
t+4	0.635[a]	
	(0.125)	
>=t+5	0.724[a]	
	(0.126)	
Weak Alliance	0.114	
	(0.192)	
RTA	0.256[a]	
	(0.063)	
Exporter x Year FE	yes	
Importer x Year FE	yes	
Dyadic FE	yes	yes
No. observ.	38.625	

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; DATT, Differenced Average Treatment on the Treated; Dependent variable is the trade from country i to country j at time t. In the DATT, defence pact's signatory effect is estimated in comparison to $k' <= t-5$. Robust standard errors clustered at country-pair level are in parentheses. Results are robust to two-way exporter and importer clustering. a, b and c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .23 – Defence pacts and UN votes

Estimator:	PPML	
Dependent variable:	Common votes (sum)	
Variables	(1)	(2)
Defence pact	0.022^a	
	(0.003)	
Common out. def. pacts		0.001^a
		(0.000)
Weak alliance	0.017^a	0.013^a
	(0.004)	(0.004)
RTA	0.019^a	0.019^a
	(0.001)	(0.001)
Abstention	0.086^a	0.085^a
	(0.001)	(0.001)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	774,578	773,454

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; Dependent variable is the sum of common UN votes between country i and j. Abstention is the sum of the common abstention between country i and j. We use the inverse hyperbolic sine transformation of Abstention. For reasons of consistency with the baseline estimation, in structural gravity, each country-pair is counted twice (ij and ji). Standard errors clustered at country-pair level are in parentheses. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .24 – The military cooperation channel

Second stage	(1)	(2)
Estimator:	PPML	
Dependent variable:	Bilateral trade	
Military cooperation	0.380[a]	0.301[a]
	(0.055)	(0.065)
Weak alliance	-0.094	-0.166
	(0.142)	(0.157)
RTA	0.052[b]	0.054[b]
	(0.025)	(0.025)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	550,686	550,192
First-stage		
Estimator:	OLS	
Dependent variable:	Military cooperation	
Defence pact	1.004[a]	
	(0.066)	
Common out. def. pacts		0.069[a]
		(0.004)
Weak alliances	0.209[b]	0.069
	(0.092)	(0.087)
RTA	0.030	0.039
	(0.024)	(0.024)
Exporter x Year FE	yes	yes
Importer x Year FE	yes	yes
Dyadic FE	yes	yes
No. observ.	552,033	551,539

Note: OLS, Ordinary Least Square; PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects. The panel starts in 1989. Common defence pacts sum all external partners for which country i and j both have a defence pact. Military cooperation is the inverse hyperbolic sine transformation of $\sum coop.mil.ev._{ijt}$. Robust standard errors clustered at country-pair level are in parentheses. Second-stage standard errors are bootstrapped. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .25 – Margins of insecurity and defence pacts

Dependent variable:	Extensive margin	Intensive margin
Estimator :	Logit	OLS
Variables	(1)	(2)
Defence pact	-1.025[a]	-0.240[a]
	(0.293)	(0.065)
Weak alliance	-0.636[c]	0.142
	(0.328)	(0.116)
RTA	-0.172[b]	0.051
	(0.097)	(0.035)
Dyadic FE	yes	yes
Year FE	yes	no
Exporter x Year FE	no	yes
Importer x Year FE	no	yes
No. observ.	174,217	32,123

Note: OLS, Ordinary Least Square; FE, Fixed effects; Dependent variables are respectively in column one and two a dummy taking the value one if the country pair faces bilateral insecurity ($INS_{ijt} > 0$) and our bilateral insecurity proxy INS_{ijt}. In column two, the sample excludes country-pair-year observations whose dependent variable (INS_{ijt}) is equal to zero. Standard errors clustered at country-pair level are in parentheses. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .26 – Extensive margin of insecurity : LPM

Estimator:	OLS
Dependent variable:	Extensive margin of insecurity
Estimator :	OLS
Variables	(1)
Defence pact	-0.094[a]
	(0.010)
Weak alliance	-0.043[a]
	(0.017)
RTA	-0.017[a]
	(0.003)
Exporter x Year FE	yes
Importer x Year FE	yes
Dyadic FE	yes
No. observ.	552,033

Note: OLS, Ordinary Least Square; FE, Fixed effects; Dependent variables is a dummy taking the value one if the country pair faces bilateral insecurity ($INS_{ijt} > 0$). Standard errors clustered at country-pair level are in parentheses. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .27 – Estimating the trade elasticity

