Forthcoming in ***Public Choice***

Conflict and Agreement in the Collective Choice of Trade Policies: Implications for Interstate Disputes*

by

Yang-Ming Chang[†] and Manaf Sellak[‡]

This revised edition: September 2, 2022
Final acceptance: December 27, 2022

Abstract: From the collective choice perspective, this paper examines how different trade regimes have differing implications for two enemy countries' arming decisions in a three-country world with a neutral third-party state. We compare the two adversaries' aggregate arming (i.e., overall conflict intensity) and show that it is in *ascending* order for the following regimes: (i) a free trade agreement (FTA) between the adversaries, leaving the third-party state as a non-member, (ii) worldwide free trade in the presence of the interstate conflict, (iii) trade wars with Nash tariffs, and (iv) an FTA between the third country and one adversary, excluding the other adversary from the trade bloc. These results have policy implications for interstate conflicts. First, "dancing between two enemies" with an FTA results in lower aggregate arming than under worldwide free trade. Second, the world is "more dangerous" in tariff wars than under free trade. Third, an FTA between one adversary and the third party while keeping the other adversary as an outsider is *conflict-aggravating* since aggregate arming is the highest compared to all other trade regimes. We also analyze aggregate arming under a customs union (CU) and discuss differences/similarities in implications between a CU and an FTA for interstate conflicts.

Keywords*:* endogenous security, optimal tariffs, regional trade agreements, aggregate arming
JEL codes*:* D74, F15, F51, F52, F53

Declarations: The authors declare that they have no conflict of interests. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

---

*We are grateful to William F. Shughart II, Simon Medcalfe, Shane Sanders, Shih-Jye Wu, and two anonymous referees for their insightful comments and helpful suggestions. The usual disclaimers apply.

[†]Department of Economics, Kansas State University, 319 Waters Hall, Manhattan, KS 66506, Tel: (785)532-4573, Fax: (785) 532-6919, E-mail: ymchang@ksu.edu
[‡]School of Business, Washburn University, Rm 110M Henderson Learning Center, 1700 SW College Ave., Topeka, KS 66621, Tel: (785)473-8816, E-mail: manaf.sellak@Washburn.edu; Corresponding author

1. Introduction

Conflict over natural resources such as oil, natural gas, minerals, or resource-rich land beyond national boundaries constitutes a vital issue of rent-seeking activities at the international level.[1] The primary objective of the present paper is to use the collective choice approach to analyze the implications of different trade regimes for interstate conflict in a three-country trade framework with resource appropriation possibilities. We pay particular attention to the conflict-trade nexus in which enemy countries allocate optimal amounts of their endowments to arming for appropriating part of each other's natural resources (i.e., international rent-seeking activities), and, meanwhile, they may engage in trade or form a regional trade agreement.

The post-World War II era has witnessed an unprecedented proliferation of regional trade agreements (RTAs), particularly in the forms of free trade agreements (FTAs) and customs unions (CUs).[2] Under either an FTA or a CU, member countries enjoy duty-free access to each other's markets within the trade bloc. An FTA allows members to independently set external tariffs on imports from non-member states, but CU members jointly determine a common external tariff on imports from outsiders. Voluminous studies in international economics literature have contributed to our understanding of regional trade agreements. For example, Baldwin (1997) and Whalley (1998) analyze the economic determinants of forming RTAs. Carrere (2006) documents that RTAs have increased trade volume for member states, but at the expense of non-members. Vicard (2009) empirically shows that RTAs granting trade preferences to member states significantly increase bilateral trade. Baldwin and Jaimovich (2012) investigate whether FTAs contribute to the rapid spread of trade regionalism and find no significant evidence of slowing down multilateralism. Bagwell, Bown, and Staiger (2016) present a systematic review of RTAs and the perils and promises facing the world trading system. This important strand of the literature on trade institutions stresses the profound integration benefits of RTAs purely from the international economics perspective.[3]

During the post-World War II period, when numerous countries moved toward a higher degree of economic integration through trade, there appeared to have been a somewhat steady but primarily declining trend of militarized interstate disputes.[4] Nevertheless, recent developments in some parts of the continents have shown increasingly unpredictable trends of armed conflicts.[5] These observations prompt one to ponder whether trade regionalism is a double-edged sword: it increases the opportunity costs of

[1] See Findlay and O'Rourke (2010) for issues on natural resources, conflict, and trade from the historical perspective.
[2] Viner (1950) was the first to provide insights into the trade-creation and trade-diversion effects of a customs union.
[3]For studies on economic integration through RTAs and related issues see, e.g., Bagwell and Staiger (1997, 1989), Baier and Bergstrand (2004), Freund and Ornelas (2010), and Bergstrand, Egger, and Larch (2016).
[4]There were debates about the frequency of wars and the trend toward peace. See, e.g., the detailed discussions in Harrison and Wolf (2012) and Gleditsch and Pickering (2014).
[5]See *The Global Risks Report of 2018*, World Economic Forum.

going to war and, in the meanwhile, raises a nation's capacity to wage war for more resources. Given that RTAs are institutional arrangements across different countries, the other strand of the literature pays attention to issues on national security, interstate disputes, democratization, arms race, and alliances.

The empirical work of Mansfield and Bronson (1997) is among the first to show that allied countries engage in a higher volume of trade than those non-allied. The authors find that the relatively higher trade volume increases when the allies form RTAs. Investigating the relationship between trade institutions and military conflicts, Mansfield and Pevehouse (2000) document that member states of RTAs are less likely to have armed conflicts than non-members. Martin, Mayer, and Thoenig (2008, 2012) analyze trade causes of war. The authors find that enlarging members in an RTA reduces economic interdependence between any pair of rival states, which, in turn, raises the likelihood of bilateral war.[6] Liu and Ornelas (2014) empirically document that a country's participation in FTAs enhances the sustainability of its democracy. The authors remark that the mechanism behind the positive relationship between trade regionalism and consolidated democracy is "the destruction of rents in FTAs" associated with a member's change in its political regime. Hadjiyiannis, Heracleous, and Tabakis (2016) examine how RTAs between two adversaries or between one adversary and a neutral third party affect the possibility of going to war. McGuire (2020) presents a graphical analysis of the trade-conflict nexus to show that international systems may result in inter-state predation for resources while engaging in trade for mutual benefits.

From the collective choice perspective, we look at how different trade regimes may have differing implications for two enemy countries' arming decisions in a three-country world with a neutral third-party state. We focus our analysis on issues related to interstate disputes, tariff wars, and trade agreements by presenting an endogenous arming model of three-country trade and conflicts. We wish to shed light on the following questions. How would the arming decisions of enemy countries affect the prices of tradable goods and hence both export revenues and import demands under different trade regimes (e.g., RTAs, worldwide free trade, and tariff wars)? Given that trading blocs negatively affect non-members economically (Carrere, 2006), what effects do different trade regions have on member and non-member countries when they are enemies? Do commitments to integration arrangements through trade effectively reduce aggregate arming by adversaries being members of a trade bloc? Would the conflict-trade nexus

[6] For empirical studies on trade and conflict see, e.g., Polacheck (1980), Barbieri (1996), Barbieri and Levy (1999), Reuveny and Kang (1998), Kim and Rousseau (2005), and Glick and Taylor (2010). Polacheck (1980) shows that strengthening the extent of trade openness between enemy countries can lower their conflicts in terms of overall armament expenditures (a result echoed by O'Neal and Russet (1999)). However, studies such as Kim and Rousseau (2005) find that the pacifying effect of greater trade openness can be neutral. Other studies (e.g., Barbieri (1996)) find that extensive links through trade may increase the likelihood of armed conflicts. Barbieri and Levy (1999) show that war exerts no significant impact on trading relationships between adversaries. There appears no consensus on the trade-conflict nexus. For theoretical studies on trade and conflict see, e.g., Garfinkel et al. (2015).

hinge on the form of trading agreements for economic integration? Under the shadow of resource appropriations, would the world become "less dangerous" (i.e., aggregate arming is lower) under global free trade than under RTAs? In answering these questions from the conflict perspective, we introduce two warring countries' resource appropriation and arming decisions into a three-country trade-theoretic model *à la* Bagwell and Staiger (1997, 1999). Explicitly, we extend the two-country trade-conflict model of Chang and Wu (2020) to allow for different types of RTAs (e.g., FTA or CUs). This extension permits us to identify the conditions under which trade institutions may aggravate regional conflicts as arms buildups increase. Alternatively, it helps identify the trade regime resulting in lower aggregate arming.

The present study deviates from the literature on the trade-conflict nexus in several significant aspects. First, we adopt an endogenous security approach to determining the conflict-related arming decisions of two warring countries and analyze the optimal tariffs in a three-country world with a neutral third-party state when there is a global tariff war. Second, we use the framework to examine different trade regimes and the resulting arming allocations optimally chosen by the adversaries in the event of fighting. Specifically, we compare aggregate arming when two adversaries establish an FTA to those under different trade regimes with worldwide free trade or a tariff war. Third, we analyze possible differences/similarities in implications between an FTA and a CU for interstate conflicts.

We summarize the key findings of the paper as follows. Aggregate arming ranks from the lowest to the highest for the four different trade regimes: (i) an FTA between the adversaries while leaving a neutral third country as a non-member, (ii) worldwide free trade in the presence of interstate conflict, (iii) trade wars with Nash tariffs, and (iv) an FTA between the neutral third country and one adversary, excluding the other adversary from the trade bloc. These results have policy implications for trade institutions versus tariff wars under interstate disputes. First, an FTA between enemy countries causes their military buildups to be lower than those under worldwide free trade. Second, the world is "less dangerous" under worldwide free trade than in tariff wars. Third, an FTA between one adversary and a neutral third country is *conflict-aggravating* since aggregate arming ranks the highest. This result suggests that a third party's involvement in an FTA (based purely on economic advantages) may worsen armed conflicts.[7] We also compare aggregate arming with that in a customs union (CU) and discuss differences in implications between CU and FTA for interstate disputes. We find that aggregate arming ranks among the lowest when two enemy countries establish a CU. The conflict-deteriorating effect of an FTA, established between a neutral third country and an adversary while excluding the other adversary as an outsider, may not be present under a CU.

[7]For studies on third-party interventions in conflicts see, e.g., Regan (1998), Siqueira (2003), Rowlands and Carment (2006), Chang, Potter, and Shane (2007), Chang and Sanders (2009), Sanders and Walia (2014), and Chang and Sellak (2022).

Our simple analysis has implications for a real-world example of the conflict-aggravating outcome. While the world is moving toward a greater degree of globalization in trade, the Russia-Ukraine war constitutes an enormous scale of an interstate militarized conflict. The Russian invasion of Ukraine provides evidence of the conflict's aggravating outcome. Particularly when we consider the case in which Ukraine is offered a preferential trade agreement by a neutral third party (i.e., the European Union). From a Russian perspective, the European Union's preferential trade agreement with Ukraine and the intention of Ukraine to join the North Atlantic military alliance serve as an economic and security platform for gains that could potentially be used against Russia. In response to these developments, Russia perceives it as the benefit of the country to wage the war by increasing its conflict-related arming allocation, hoping to avoid any coercive action from a future economically and politically stronger Ukraine.[8]

The remainder of the paper proceeds as follows. Section 2 presents a three-country trade model with interstate disputes and derives the equilibrium under tariff wars. Section 3 analyzes the outcome when two adversaries establish an FTA, and Section 4 examines the case under free trade. Section 5 discusses an FTA between an adversary and a neutral third party. We then compare arming allocations under different trade regimes. Section 6 examines arming under a CU. Section 7 presents aggregate payoff comparisons across all the trade regimes, and Section 8 concludes.

2. The Three-Country Trade Model with Interstate Conflicts

2.1 *Basic assumptions on resource predation, product markets, and aggregate payoff*

We consider a world of three countries, *A*, *B*, and *C*, where *A* and *B* are "enemies" as they contest part of each other's resources, and *C* is a neutral third party (or the rest of the world). Each country possesses R units of a different resource input exclusively used to produce a country-specific good for consumption or exportation. We incorporate elements of conflict into a standard three-country trade framework to analyze trade among the three large open economies. This approach allows us to see how arming decisions of two resource-conflict countries (*A* and *B*) are affected by different trade regimes. There are three different consumption goods: a, b, and c. Each country specializes in producing a tradable good in its country name, while imports two other products. For each country's production technology, we consider one unit of resource input produces one unit of final good in its specialization.

Given that *A* and *B* are each other's enemies, they transform fractions of their endowments into

[8] Our analysis may also have implications for WTO trade policymakers. A member country, that is engaged in war with another member country, is likely to aggravate conflict intensity when one adversary signs a preferential trade agreement with a neutral third-party state while excluding the other adversary as a non-member. The world would become "less dangerous" (that is, less military buildup) when WTO policymakers encourage all the countries (the adversaries and the third-party state) to form an FTA or a CU.

guns for appropriating each other's resources. We consider a simple military technology that one unit of an endowed resource produces one unit of guns. Denote $G^A(>0)$ and $G^B(>0)$ as the amounts of resources allocated to arming by *A* and *B*, respectively. Following the conflict literature, we use the conflict-related arming allocation of a contending country to reflect its security policy. To measure a conflicting country's share in retaining its endowed resource after fighting, denoted as Ψ^A for *A* and Ψ^B for B, we follow Tullock (1980), Hirshleifer (1989), and Skaperdas (1996) by using the following contest success functions (CSFs):

$$\Psi^A = \frac{G^A}{G^A + G^B} \text{ and } \Psi^B = \frac{G^B}{G^A + G^B} \text{ where } G^A + G^B > 0. \tag{1}$$

In conflict, country *A* loses K^A units of good *a*, and country *B* loses K^B units of good *b*.[9] Taking into account arming allocations and destruction costs, we calculate the quantities of goods a and b that countries *A* and *B* supply to the markets:

$$Z_a^A = (\frac{G^A}{G^A + G^B})R - G^A - K^A \text{ and } Z_b^B = (\frac{G^B}{G^A + G^B})R - G^B - K^B. \tag{2}$$

As for consumer preferences over the final (or civilian) goods, we assume for analytical simplicity that market demand for good $i \in \{a,b,c\}$ in country $j \in \{A,B,C\}$ is linear:

$$Q_i^j = \alpha - \beta P_i^j, \tag{3a}$$

where P_i^j is the price of good i in country j, the parameter $\alpha(>1>R)$ is a measure of market size, and $\beta > 0$. Corresponding to the demands in (3a), we have consumer surplus (*CS*) for country j:

$$CS^j = \frac{1}{2\beta}[(\alpha - \beta P_a^j)^2 + (\alpha - \beta P_b^j)^2 + (\alpha - \beta P_c^j)^2]. \tag{3b}$$

This *CS* measure implies that the benefits of each country's consumers depend on a product domestically produced and two other products from abroad (either through imports or via appropriation from its enemy). The CS measure in (3b) may reflect "economic interdependence" in consumption through international trade and/or appropriation.

As for producers in each country, we first look at the producer surplus (*PS*) measures of the two adversaries *A* and *B*. The amounts of final goods that the enemy countries appropriate from each other are: $APP_b^A = [G^A/(G^A + G^B)]R$ for country *A* and $APP_a^B = [G^B/(G^A + G^B)]R$ for country *B*. As such, the *PS* measures for *A* and *B* are the total values of domestic production and interstate appropriation:

[9]As in Hadjiyiannis et al (2016), we assume that K^A and K^B are fixed costs of destruction to *A* and *B*.

$$PS^A = P_a^A Z_a^A + P_b^A[(\frac{G^A}{G^A+G^B})R] \text{ and } PS^B = P_b^B Z_b^B + P_a^B[(\frac{G^B}{G^A+G^B})R], \tag{4}$$

where Z_a^A is the quantity of good a produced by country *A* and Z_b^B is that of good b produced by country B (see equation 2). The two measures PS^A and PS^B in (4) represent the market values of production and predation for *A* and *B*, respectively.

Country *C*, not an enemy to either *A* or *B*, produces and supplies R units of good c to the market. This implies that country *C*'s producer surplus is:

$$PS^C = P_c^C R. \tag{5}$$

The objective of country *j* is to maximize its domestic aggregate payoff (Π^j) taken as follows:

$$\Pi^j = CS^j + PS^j + TR^j \text{ for } j \in \{A, B, C\}, \tag{6}$$

where CS^j and PS^j are given in (3)-(5). Note that tariff revenues TR^j depend on the trading relationships among the three countries, which are the focal points of our subsequent analyses.

We adopt a four-stage game to analyze different trade regimes and interstate conflict in a three-country world. Stage one is the trade regime commitment stage at which (i) two countries forming an RTA agree on duty-free access to each other's market, or (ii) the three countries agree upon a worldwide free trade despite an interstate conflict, or (iii) they commit to engaging in tariff trade wars. Stage two is the security stage at which the two adversaries, *A* and *B*, independently determine their optimal arming allocations in the event of fighting. Stage three is the tariff-setting stage at which each country determines its tariff structure on imports, depending on whether two of the three countries form an FTA, whether there is worldwide free trade (under which tariff rates are zero), or whether there are tariff wars. At the fourth and last stage of the game, the three countries engage in trade, taken as given the conditions and decisions in the previous stages. We use backward induction to derive a sub-game perfect Nash equilibrium for each trade regime. We first examine the regime with a global (three-country) tariff war.