Estimator: PPML	
Dependent variable:	Bilateral trade
Variables	(1)
ln(1+Tariffs)	-3.381[a]
	(0.679)
ln(Distance)	-0.798[a]
	(0.033)
Common religion	-0.022
	(0.103)
Contiguity	0.394[a]
	(0.056)
Common language	0.137[b]
	(0.069)
Exporter x Year FE	yes
Importer x Year FE	yes
No. observ.	179,558

Note: PPML, Poisson Pseudo Maximum Likelihood; FE, Fixed effects; Dependent variable is trade from country i to country j at time t in millions of current dollars. Standard errors clustered at country-pair level are in parentheses. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .28 – Estimating the income elasticiy of insecurity

Estimator:	Logit	OLS
Dependent variable:	Extensive margin	Intensive margin
Variables	(1)	(2)
ln(gdp_i)	-0.609[a]	-0.221[a]
	(0.039)	(0.062)
ln(gdp_j)	-0.607[a]	-0.234[a]
	(0.039)	(0.062)
Dyadic FE	yes	yes
Year FE	yes	yes
No. observ.	276,307	47,809

Note: OLS, Ordinary Least Square; FE, Fixed effects; In column 1, the dependent variable is a dummy variable taking the value one if country-pair ij's bilateral insecurity is positive. In column 2, it is INS_{ijt} while null values are dropped. The panel goes from 1960 to 2018. Standard errors clustered at country-pair level are in parentheses. a, b, c denote significantly different from 0 at 1%, 5% and 10% level, respectively.

Table .29 – GE trade and welfare gains from alliances with bilateral elasticities

Country	Trade	Real revenues	Country	Trade	Real revenues	Country	Trade	Real revenues
AFG	36.29	-0.86	AGO	-3.21	-0.80	ALB	161.19	-0.32
ARE	4.51	0.06	ARG	4.42	0.84	ARM	33.54	0.22
AUS	2.26	-0.24	AUT	-2.86	-0.42	AZE	2.41	1.27
BDI	26.54	0.24	BEN	9.39	0.43	BFA	15.26	-0.24
BGD	-3.83	-0.36	BGR	54.62	-0.19	BHR	41.55	4.09
BIH	1.32	-0.33	BLR	64.02	0.98	BLZ	20.73	8.17
BOL	14.69	0.93	BRA	3.66	0.70	BRB	38.74	7.83
BRN	-1.04	-0.07	BWA	0.70	-0.01	CAF	1.48	0.04
CAN	34.47	5.60	CHE	-4.03	-0.73	CHL	14.63	0.13
CHN	-2.07	-0.57	CIV	3.56	0.59	CMR	-0.46	-0.18
COG	-1.55	0.51	COL	17.30	0.39	CPV	-0.19	0.18
CUB	-6.07	-0.19	CZE	34.53	5.46	DEU	18.11	2.70
DNK	25.34	4.81	DOM	90.19	1.22	DZA	-3.41	-0.66
ECU	14.94	1.10	EGY	-7.20	-0.17	ESP	40.69	0.56
EST	15.77	8.35	ETH	-2.88	-0.30	FIN	-1.10	-0.43
FJI	-6.44	-0.36	FRA	34.88	2.44	GAB	1.84	1.03
GBR	42.31	0.91	GEO	35.85	0.62	GHA	3.87	-0.85
GMB	2.50	0.41	GRC	82.83	-0.25	GTM	68.01	0.02
HRV	80.70	4.76	HTI	74.22	1.65	HUN	25.99	2.13
IDN	-2.26	-0.43	IND	-5.67	-0.23	IRN	-0.69	-0.33
IRQ	-1.03	-0.19	ISL	40.29	5.06	ISR	-4.14	-0.77
ITA	24.70	2.13	JAM	36.04	5.60	JOR	25.91	1.54
JPN	5.59	0.30	KAZ	7.90	1.94	KEN	18.71	0.60
KGZ	105.57	0.83	KHM	-2.84	0.27	KOR	3.43	0.23
KWT	-0.51	-0.07	LAO	-1.49	-0.21	LBN	29.12	0.94
LBR	0.32	4.08	LBY	-0.18	0.05	LCA	6.20	11.02
LKA	-3.58	-0.42	LSO	-6.94	-0.28	LTU	45.44	4.53
LVA	35.54	8.17	MAR	7.05	-0.60	MDA	49.56	5.68
MDG	-4.42	-0.41	MDV	-3.45	-0.11	MEX	32.54	3.56
MKD	-8.70	-0.75	MMR	-1.48	-0.54	MNG	34.26	-0.14
MOZ	-2.69	-0.24	MUS	-7.11	-0.78	MWI	-2.36	-0.12
MYS	-3.49	-0.76	NAM	-3.06	-0.25	NER	17.96	0.13
NGA	-1.68	-0.68	NIC	27.50	1.04	NOR	18.22	2.79
NPL	-0.17	-0.19	NZL	-3.16	-0.58	OMN	2.39	0.08
PAK	13.77	-0.56	PER	9.48	0.86	PHL	3.68	0.59
PNG	-0.94	-0.09	POL	81.39	-0.48	PRT	55.57	1.57
PRY	81.18	-0.32	QAT	0.05	0.03	ROU	27.39	-0.57
RUS	5.92	1.30	RWA	28.20	-0.12	SAU	-1.19	-0.19
SEN	4.71	0.10	SLV	98.77	0.44	SOM	69.57	1.03
SVK	20.88	12.53	SVN	40.49	6.04	SWE	-3.92	-0.54
SWZ	17.84	4.73	SYR	10.16	0.42	THA	-4.00	-0.51
TJK	53.22	4.99	TON	-0.23	0.51	TTO	8.51	1.29
TUN	3.35	-0.13	TUR	54.34	-1.72	TZA	8.52	0.02
UGA	23.79	-0.84	UKR	32.17	0.51	URY	32.64	0.41
USA	55.86	0.79	UZB	60.47	-0.06	VEN	6.97	2.23
VNM	-1.62	-0.43	YEM	17.85	-0.02	ZAF	-1.56	-0.47
ZMB	0.70	0.10	ZWE	-3.66	-0.40			