2.2 *Global tariff war (or the protectionist regime) as the benchmark*

In the absence of economic integration through cooperative trading arrangements, there is a protectionist regime under which each country imposes tariffs for restraining imports. Denote τ_i^j as the specific tariff that country $j \in \{A, B, C\}$ imposes on its import of good $i \in \{a, b, c\}$. We derive the conflict-trade equilibrium for the case of resource appropriation possibilities between adversaries *A* and *B*. This case is the benchmark for evaluating equilibrium outcomes under other trade regimes.

To maintain the patterns of trade and the specialization of production as described earlier, we follow the comparative advantage principle that a good's price in an exporting country plus a specific tariff imposed on the good by an importing country will not be lower than the good's price in the importing country. This principle excludes arbitrage in the three-country framework (Bagwell and Staiger, 1997, 1999). For good *a* that country *A* produces and exports, we have the no-arbitrage conditions:

$$P_a^A + \tau_a^B = P_a^B \text{ and } P_a^A + \tau_a^C = P_a^C, \tag{7}$$

where τ_a^B and τ_a^C are specific tariffs imposed by countries *B* and *C*, respectively, on good *a*.[10] We solve the equilibrium price of the good in country *A* by equating its aggregate demand with aggregate supply. That is, trade equilibrium for good *a* requires that

$$(\alpha - \beta P_a^A) + (\alpha - \beta P_a^B) + (\alpha - \beta P_a^C) = 3 - G^A - K^A. \tag{8}$$

In (8),[11] we assume that the value of R equals 3 as in Hadjiyiannis et al. (2016) for tractability. Equations (7) and (8) imply that the market prices of good a in the three countries are:

$$P_a^A = \frac{3\alpha - \beta(\tau_a^B + \tau_a^C) - (3 - G^A - K^A)}{3\beta}, \quad P_a^B = \frac{3\alpha + 2\beta\tau_a^B - \beta\tau_a^C - (3 - G^A - K^A)}{3\beta},$$

$$P_a^C = \frac{3\alpha - \beta\tau_a^B + 2\beta\tau_a^C - (3 - G^A - K^A)}{3\beta}. \tag{9}$$

Similarly, for good *b* that country *B* produces and exports, the no-arbitrage conditions are:

$$P_b^B + \tau_b^A = P_b^A \text{ and } P_b^B + \tau_b^C = P_b^C, \tag{10}$$

where τ_b^A and τ_b^C are specific tariffs set by countries *A* and *C* on good *b*. Trade equilibrium requires that

$$(\alpha - \beta P_b^A) + (\alpha - \beta P_b^B) + (\alpha - \beta P_b^C) = 3 - G^B - K^B. \tag{11}$$

Equations (10) and (11) imply that the market prices of good b in the three countries are:[12]

$$P_b^B = \frac{3\alpha - \beta(\tau_b^A + \tau_b^C) - (3 - G^B - K^B)}{3\beta}, \quad P_b^A = \frac{3\alpha + 2\beta\tau_b^A - \beta\tau_b^C - (3 - G^B - K^B)}{3\beta},$$

$$P_b^C = \frac{3\alpha - \beta\tau_b^A + 2\beta\tau_b^C - (3 - G^B - K^B)}{3\beta}. \tag{12}$$

As for good c, the balance-of-trade condition is:

$$(\alpha - \beta P_c^A) + (\alpha - \beta P_c^B) + (\alpha - \beta P_c^C) = 3, \tag{13}$$

---

[10] Since τ_a^B and τ_a^C are all positive under the protectionist regime, the non-arbitrage conditions imply that $P_a^A < P_a^B$ and $P_a^A < P_a^C$. Country *A* thus has the comparative advantage in producing and exporting good a.

[11] An alternative approach leading to the same trade equilibrium condition (8) can be found in Appendix A-1.

[12] See Appendix A-2 for an alternative approach that result in the same trade equilibrium condition as in (11).

where P_c^A and P_c^B satisfy the non-arbitrary conditions:

$$P_c^C + \tau_c^A = P_c^A \quad \text{and} \quad P_c^C + \tau_c^B = P_c^B. \tag{14}$$

Equations (13)-(14) imply that the market prices of good c in the three countries are:

$$P_c^A = \frac{3\alpha + 2\beta\tau_c^A - \beta\tau_c^B - 3}{3\beta},\ P_c^B = \frac{3\alpha - \beta\tau_c^A + 2\beta\tau_c^B - 3}{3\beta},\ P_c^C = \frac{3\alpha - \beta(\tau_c^A + \tau_c^B) - 3}{3\beta}. \tag{15}$$

The above analysis depicts the last stage of the four-stage game where the three countries engage in trade.

We proceed to the third stage at which the three countries determine their optimal tariffs. For country *A*, its total revenue from imposing tariffs, $\{\tau_b^A, \tau_c^A\}$, on goods *b* and *c* is:

$$TR^A = \tau_b^A M_b^A + \tau_c^A M_c^A, \tag{16a}$$

where M_b^A and M_c^A are the quantities of the two goods imported. That is,

$$M_b^A = [(\frac{G^B}{G^A + G^B})3 - G^B - K^B] - (\alpha - \beta P_b^B) - (\alpha - \beta P_b^C), \tag{16b}$$

$$M_c^A = 3 - (\alpha - \beta P_c^B) - (\alpha - \beta P_c^C). \tag{16c}$$

Substituting the price equations from (9), (12), and (15) into CS^A in (3), PS^A in (4), and TR^A in (16a), we calculate country *A*'s aggregate payoff $\Pi^A (\equiv CS^A + PS^A + TR^A)$ as a function of tariff rates, $\{\tau_b^A, \tau_c^A, \tau_a^B, \tau_c^B, \tau_a^C, \tau_b^C\}$, and arming allocations, $\{G^A, G^B\}$. Country *A* determines an optimal tariff structure, $\{\tau_b^A, \tau_c^A\}$, to maximize its aggregate payoff according to the first-order conditions (FOCs): $\partial\Pi^A / \partial\tau_b^A = 0$ and $\partial\Pi^A / \partial\tau_c^A = 0$. Solving for *A*'s tariffs yields:

$$\tau_b^A = \frac{\beta\tau_b^C - K^B}{8\beta} + \frac{(3 - G^A - G^B)G^B - 6G^A}{8\beta(G^A + G^B)} \quad \text{and} \quad \tau_c^A = \frac{\tau_c^B}{8} + \frac{3}{8\beta}. \tag{17}$$

For country *B*, its total revenue from imposing tariffs, $\{\tau_a^B, \tau_c^B\}$, on goods *a* and *c* is:

$$TR^B = \tau_a^B M_a^B + \tau_c^B M_c^B, \tag{18a}$$

where M_a^B and M_c^B are given, respectively, as

$$M_a^B = [(\frac{G^A}{G^A + G^B})3 - G^A - K^A] - (\alpha - \beta P_a^A) - (\alpha - \beta P_a^C), \tag{18b}$$

$$M_c^B = 3 - (\alpha - \beta P_c^A) - (\alpha - \beta P_c^C). \tag{18c}$$

Similarly, we substitute the price equations from (9), (12), and (15) into CS^B in (3), PS^B in (4), and TR^B in (18a) to calculate country *B*'s aggregate payoff $\Pi^B (\equiv CS^B + PS^B + TR^B)$ as a function of tariff rates, $\{\tau_b^A, \tau_c^A, \tau_a^B, \tau_c^B, \tau_a^C, \tau_b^C\}$, and arming allocations, $\{G^A, G^B\}$. Country *B* determines an optimal tariff structure, $\{\tau_a^B, \tau_c^B\}$, to maximize its aggregate payoff Π^B. Solving for *B*'s tariffs yields:

$$\tau_a^B = \frac{\beta\tau_a^C - K^A}{8\beta} + \frac{(3 - G^A - G^B)G^A - 6G^B}{8\beta(G^A + G^B)} \text{ and } \tau_c^B = \frac{\tau_c^A}{8} + \frac{3}{8\beta}. \tag{19}$$

For country *C*, its total revenue from imposing tariffs, $\{\tau_a^C, \tau_b^C\}$, on goods *a* and *b* is:

$$TR^C = \tau_a^C M_a^C + \tau_b^C M_b^C, \tag{20}$$

where M_a^C and M_b^C are given, respectively, as $M_a^C = (\alpha - \beta P_a^C)$ and $M_b^C = (\alpha - \beta P_b^C)$.

Substituting the price equations from (9), (12), and (15) into CS^C in (3), PS^C in (5), and TR^C in (20), we calculate country *C*'s aggregate payoff $\Pi^C (\equiv CS^C + PS^C + TR^C)$ as a function of tariff rates, $\{\tau_b^A, \tau_c^A, \tau_a^B, \tau_c^B, \tau_a^C, \tau_b^C\}$, and arming allocations, $\{G^A, G^B\}$. Country *C* sets an optimal tariff structure, $\{\tau_a^C, \tau_b^C\}$, to maximize its aggregate payoff. Solving for *C*'s tariffs yields:

$$\tau_a^C = \frac{\tau_a^B}{8} + \frac{3 - G^A - K^A}{8\beta} \text{ and } \tau_b^C = \frac{\tau_b^A}{8} + \frac{3 - G^B - K^B}{8\beta}. \tag{21}$$

Utilizing the tariff equations, as shown in (17), (19), and (21), we calculate the equilibrium Nash tariffs as functions of arming allocations under the protectionist regime (*PR*):

$$\tau_b^{A,PR} = \frac{(3 - G^A - G^B)G^B - 5G^A}{7\beta(G^A + G^B)} - \frac{K^B}{7\beta}, \quad \tau_a^{B,PR} = \frac{(3 - G^A - G^B)G^A - 5G^B}{7\beta(G^A + G^B)} - \frac{K^A}{7\beta},$$

$$\tau_a^{C,PR} = \frac{2G^B + (3 - G^A - G^B)G^A}{7\beta(G^A + G^B)} - \frac{K^A}{7\beta}, \quad \tau_b^{C,PR} = \frac{2G^A + (3 - G^A - G^B)G^B}{7\beta(G^A + G^B)} - \frac{K^B}{7\beta},$$

$$\tau_c^{A,PR} = \frac{3}{7\beta}, \quad \tau_c^{B,PR} = \frac{3}{7\beta}. \tag{22a}$$

The Nash tariffs in (22a) imply the following comparative-static results (see Appendix A-3):

$$\frac{\partial\tau_b^{A,PR}}{\partial G^A} < 0, \quad \frac{\tau_b^{A,PR}}{\partial G^B} < 0, \quad \frac{\partial\tau_a^{B,PR}}{\partial G^A} < 0, \quad \frac{\partial\tau_a^{B,PR}}{\partial G^B} < 0, \quad \frac{\partial\tau_a^{C,PR}}{\partial G^A} < 0, \quad \frac{\partial\tau_a^{C,PR}}{\partial G^B} < 0,$$

$$\frac{\partial\tau_b^{C,PR}}{\partial G^A} < 0, \quad \frac{\partial\tau_b^{C,PR}}{\partial G^B} < 0, \quad \tau_c^{A,PR} > \tau_a^{C,PR}, \quad \tau_c^{B,PR} > \tau_b^{C,PR}. \tag{22b}$$

We summarize their economic implications as follows:

LEMMA 1. *Under the protectionist regime, we have:*

(i) Optimal tariffs set by the adversaries on their imports from the neutral third country are independent of their arming allocations. However, optimal tariffs are negatively correlated with each adversary's arming;

(ii) Optimal tariffs that the adversaries impose on their imports from the third country are <u>*higher*</u> *than the tariffs that the third country imposes on imports from the adversaries.*

The economic intuitions are as follows. Given that country *C* is not an enemy of *A* and *B*, the adversaries' arming allocations do not affect their tariffs on imports from the third party. As *A* and *B* are involved in resource conflicts, increasing each adversary's arming lowers the amount of its endowed resource available for domestic production, which is payoff-reducing. In response to this adverse effect, both *A* and *B* find it better off to lower tariffs on their imports. This explains why the optimal tariffs set by the adversaries *A* and *B* are negatively related to their arming. Although the optimal tariffs set by *A* and *B* on their imports from *C* are independent of their arming allocations, each adversary sets a higher tariff rate than that set by the neutral country *C*. This higher tariff allows each adversary country to mitigate the production-distortion effect of arming as it negatively affects domestic consumption.

Next, we proceed to the arming stage, where the adversaries *A* and *B* independently decide on their allocations of resources for fighting. Under symmetry, $G^{A,PR} = G^{B,PR} = G^{PR}$. This exercise yields

$$G^{PR} = \frac{\sqrt{38416\alpha^2 + 4312\alpha - 22319 + K(17424K + 51744\alpha - 28248)}}{264} - \frac{49}{66}\alpha - \frac{1}{2}K + \frac{35}{24}. \tag{23}$$

It can be verified that G^{PR} in (23) is positive for $\alpha > R,$ where R is taken to be 3.

It is instructive to see how each adversary country's arming affects its domestic aggregate payoff. Using country *A* as an example (under the assumption of symmetry), we show in Appendix A-4 the following aggregate payoff decomposition:

$$\begin{aligned}\frac{\partial \Pi^A}{\partial G^A} = & \underbrace{[Z_a^A - (\alpha - \beta P_a^A)]\frac{\partial P_a^A}{\partial G^A}}_{\substack{\text{Export-revenue effect} \\ (+)}} + \underbrace{\frac{\partial (APP_b^A)}{\partial G^A} P_b^A}_{\substack{\text{Resource-appropriation effect} \\ (+)}} \\ & + \underbrace{[\tau_b^A \frac{\partial M_b^A}{\partial G^A} + M_b^A \frac{\partial \tau_b^A}{\partial G^A}) - M_b^A \frac{\partial P_b^A}{\partial G^A}]}_{\substack{\text{Tariff-revenue plus import-spending effect} \\ (-)}} + \underbrace{\frac{\partial Z_a^A}{\partial G^A} P_a^A}_{\substack{\text{Output-distortion effect} \\ (-)}} = 0\end{aligned} \tag{24}$$

where $APP_b^A \equiv [G^A/(G^A + G^B)]R$ for $R = 3$ is the amount of good *b* appropriated by country *A*. We thus have:

LEMMA 2. *In tariff wars within a three-country world with two adversaries and one neutral third party, the impact of an adversary's arming on its domestic aggregate payoff contains four components: (i) The first is an export-revenue effect, increasing the aggregate payoff as arming causes export price and revenue to go up. (ii) The second is a resource-appropriation effect, increasing the aggregate payoff as arming increases the appropriation of a final good for domestic consumption. (iii) The third is a tariff-revenue plus import-spending effect, reducing the aggregate payoff as arming raises import price, lowers import demand, and reduces tariff revenue net of import spending. (iv) The fourth is an output-distortion effect, reducing the aggregate payoff as arming causes decreases domestic production.*

The first two effects (*i* and *ii*) increase aggregate payoff and constitute the marginal revenue (*MR*) of arming, whereas the last two effects (*iii* and *iv*) decrease aggregate payoff and reflect the marginal cost (*MC*) of arming. Each adversary's arming is determined by the marginal condition that *MR = MC.*[13]

The above analysis promotes us to analyze how the optimal arming, G^{PR}, under the tariff war is affected by different types of FTAs (e.g., an FTA between two adversaries or between one of the adversaries and a neutral third party). We shall see that the endogenous arming analysis permits us to compare the optimal security/arming levels under alternative trade regimes. We investigate the following scenario: two enemy countries form a free trade agreement.

3. FTA between Two Adversaries (with Third-Party State as a Non-Member)

The primary question concerns how the endogenous arming decisions of two adversaries *A* and *B* would change when they establish an FTA to access each other's market duty-free (despite the resource appropriation possibilities). One issue of policy importance is: Would each adversary allocate more or less of its endowed resource to arming under the FTA regime (i.e., “dancing with the enemy” in trade regionalism) than the conflict equilibrium in the tariff wars?

In such a framework of an FTA between two enemy countries, the third country *C* (as a non-member) imposes tariffs on imports from *A* and *B*. We use a four-stage game to determine the sub-game perfect Nash equilibrium for an FTA between *A* and *B*. We denote this trade institution as the *FTA(A&B)* regime. At stage one, *A* and *B* commit to establishing the *FTA(A&B)* regime. At stage two, *A* and *B* independently and simultaneously determine optimal arming allocations that maximize their domestic aggregate payoff. At stage three, *A* and *B* set zero tariffs ($\tau_b^A = \tau_a^B = 0$) on each others' imports and independently determine their optimal tariffs τ_c^A and τ_c^B on imports from the third country *C*. In the meanwhile, country *C* sets its optimal tariff structure, $\{\tau_a^C, \tau_b^C\}$, on imports from *A* and *B*. At stage four,

[13]This aligns with Hirshleifer (1991) in analyzing arming and the technology of conflict as an economic activity.

the three countries engage in trade.