Note: The real revenue is our measure of welfare. All numbers are variations in percentage. GE results are computed based on the theoretical framework described in section D.

Table .30 – Welfare impact of Eastern NATO expansion

Country	Real revenues	Country	Real revenues	Country	Real revenues
AFG	-0.03	AGO	0.03	ALB	0.35
ARE	-0.08	ARG	0.05	ARM	3.11
AUS	0.01	AUT	15.40	AZE	0.96
BDI	0.02	BEN	0.03	BFA	0.10
BGD	0.04	BGR	0.99	BHR	0.00
BIH	-0.33	BLR	-0.09	BLZ	-0.06
BOL	0.04	BRA	0.05	BRB	-0.09
BRN	0.07	BWA	-0.06	CAF	0.05
CAN	0.23	CHE	14.86	CHL	-0.01
CHN	0.07	CIV	-0.12	CMR	-0.02
COG	0.02	COL	0.04	CPV	-0.01
CUB	0.05	CZE	0.87	DEU	1.07
DNK	2.33	DOM	0.04	DZA	-0.04
ECU	0.03	EGY	-0.03	ERI	0.02
ESP	0.27	EST	5.92	ETH	0.03
FIN	9.35	FJI	0.00	FRA	0.50
GAB	0.00	GBR	0.58	GEO	6.46
GHA	0.06	GMB	-0.03	GRC	0.51
GTM	0.02	HRV	0.77	HTI	0.06
HUN	0.90	IDN	0.03	IND	-0.01
IRN	-0.05	IRQ	-0.01	ISL	0.95
ISR	-0.44	ITA	0.64	JAM	-0.09
JOR	-0.02	JPN	0.05	KAZ	4.29
KEN	0.01	KGZ	1.70	KHM	-0.04
KOR	0.02	KWT	0.03	LAO	0.08
LBN	-0.26	LBR	-0.18	LBY	-0.17
LCA	-0.13	LKA	-0.09	LSO	0.04
LTU	0.93	LVA	1.67	MAR	-0.08
MDA	8.62	MDG	0.01	MDV	0.05
MEX	0.01	MKD	-0.38	MMR	0.09
MNG	0.06	MOZ	-0.00	MUS	-0.26
MWI	0.00	MYS	-0.04	NAM	-0.03
NER	0.06	NGA	0.04	NIC	-0.01
NOR	1.36	NPL	0.03	NZL	-0.00
OMN	0.02	PAK	0.03	PER	0.05
PHL	0.02	PNG	0.02	POL	0.29
PRT	0.38	PRY	0.01	QAT	0.02
ROU	0.81	RUS	-0.20	RWA	0.02
SAU	-0.04	SEN	-0.01	SLV	0.01
SOM	0.03	SVK	0.75	SVN	-1.23
SWE	13.67	SWZ	0.07	SYR	-0.04
THA	-0.03	TJK	2.88	TON	0.07
TTO	-0.01	TUN	-0.21	TUR	0.52
TZA	-0.05	UGA	0.04	UKR	3.29
URY	0.02	USA	0.19	UZB	1.51
VEN	0.06	VNM	0.02	YEM	-0.03
ZAF	-0.09	ZMB	-0.02	ZWE	-0.07

Note: The real revenue is our measure of welfare. All numbers are percentage variations. Country code is ISO3.