Given that $\tau_b^A = \tau_a^B = 0$ under the *FTA(A&B)* regime, we substitute zero tariff rates into the price equations in (9), (12), and (15). As such, the market prices of goods *a*, *b*, and *c* are:

$$P_a^{A,FTA(A\&B)} = P_a^{B,FTA(A\&B)} = \frac{3\alpha - \beta\tau_a^C - (3 - G^A - K^A)}{3\beta},$$

$$P_b^{A,FTA(A\&B)} = P_b^{B,FTA(A\&B)} = \frac{3\alpha - \beta\tau_b^C - (3 - G^B - K^B)}{3\beta},$$

$$P_a^{C,FTA(A\&B)} = \frac{3\alpha + 2\beta\tau_a^C - (3 - G^A - K^A)}{3\beta}, \quad P_b^{C,FTA(A\&B)} = \frac{3\alpha + 2\beta\tau_b^C - (3 - G^B - K^B)}{3\beta},$$

$$P_c^{A,FTA(A\&B)} = \frac{3\alpha + 2\beta\tau_c^A - \beta\tau_c^B - 3}{3\beta}, \quad P_c^{B,FTA(A\&B)} = \frac{3\alpha - \beta\tau_c^A + 2\beta\tau_c^B - 3}{3\beta},$$

$$P_c^{C,FTA(A\&B)} = \frac{3\alpha - \beta(\tau_c^A + \tau_c^B) - 3}{3\beta}. \tag{25}$$

Note that the tariff rates, τ_c^A, τ_c^B, and $\{\tau_a^C, \tau_b^C\}$ in (25) remain to be determined by the countries at the third stage of the game.

To calculate an optimal tariff that country *A* imposes on good *c*, denoted as $\tau_c^{A,FTA(A\&B)}$, we note the import demand equation: $M_c^{A,FTA(A\&B)} = \alpha - \beta P_c^{A,FTA(A\&B)}$, where $P_c^{A,FTA(A\&B)}$ is given in (25). Country *A*'s aggregate payoff function is:

$$\Pi^{A,FTA(A\&B)} = CS^{A,FTA(A\&B)} + PS^{A,FTA(A\&B)} + \tau_c^{A,FTA(A\&B)} M_c^{A,FTA(A\&B)},$$

where the first term is consumer surplus (see equation 3b), and the second term is producer surplus (see equation 4) with the prices of goods *a*, *b*, and *c* being given in (25). Country *A*'s FOC is:

$$\frac{\partial \Pi^{A,FTA(A\&B)}}{\partial \tau_c^{A,FTA(A\&B)}} = \frac{\beta\tau_c^{B,FTA(A\&B)}}{9} - \frac{8\tau_c^{A,FTA(A\&B)}}{9} + \frac{1}{3} = 0,$$

which implies that

$$\tau_c^{A,FTA(A\&B)} = \frac{\tau_c^{B,FTA(A\&B)}}{8} + \frac{3}{8\beta}. \tag{26a}$$

To calculate country *B*'s optimal tariff on good *c*, we note the import demand: $M_c^{B,FTA(A\&B)} = \alpha - \beta P_c^{B,FTA(A\&B)}$, where $P_c^{B,FTA(A\&B)}$ is given in (25). Country *B*'s aggregate payoff function is: $\Pi^{B,FTA(A\&B)} = CS^{B,FTA(A\&B)} + PS^{B,FTA(A\&B)} + \tau_c^{B,FTA(A\&B)} M_c^{B,FTA(A\&B)}$, where the first term is consumer surplus (see equation 3b), and the second term is producer surplus (see equation 4) with the prices of goods *a*, *b*, and *c* being given in (25). Country *B*'s FOC is:

$$\frac{\partial \Pi^{B,FTA(A\&B)}}{\partial \tau_c^{B,FTA(A\&B)}} = \frac{\beta \tau_c^{A,FTA(A\&B)}}{9} - \frac{8\tau_c^{B,FTA(A\&B)}}{9} + \frac{1}{3} = 0,$$

which implies that

$$\tau_c^{B,FTA(A\&B)} = \frac{\tau_c^{A,FTA(A\&B)}}{8} + \frac{3}{8\beta}. \tag{26b}$$

As for country *C*, it sets an optimal tariff structure on imports from *A* and *B* to maximize its aggregate payoff: $\Pi^{C,FTA(A\&B)} = CS^{C,FTA(A\&B)} + PS^{C,FTA(A\&B)} + TR^{C,FTA(A\&B)}$, where the first term is consumer surplus, the second term is producer surplus, and the third term is tariff revenue, $TR^{C,FTA(A\&B)} = \tau_a^{C,FTA(A\&B)}[\alpha - \beta P_a^{C,FTA(A\&B)}] + \tau_b^C[\alpha - \beta P_b^{C,FTA(A\&B)}]$, with the prices of goods *a*, *b*, and *c* being given in (25). Country *C*'s FOCs imply that

$$\tau_a^{C,FTA(A\&B)} = \frac{3 - G^A - K^A}{8\beta} \text{ and } \tau_b^{C,FTA(A\&B)} = \frac{3 - G^B - K^B}{8\beta}. \tag{26c}$$

Making use of (26a)-(26c), we solve for the optimal tariffs:

$$\tau_c^{A,FTA(A\&B)} = \tau_c^{B,FTA(A\&B)} = \frac{3}{7\beta}. \tag{26d}$$

Following from (26c) and (26d), we have:

$$\frac{\partial \tau_a^{C,FTA(A\&B)}}{\partial G^A} = \frac{\partial \tau_b^{C,FTA(A\&B)}}{\partial G^B} = -\frac{1}{8\beta} < 0,$$

$$\tau_c^{A,FTA(A\&B)} > \tau_a^{C,FTA(A\&B)}, \text{ and } \tau_c^{B,FTA(A\&B)} > \tau_b^{C,FTA(A\&B)}. \tag{27}$$

Under the *FTA(A&B)* regime, the optimal tariffs set by *A* and *B* on imports from the neutral third country C are independent of their conflict-related arming decisions. However, the optimal tariffs set by C on its imports from *A* and *B* are lower as the adversaries' arming levels are higher. We also observe that *A* and *B*, as FTA members, set higher tariffs on their imports from the third country (as a non-member) than the third country's tariffs on its imports from *A* and *B*.[14]

We proceed to the second stage, where the adversaries *A* and *B* independently and simultaneously determine their optimal arming allocations. Substituting the tariff rates from (26c) back into the aggregate payoff functions of *A* and *B*, we have $\Pi^{A,FTA(A\&B)}$ and $\Pi^{B,FTA(A\&B)}$ as functions of arming allocations,

[14] These qualitative results in (27) are similar to those as shown in Lemmas 1 and 2 for the tariff comparisons under the protectionist regime.

G^A and G^B. The FOCs for countries *A* and *B* are: $\partial\Pi^{A,FTA(A\&B)}/\partial G^A = 0$ and $\partial\Pi^{B,FTA(A\&B)}/\partial G^B = 0.$ Under the assumption of symmetry, we have the Nash equilibrium arming levels as $G^{A,FTA(A\&B)} = G^{B,FTA(A\&B)} = G^{FTA(A\&B)}$. This exercise allows us to solve for the optimal arming as follows:

$$G^{FTA(A\&B)} = \frac{\sqrt{4096\alpha^2 - 3159 + K(1521K + 4992\alpha - 3510)}}{78} - \frac{32\alpha}{39} - \frac{K}{2} + \frac{3}{2}. \tag{28}$$

Under symmetry and the same values of the exogenous variables, we have from $G^{FTA(A\&B)}$ in (28) and G^{PR} in (23) that

$$G^{FTA(A\&B)} < G^{PR}. \tag{29a}$$

The result in (29a) indicates that the enemy countries *A* and *B* allocate fewer resources to arming under the *FTA(A&B)* regime than in a tariff war. Denoting aggregate arming as $ARMS \equiv G^A + G^B$, we have from (29a) that

$$ARMS^{FTA(A\&B)} < ARMS^{PR}. \tag{29b}$$

Given the results in (29a) and (29b), we compare the optimal tariffs under the protectionist regime to those under the *FTA*(*A&B*) regime, as shown in (22a) and (27a). This exercise yields:

$$\tau_a^{C,FTA(A\&B)} < \tau_a^{C,PR} \text{ and } \tau_b^{C,\,FTA(A\&B)} < \tau_b^{C,\,PR}.$$

The economic implications are as follows. Moving from the protectionist regime to the *FTA(A&B)* regime, the adversary countries *A* and *B* become intra-bloc members, whereas country *C* is an outsider. In response, country *C* sets <u>lower</u> tariffs in the face of the *FTA(A&B)* regime than its tariffs under the protectionist regime (i.e., in the trade wars). This result is consistent with the "tariff complementarity effect" associated with an FTA in a peacetime scenario without fighting, as shown in the trade literature (Bagwell and Staiger, 1999). The *FTA(A&B)* regime improves terms-of-trade benefits for member countries *A* and *B* *vis-à-vis* non-member country *C*.