Table .31 – Welfare impact of Eastern NATO withdrawal

Country	Real revenues	Country	Real revenues	Country	Real revenues
AFG	-0.08	AGO	0.00	ALB	-3.40
ARE	0.03	ARG	-0.00	ARM	-0.11
AUS	0.00	AUT	0.25	AZE	-0.01
BDI	-0.01	BEN	-0.00	BFA	0.03
BGD	0.03	BGR	-7.69	BHR	0.01
BIH	0.05	BLR	-0.49	BLZ	0.02
BOL	-0.01	BRA	-0.01	BRB	0.00
BRN	-0.00	BWA	0.01	CAF	0.01
CAN	-0.11	CHE	0.18	CHL	0.01
CHN	-0.00	CIV	0.02	CMR	0.00
COG	0.01	COL	-0.01	CPV	-0.05
CUB	-0.04	CZE	-1.32	DEU	-1.22
DNK	-0.78	DOM	-0.02	DZA	0.03
ECU	-0.03	EGY	0.00	ERI	-0.01
ESP	-0.32	EST	-11.51	ETH	-0.02
FIN	0.16	FJI	-0.00	FRA	-0.64
GAB	0.01	GBR	-0.37	GEO	0.33
GHA	0.02	GMB	-0.00	GRC	-0.88
GTM	-0.01	HRV	-0.89	HTI	-0.02
HUN	-11.29	IDN	0.00	IND	-0.00
IRN	0.06	IRQ	0.01	ISL	-0.51
ISR	0.08	ITA	-0.55	JAM	-0.01
JOR	0.04	JPN	-0.00	KAZ	0.10
KEN	-0.02	KGZ	-0.12	KHM	-0.03
KOR	0.00	KWT	0.01	LAO	-0.00
LBN	0.06	LBR	0.03	LBY	0.01
LCA	0.04	LKA	-0.01	LSO	-0.05
LTU	-11.42	LVA	-16.03	MAR	0.03
MDA	-0.24	MDG	0.01	MDV	-0.01
MEX	-0.01	MKD	0.46	MMR	-0.00
MNG	0.09	MOZ	-0.00	MUS	0.05
MWI	0.00	MYS	0.01	NAM	-0.01
NER	0.01	NGA	-0.01	NIC	-0.01
NOR	-0.33	NPL	-0.00	NZL	0.00
OMN	0.01	PAK	0.01	PER	-0.00
PHL	0.00	PNG	-0.00	POL	-6.53
PRT	-0.20	PRY	-0.02	QAT	0.01
ROU	-6.21	RUS	-1.39	RWA	-0.01
SAU	0.02	SEN	-0.00	SLV	-0.02
SOM	-0.02	SVK	-2.59	SVN	0.36
SWE	0.19	SWZ	-0.02	SYR	0.06
THA	0.00	TJK	0.16	TON	-0.01
TTO	0.01	TUN	0.08	TUR	-1.86
TZA	-0.01	UGA	-0.02	UKR	-0.46
URY	0.00	USA	-0.07	UZB	-0.06
VEN	-0.01	VNM	-0.00	YEM	-0.00
ZAF	0.04	ZMB	-0.00	ZWE	0.01

Note: The real revenue is our measure of welfare. All numbers are percentage variations. Country code is ISO3.

Table .32 – Welfare impact of a new Eastern bloc

Country	Real revenues	Country	Real revenues	Country	Real revenues
AFG	0.03	AGO	0.17	ALB	-2.38
ARE	0.10	ARG	0.04	ARM	0.01
AUS	0.11	AUT	0.13	AZE	-0.02
BDI	0.02	BEN	0.06	BFA	0.02
BGD	0.01	BGR	-3.08	BHR	0.04
BIH	-0.08	BLR	1.08	BLZ	0.02
BOL	0.05	BRA	0.06	BRB	0.04
BRN	0.10	BWA	0.05	CAF	0.00
CAN	-0.04	CHE	0.16	CHL	0.09
CHN	0.24	CIV	-0.01	CMR	0.04
COG	0.18	COL	0.04	CPV	-0.03
CUB	0.04	CZE	-1.44	DEU	-1.24
DNK	-0.79	DOM	0.05	DZA	0.01
ECU	0.04	EGY	-0.05	ERI	0.04
ESP	-0.34	EST	1.61	ETH	0.02
FIN	-0.00	FJI	0.05	FRA	-0.65
GAB	0.12	GBR	-0.36	GEO	-0.11
GHA	0.01	GMB	0.05	GRC	-1.09
GTM	0.05	HRV	-0.99	HTI	0.05
HUN	-4.55	IDN	0.08	IND	0.04
IRN	0.68	IRQ	0.18	ISL	-0.51
ISR	0.10	ITA	-0.59	JAM	0.06
JOR	-0.05	JPN	0.08	KAZ	0.02
KEN	0.03	KGZ	0.06	KHM	-0.03
KOR	0.09	KWT	0.08	LAO	0.10
LBN	-0.14	LBR	-0.18	LBY	-0.02
LCA	0.06	LKA	-0.02	LSO	0.05
LTU	0.89	LVA	-1.22	MAR	0.00
MDA	5.57	MDG	0.04	MDV	0.04
MEX	0.06	MKD	0.12	MMR	0.09
MNG	0.22	MOZ	0.02	MUS	0.03
MWI	0.00	MYS	0.10	NAM	0.06
NER	0.05	NGA	0.04	NIC	0.05
NOR	-0.32	NPL	0.06	NZL	0.08
OMN	0.17	PAK	0.04	PER	0.08
PHL	0.12	PNG	0.08	POL	-4.20
PRT	-0.20	PRY	0.02	QAT	0.10
ROU	-2.17	RUS	-0.34	RWA	0.03
SAU	0.08	SEN	0.02	SLV	0.05
SOM	0.03	SVK	-2.87	SVN	0.17
SWE	0.12	SWZ	0.03	SYR	1.23
THA	0.08	TJK	-0.09	TON	0.07
TTO	0.06	TUN	0.01	TUR	-1.00
TZA	0.04	UGA	0.02	UKR	2.24
URY	0.05	USA	-0.01	UZB	-0.01
VEN	0.06	VNM	0.05	YEM	0.14
ZAF	0.09	ZMB	0.09	ZWE	0.05

Note: The real revenue is our measure of welfare. All numbers are percentage variations. Country code is ISO3.

Table .33 – Welfare impact of the US withdrawal from alliances

Country	Real revenues	Country	Real revenues	Country	Real revenues
AFG	0.06	AGO	0.27	ALB	0.02
ARE	0.10	ARG	-0.23	ARM	0.12
AUS	-0.48	AUT	0.18	AZE	0.05
BDI	0.10	BEN	0.16	BFA	0.07
BGD	0.22	BGR	-0.18	BHR	0.14
BIH	0.04	BLR	0.10	BLZ	-4.97
BOL	-0.93	BRA	-0.40	BRB	-3.34
BRN	0.02	BWA	0.10	CAF	0.10
CAN	-8.50	CHE	0.29	CHL	-1.21
CHN	0.20	CIV	0.14	CMR	0.16
COG	0.30	COL	-2.14	CPV	0.03
CUB	-0.04	CZE	-0.26	DEU	-0.72
DNK	-0.70	DOM	-5.38	DZA	0.20
ECU	-2.53	EGY	0.10	ERI	-0.13
ESP	-0.31	EST	-0.62	ETH	0.10
FIN	0.15	FJI	0.34	FRA	-0.67
GAB	0.19	GBR	-1.16	GEO	0.14
GHA	0.13	GMB	0.09	GRC	-0.24
GTM	-3.73	HRV	-0.34	HTI	-4.06
HUN	-0.39	IDN	0.14	IND	0.15
IRN	0.10	IRQ	0.17	ISL	-1.45
ISR	0.46	ITA	-0.49	JAM	-3.50
JOR	0.23	JPN	-0.89	KAZ	0.12
KEN	0.10	KGZ	0.12	KHM	0.22
KOR	-0.97	KWT	0.11	LAO	0.15
LBN	0.16	LBR	-1.31	LBY	0.08
LCA	-4.01	LKA	0.26	LSO	0.72
LTU	-0.44	LVA	-0.37	MAR	0.11
MDA	0.13	MDG	0.18	MDV	0.13
MEX	-7.51	MKD	0.10	MMR	0.15
MNG	0.22	MOZ	0.11	MUS	0.21
MWI	0.14	MYS	0.32	NAM	0.14
NER	0.17	NGA	0.25	NIC	-4.39
NOR	-0.59	NPL	0.17	NZL	0.24
OMN	0.17	PAK	-0.46	PER	-0.97
PHL	-1.79	PNG	0.25	POL	-0.14
PRT	-0.36	PRY	-0.15	QAT	0.01
ROU	-0.23	RUS	0.12	RWA	0.11
SAU	0.16	SEN	0.11	SLV	-4.39
SOM	0.11	SVK	-0.23	SVN	-0.36
SWE	0.23	SWZ	0.12	SYR	0.14
THA	0.23	TJK	0.17	TON	0.21
TTO	-5.86	TUN	0.11	TUR	-0.11
TZA	0.10	UGA	0.11	UKR	0.12
URY	-0.47	USA	-3.29	UZB	0.11
VEN	-2.68	VNM	0.18	YEM	0.17
ZAF	0.19	ZMB	0.13	ZWE	0.14