Moreover, as FTA members, the enemy countries (*A* and *B*) benefit from duty-free access to each other's market, encouraging them to allocate more resources to produce final goods for exports within the trade bloc. FTA provides a positive incentive for each adversary to allocate fewer resources to arming. Consequently, a conflict-reducing effect is associated with forming an FTA between two adversaries. As shown in the aggregate payoff decomposition analysis (see equation 24), the results imply that, under the *FTA(A&B)* regime, the positive resource-appropriation effect of arming on aggregate payoff is insufficient to outweigh the economic benefits from the following two factors. One is the elimination of trade barriers by forming an FTA between *A* and *B*. The other is the tariff complementarity effect, which improves the trading positions of both *A* and *B* relative to *C*.

The results of the above analyses permit us to establish the first proposition:

PROPOSITION 1. *In a three-country world with two adversaries and one neutral third country, an FTA between the adversaries (A and B) allows each member country to access the other's market duty-free while independently setting their optimal tariff rates on imports from the third country. Moreover, the FTA(A&B) regime results in lower aggregate arming than in trade wars with Nash tariffs.*

Proposition 1 indicates that the commitment to form an FTA between two enemy countries (keeping the neutral third country as a non-member) has an important policy implication for interstate conflicts. FTA makes it possible for the adversary countries to be members of a trade institution. The adversaries become less likely to engage in military aggression since the FTA allows each member to access the other's market duty-free. This trade regime encourages each FTA member to allocate more resources to produce their products for exports, causing the aggregate arming to decline. In other words, FTA constitutes a conflict-reducing trade institution for two enemy countries. This endogenous arming analysis provides a theoretical justification for the empirical finding of Mansfield and Pevehouse (2000). The authors empirically show that joint memberships in preferential trade agreements significantly reduce hostility between intra-bloc members.

One crucial issue that appears not to have been examined in the conflict and trade literature concerns whether forming an FTA between two adversaries makes the world relatively "less dangerous" (in terms of aggregate arming or conflict intensity) than the global free trade regime in the presence of an interstate conflict. We proceed to investigate this issue in the next section.

4. Worldwide Free Trade (Despite the Presence of a Two-Country Conflict)

When there is worldwide free trade (denoted as *WFT*), tariff rates set by the three countries (*A*, *B*, and *C*) at the third stage of the four-stage game are all zero. That is, $\tau_i^{j,WFT} = 0$ for $i \in \{a,\ b, c\}$ and $j \in \{A,\ B,\ C\}$. Given the zero tariffs, the three countries engage in free trade such that the market prices of goods *a*, *b*, and *c* under the *WFT* regime are:[15]

$$P_a^{A,WFT} = P_a^{B,WFT} = P_a^{C,WFT} = \frac{3\alpha - (3 - G^A - K^A)}{3\beta},$$

$$P_b^{A,WFT} = P_b^{B,WFT} = P_b^{C,WFT} = \frac{3\alpha - (3 - G^B - K^B)}{3\beta},$$

[15]We substitute zero tariff rates into the price equations in (9), (12), and (15).

$$P_c^{A,WFT} = P_c^{B,WFT} = P_c^{C,WFT} = \frac{\alpha - 1}{\beta}. \tag{30}$$

At the second stage, both the adversaries *A* and *B* determine their optimal arming allocations. For country *A*, its aggregate payoff function is: $\Pi^{A,WFT} = CS^{A,WFT} + PS^{A,WFT}$, where $CS^{A,WFT}$ is consumer surplus (see equation 3b) and $PS^{A,WFT}$ is producer surplus (see equation 4) with the prices of goods *a*, *b*, *c* being given by (30). Symmetrically, country *B*'s aggregate payoff function is:

$$\Pi^{B,WFT} = CS^{B,WFT} + PS^{B,WFT},$$

where $CS^{B,WFT}$ is consumer surplus and $PS^{B,WFT}$ is producer surplus with the goods' prices in (30a).

The FOCs for *A* and *B*, $\partial\Pi^{A,WFT}/\partial G^A = 0$ and $\partial\Pi^{B,WFT}/\partial G^B = 0$, lead to the Nash equilibrium levels of arming, denoted as $\{G^{A,WFT}, G^{B,WFT}\}$. Under symmetry, we have $G^{A,WFT} = G^{B,WFT} = G^{WFT}$. This exercise yields the optimal arming as follows:

$$G^{WFT} = \frac{\sqrt{81\alpha^2 - 45 + K(25K + 90\alpha - 60)}}{10} - \frac{9\alpha}{10} - \frac{K}{2} + \frac{3}{2}. \tag{31}$$

A direct comparison among $G^{FTA(A,B)}$ in (28), G^{PR} in (23), and G^{WFT} in (31), under symmetry and the plausible values of exogenous variables, yields

$$G^{FTA(A\&B)} < G^{WFT} < G^{PR}. \tag{32}$$

In terms of aggregate arming, it is straightforward that

$$ARMS^{FTA(A\&B)} < ARMS^{WFT} < ARMS^{PR}. \tag{33}$$

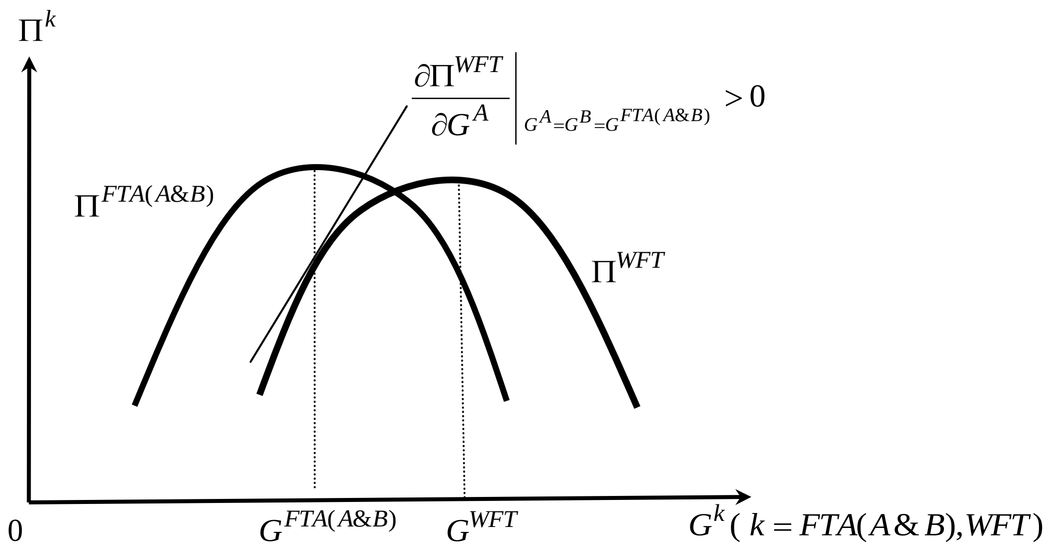
Moving from the *PR* regime to the *WFT* regime, all the countries enjoy economic benefits from duty-free access to each other's markets. The two adversaries are better off by reducing arming and producing more final goods for consumption and exports. There is a resource appropriation effect of arming, which is aggregate payoff-improving. However, the resource appropriation effect of arming is more than offset by the gains from free trade, causing arming to decline under the *WFT* regime.

In comparing arming allocations for a regime shift from *FTA*(*A*&*B*) to *WFT*, we use an aggregate payoff decomposition approach to explain why the optimal arming increases. We show in Appendix A-5 the following result:

$$\left.\frac{\partial \Pi^{WFT}}{\partial G^A}\right|_{G^A = G^B = G^{FTA(A\&B)}} = \frac{31(G^{FTA(A\&B)})^2 - 93G^{FTA(A\&B)} + 31G^{FTA(A\&B)}K - 36K + 108}{576\beta G^{FTA(A\&B)}} > 0.$$

The slope of each adversary's aggregate payoff function with respect to arming under the *WFT* regime, when evaluated at the point where $G^{A} = G^{B} = G^{FTA(A\&B)}$, is strictly positive.

Figure 1 is a graphical illustration of the above result. As shown in the aggregate payoff decomposition analysis (see Appendix A-4), the strict positivity of this derivative is because the export-revenue effect plus the resource-appropriation effect, which defines the marginal revenue of arming, exceeds the output-distortion effect, which defines the marginal cost of arming. Moving from *FTA*(*A*&*B*) to *WFT*, the marginal revenue of arming exceeds its marginal cost. In response to this, adversaries *A* and *B* increase their arming allocations.



We thus have:

PROPOSITION 2. *In a three-country world with two warring adversaries and a neutral third country, each adversary's optimal arming is* <u>*lower*</u> *under the FTA(A&B) regime than under the WFT regime. A shift in trade regime from FTA(A&B) to WFT causes arming to increase since the marginal revenue of arming (resulting from the export-revenue effect and the appropriation effect)* <u>*exceeds*</u> *its marginal cost (resulting from the output-distortion effect). Thus, an FTA between the adversaries (keeping the third party as a non-member) leads to lower aggregate arming than under the WFT regime*.