Note: The real revenue is our measure of welfare. All numbers are percentage variations. Country code is ISO3.

Table .34 – Welfare impact of a new geopolitically fragmented world

Country	Real revenues	Country	Real revenues	Country	Real revenues
AFG	-0.23	AGO	-0.09	ALB	-0.05
ARE	-0.34	ARG	-0.58	ARM	1.23
AUS	-0.85	AUT	16.17	AZE	3.90
BDI	-0.23	BEN	-0.18	BFA	-0.48
BGD	-0.16	BGR	-0.31	BHR	-0.22
BIH	-0.46	BLR	-0.19	BLZ	-5.40
BOL	-1.30	BRA	-0.75	BRB	-3.81
BRN	-0.34	BWA	-0.27	CAF	-0.21
CAN	-8.66	CHE	14.40	CHL	-1.59
CHN	-0.14	CIV	-0.22	CMR	-0.19
COG	-0.06	COL	-2.52	CPV	-0.27
CUB	-0.46	CZE	1.25	DEU	0.61
DNK	2.66	DOM	-5.77	DZA	-0.17
ECU	-2.94	EGY	-0.24	ERI	-0.72
ESP	-0.10	EST	7.09	ETH	-0.20
FIN	10.17	FJI	-0.02	FRA	-0.24
GAB	-0.17	GBR	-0.43	GEO	6.34
GHA	-0.29	GMB	-0.35	GRC	0.13
GTM	-4.13	HRV	0.75	HTI	-4.44
HUN	1.06	IDN	-0.21	IND	-0.14
IRN	-0.18	IRQ	-0.16	ISL	-0.22
ISR	-0.19	ITA	0.34	JAM	-3.95
JOR	-0.16	JPN	-1.25	KAZ	5.11
KEN	-0.22	KGZ	1.08	KHM	-0.11
KOR	-1.34	KWT	-0.24	LAO	-0.19
LBN	-0.47	LBR	-1.60	LBY	-0.23
LCA	-4.44	LKA	-0.17	LSO	0.42
LTU	0.93	LVA	2.17	MAR	-0.26
MDA	8.56	MDG	-0.15	MDV	-0.18
MEX	-7.93	MKD	-0.32	MMR	-0.19
MNG	-0.06	MOZ	-0.25	MUS	-0.26
MWI	-0.23	MYS	-0.08	NAM	-0.26
NER	-0.18	NGA	-0.10	NIC	-4.79
NOR	1.44	NPL	-0.12	NZL	-0.13
OMN	-0.21	PAK	-0.80	PER	-1.35
PHL	-2.15	PNG	-0.06	POL	-0.31
PRT	0.15	PRY	-0.55	QAT	-0.37
ROU	0.60	RUS	-1.64	RWA	-0.18
SAU	-0.24	SEN	-0.25	SLV	-4.77
SOM	-0.19	SVK	1.24	SVN	-1.39
SWE	13.94	SWZ	-0.18	SYR	0.22
THA	-0.16	TJK	3.77	TON	-0.13
TTO	-6.20	TUN	-0.28	TUR	-0.02
TZA	-0.22	UGA	-0.20	UKR	3.45
URY	-0.84	USA	-3.68	UZB	1.23
VEN	-3.05	VNM	-0.19	YEM	-0.19
ZAF	-0.23	ZMB	-0.24	ZWE	-0.26

Note: The real revenue is our measure of welfare. All numbers are percentage variations. Country code is ISO3.