Propositions 1 and 2 suggest that forming an FTA between two enemy countries reduces interstate military tensions compared to those under worldwide free trade. Thus, other things being equal, an FTA between adversaries constitutes an effective trade institution in lowering military buildups.

5. FTA between an Adversary and a Third Party (*A* and *C*)

We now examine the case where one of the adversary countries (say, *A*) forms an FTA with the neutral third country *C* to enjoy free-duty access to each other's market. Denoting this agreement as the *FTA*(*A*&*C*) regime, we have: $\tau_c^{A,FTA(A\&C)} = \tau_a^{C,FTA(A\&C)} = 0$.

At the trade policy stage, countries *A* and *C* independently determine optimal tariffs, τ_b^A and τ_b^C, on their imports of good *b*. In the meanwhile, country *B* sets an optimal tariff structure, $\{\tau_a^B, \tau_c^B\}$, on its imports of goods *a* and *c*. Given that $\tau_c^{A,FTA(A\&C)} = \tau_a^{C,FTA(A\&C)} = 0$ under *FTA*(*A*&*C*), the market prices of the final goods become:[16]

$$P_a^{A,FTA(A\&C)} = P_a^{C,FTA(A\&C)} = \frac{3\alpha - \beta\tau_a^B - (3 - G^A - K^A)}{3\beta},$$

$$P_c^{A,FTA(A\&C)} = P_c^{C,FTA(A\&C)} = \frac{3\alpha - \beta\tau_c^B - 3}{3\beta},\ P_a^{B,FTA(A\&C)} = \frac{3\alpha + 2\beta\tau_a^B - (3 - G^A - K^A)}{3\beta},$$

$$P_b^{A,FTA(A\&C)} = \frac{3\alpha + 2\beta\tau_b^A - \beta\tau_b^C - (3 - G^B - K^B)}{3\beta},$$

$$P_b^{B,FTA(A\&C)} = \frac{3\alpha - \beta\tau_b^A - \beta\tau_b^C - (3 - G^B - K^B)}{3\beta},$$

$$P_b^{C,FTA(A\&C)} = \frac{3\alpha - \beta\tau_b^A + 2\beta\tau_b^C - (3 - G^B - K^B)}{3\beta},\quad P_c^{B,FTA(A\&C)} = \frac{3\alpha + 2\beta\tau_c^B - 3}{3\beta}.$$

At the third stage of setting import tariffs, country *A* sets an optimal tariff rate on good *b* to maximize aggregate payoff:

$$\Pi^{A,FTA(A\&C)} = CS^{A,FTA(A\&C)} + PS^{A,FTA(A\&C)} + \tau_b^A M_b^{A,FTA(A\&C)},$$

where the first term is consumer surplus (see equation 3b), the second term is producer surplus (see equation 4), $M_b^{A,FTA(A\&C)} = \alpha - \beta P_b^{A,FTA(A\&C)} - [G^A/(G^A + G^B)]3$, and the prices for the three goods *a*, *b*, *c* are shown above under the *FTA*(*A*&*C*) regime. The FOC for country *A* implies that its optimal tariff on good *b* is:

$$\tau_b^{A,FTA(A\&C)} = \frac{G^B(3 - G^A - G^B) - 6G^A + (\beta\tau_b^C - K^B)(G^A + G^B)}{8\beta(G^A + G^B)}.. \qquad (34)$$

Country *B* determines an optimal tariff structure, $\{\tau_a^B, \tau_c^B\}$, to maximize aggregate payoff:

[16]We set the tariff rates for τ_c^A and τ_a^C to be zero in the price equations in (9), (12), and (15).

$$\Pi^{B,FTA(A\&C)} = CS^{B,FTA(A\&C)} + PS^{B,FTA(A\&C)} + \tau_a^B M_a^{B,FTA(A\&C)} + \tau_c^B M_c^{B,FTA(A\&C)}.$$

Country *B*'s FOCs imply the following tariff structure:

$$\tau_a^B = \frac{G^A(3-G^A-G^B)-6G^B-K^A(G^A+G^B)}{8\beta(G^A+G^B)} \text{ and } \tau_c^B = \frac{3}{8\beta}. \tag{35}$$

Country *C* decides on an optimal tariff that maximizes its aggregate payoff:

$$\Pi^{C,FTA(A\&C)} = CS^{C,FTA(A\&C)} + PS^{C,FTA(A\&C)} + \tau_b^C M_b^{C,FTA(A\&C)},$$

where M_b^C is given in (20c). Country *C*'s FOC implies that its optimal tariff on good *b* is:

$$\tau_b^{C,FTA(A\&C)} = \frac{(3-G^B-K^B)+\beta\tau_b^A}{8\beta}. \tag{36}$$

Making use of (34)-(36), we solve for the equilibrium tariffs and record the results as follows:

$$\tau_b^{A,FTA(A\&C)} = \frac{G^B(3-G^A-G^B)-5G^A}{7\beta(G^A+G^B)} - \frac{K^B}{7\beta},$$

$$\tau_a^{B,FTA(A\&C)} = \frac{G^A(3-G^A-G^B)-6G^B}{8\beta(G^A+G^B)} - \frac{K^A}{8\beta},$$

$$\tau_b^{C,FTA(A\&C)} = \frac{G^B(3-G^A-G^B)+2G^A}{7\beta(G^A+G^B)} - \frac{K^B}{7\beta}, \quad \tau_c^{B,FTA(A\&C)} = \frac{3}{8\beta}. \tag{37}$$

We proceed to the second stage of the game, at which countries *A* and *B* decide on their conflict-related arming allocations. Country *A* determines an optimal arming allocation, denoted as $G^{A,FTA(A\&C)}$, that maximizes $\Pi^{A,FTA(A\&C)} = CS^{A,FTA(A\&C)} + PS^{A,FTA(A\&C)} + \tau_b^A M_b^{A,FTA(A\&C)}$, with the equilibrium tariffs being derived in (37). Evaluating the slope $\partial\Pi^{A,FTA(A\&C)} / \partial G^A$ at the point where $G^A = G^{A,PR}$ we have[17]

$$\frac{\partial\Pi^{A,FTA(A\&C)}}{\partial G^A}\Big|_{G^A=G^{A,PR}} > 0.$$

The strict concavity of the aggregate payoff function implies that

$$G^{A,FTA(A\&C)} > G^{A,PR}. \tag{38a}$$

Similarly, we have

$$\frac{\partial\Pi^{B,FTA(A\&C)}}{\partial G^B}\Big|_{G^B=G^{B,PR}} > 0,$$

[17]Note that we assign some plausible values for K (i.e., $K = 0.2$) in evaluating the derivative.

which implies that

$$G^{B,FTA(A\&C)} > G^{B,PR}. \qquad (38b)$$

The result in (38b) indicates that *B* increases arming when *A* forms an FTA with country *C*, relative to the case of a protectionist regime. In terms of aggregate arming, we have from (38a) and (38b) that

$$ARMS^{FTA(A\&C)} > ARMS^{PR}. \qquad (38c)$$

In the *FTA*(*A*&*C*) regime, there is an improvement of terms-of-trade benefit for country *A* (an insider) vis-à-vis country *B* (an outsider). Moreover, country *A* can enjoy duty-free access to country *C's* market. When *A* increases its arming, its aggregate payoff-reducing effect on domestic production is more than offset by its gains from trade, the latter of which coming from the terms-of-trade improvement and the integration benefit with country *C*. Besides, there is an aggregate payoff-increasing effect of arming for country *A* due to gains from appropriation.

As for country *B*, the adversary excluded from the FTA to be an outsider, we see a terms-of-trade deterioration for *B vis-à-vis A* and *C*. Nonetheless, the output-appropriation effect of arming encourages country *B* to increase arming since it is aggregate payoff-increasing. These results may explain why we have the inequalities in (38a) and (38b). We, therefore, have:

PROPOSITION 3. *Relative to the conflict equilibrium under the protectionist regime, each adversary's arming is* <u>*higher*</u> *when one adversary forms an FTA with a neutral third-party state leaving the other adversary as a non-member.*

Taken together all the equilibrium outcomes (see equations 30b, 33c, and 38) as shown earlier, we have a systematic ranking of the adversaries' arming allocations under the alternative trade regimes:

$$G^{FTA(A\&B)} < G^{WFT} < G^{PR} < G^{FTA(A\&C)}.$$

In terms of aggregate arming, it is straightforward that

$$ARMS^{FTA(A\&B)} < ARMS^{WFT} < ARMS^{PR} < ARMS^{FTA(A\&C)}. \qquad (39)$$

We thus have:

PROPOSITION 4. *Among the different regimes in the three-country world, we have:*

(i) An FTA between two enemy countries (leaving a third party as a non-member) has the lowest level of aggregate arming;

(ii) Aggregate arming is the second-lowest when there is global free trade;

(iii) Aggregate arming is lower under global free trade than under a tariff war;

(iv) An FTA between one adversary and a third country while excluding the other adversary as an outsider is conflict-aggravating since aggregate arming ranks the highest.

Based on the results (*i*)-(*iii*) in Proposition 4, we find that "dancing between two enemies" in the form of an FTA is conflict-reducing. It is then straightforward to see implications for the scenario where two adversaries fail to establish an FTA. Under this circumstance, a global free trade regime turns out to be an option for making the world relatively safe. The rationale behind this argument is that the resulting aggregate arming is relatively lower under free trade than under a tariff regime.

The result (iv) in Proposition 4 has interesting implications concerning the role of a third party in affecting interstate conflicts. Despite that establishing an FTA is based purely on economic advantages, a neutral third party's economic integration through trade with one country while leaving the country's enemy as a non-member ends up escalating their military buildups.

6. Aggregate Arming under CU

We have analyzed and compared equilibrium levels of arming allocations under four different trade regimes when a regional trade agreement is an FTA. The next concerns how the ranking of conflict-related arming allocations is affected when there is a CU. For forming a CU between the adversaries *A* and *B*, referred to as the *CU(A&B)* regime, we show in Appendix A-6 that:

$$G^{A,CU(A\&B)} = G^{A,FTA(A\&B)} \text{ and } G^{B,CU(A\&B)} = G^{B,FTA(A\&B)}. \quad (40)$$

Combining the results in (40) with those in (33) that $G^{FTA(A\&B)} < G^{WFT} < G^{PR}$, we have:

$$G^{A,CU(A\&B)} < G^{A,WFT} < G^{A,PR}; \quad (41a)$$

$$G^{B,CU(A\&B)} < G^{B,WFT} < G^{B,PR}. \quad (41b)$$

Thus, under either *FTA*(*A*&*B*) or *CU*(*A*&*B*), *A* and *B* allocate less resources to arming, compared to their arming allocations under the protectionist regime. Note that the main difference between *CU*(*A*&*B*) and *FTA*(*A*&*B*) lies in their different decisions in setting external tariffs to the non-member country, *C*. Under *CU*(*A*&*B*), the common external tariff on imports is <u>lower</u> than the external tariffs under *FTA*(*A*&*B*). Given that the arming decisions of the adversaries *A* and *B* do not affect their import tariffs on the neutral third party (country *C*),[18] we have:

$$G^{CU(A\&B)} = G^{FTA(A\&B)}.$$

We show detailed derivations in Appendix A-7 that the striking differences in the arming decisions of *A* and *B* emerge when one adversary (say, *A*) and a neutral third country (*C*) form a customs union. We denote this regime as *CU*(*A*&*C*). For country *A*, we find that

$$\frac{\partial \Pi^{A,CU(A\&C)}}{\partial G^A}\Big|_{G^A = G^{A,PR}} > 0,$$

which implies that

---

[18]See equation (26.a) for the case of the *FTA(A&B)* regime and equation (a.6) for that of the *CU(A&B)* regime.

$$G^{A,CU(A\&C)} > G^{A,PR}. \tag{42}$$

That is, country *A*'s optimal arming is higher under *CU(A&C)* than under a tariff war. Combining the results in (40)-(42), we have

$$G^{A,CU(A\&B)} < G^{A,WFT} < G^{A,PR} < G^{A,CU(A\&C)}. \tag{43}$$

For country *B*, however, we find that the sign of the following derivative is negative:

$$\frac{\partial \Pi^{B,CU(A\&C)}}{\partial G^B}\bigg|_{G^B = G^{B,PR}} < 0,$$

which implies that

$$G^{B,CU(A\&C)} < G^{B,PR}. \tag{44}$$

Country *B*'s optimal arming is lower under *CU(A&C)* than under a tariff war. It follows that

$$G^{B,CU(A\&B)} < G^{B,WFT} < G^{B,PR}; \;\; G^{B,CU(A\&C)} < G^{B,PR}. \tag{45}$$

Based on the findings in (43) and (45), we cannot predict unambiguously whether aggregate arming under *CU*(*A*&*C*), $ARMS^{CU(A\&C)} = G^{A,CU(A\&C)} + G^{B,CU(A\&C)}$, is higher, equal to, or lower than that under a tariff war, $ARMS^{PR} = G^{A,PR} + G^{B,PR}$. We summarize the results as follows:

PROPOSITION 5. *In the three-country world of trade and interstate conflicts, we have:*

(i) The CU(A&B) and FTA(A&B) regimes are equally effective in reducing arming, with aggregate arming being the lowest among all the regimes;

(ii) The complete ranking of adversary A's arming is:

$$G^{A,FTA(A\&B)} = G^{A,CU(A\&B)} < G^{A,WFT} < G^{A,PR} < G^{A,CU(A\&C)}.$$

The ranking of adversary B's arming involves two separate inequalities:

$$G^{B,CU(A\&B)} < G^{B,WFT} < G^{B,PR} \text{ and } G^{B,CU(A\&C)} < G^{B,PR}.$$

(ii) Relative to the equilibrium aggregate arming in a Nash tariff war, the CU(A&C) regime may not be conflict-aggravating for enemy countries A and B.

The results in Propositions 4 and 5 reveal similarities and differences between a CU and an FTA in affecting the equilibrium levels of aggregate arming (relative to the tariff regime). The conflict-reducing effect associated with the *FTA*(*A*&*B*) regime continues to emerge under the *CU(A&B)* regime. Nevertheless, under *CU*(*A*&*C*), the common external tariff that countries *A* and *C* impose on good *b* is strictly *lower* than the optimal tariffs that the non-member *B* imposes on goods *a* and *c*. The economic intuition is as follows. The tariff complementarity effect allows country *B* to enjoy economic benefits from producing and exporting more of its final good to the CU markets in *A* and *C*; therefore, provides a positive incentive for country *B* as a non-member to lower its arming under *CU*(*A*&*C*). This result suggests that the conflict-aggravating effect associated with *FTA*(*A*&*C*) may not show up for *CU*(*A*&*C*).

7. Aggregate Payoff Comparisons Across Different Trade Regimes

It is instructive to compare the equilibrium levels of aggregate payoffs under different trade regimes. Due to the complexity of the three-country model with a multiple-stage game for each regime, we conduct a simulation analysis for regimes in which reduced-form solutions are available.[19]

According to our simulation results in Table 1, we have the following economic implications. First, for each of the enemy countries (*A* and *B*) under symmetry, domestic aggregate payoff is the highest when they form a customs union, *CU* (*A*,*B*).[20] Under the *CU* regime, the neutral third country's aggregate payoff is the lowest. Second, domestic aggregate payoff is the second-highest for each enemy country when the two adversaries form an FTA, i.e., *FTA*(*A*,*B*). Third, when the enemy countries do not establish any cooperative trade institutions between themselves or with a neutral third country, the two adversaries are better off under the protectionist regime (i.e., tariff war) than worldwide free trade. Fourth, each enemy country's aggregate payoff turns out to be the *lowest* under worldwide free trade without having any form of trade institutions. In this case, the neutral third country's aggregate payoff is the highest.

Table 1. ***Aggregate payoff comparisons across trade regimes under symmetry***

A state's aggregate payoff	Π^A		Π^B		Π^C		Global payoff	
Trade regime	$\alpha=4$	$\alpha=10$	$\alpha=4$	$\alpha=10$	$\alpha=4$	$\alpha=10$	$\alpha=4$	$\alpha=10$
PR	6.39	15.41	6.39	15.41	9.15	27.14	21.93	57.96
$FTA(A,B)$	***6.46***	***15.5***	***6.46***	***15.5***	*9.28*	*27.36*	**22.2**	***58.36***
WFT	6.2	15.23	6.2	15.23	**9.77**	**27.75**	22.17	58.21
$CU(A,B)$	***6.63***	***15.66***	***6.63***	***15.66***	*8.53*	*26.51*	**21.79**	**57.83**

Notes: In undertaking the simulation, we assume for ease of illustration that $K=0$ and $\beta=1$.

[19] For the two regimes *FTA* (*A*,*C*) and *CU* (*A*,*C*) that involve elements of asymmetry, the equilibrium levels of aggregate payoff are analytically unsolvable and hence are omitted.
[20] This result is consistent with the empirical finding of the study by Hadjiyiannis et al. (2016).

One interesting finding from the simulation is its implication for global payoff $(G\Pi)$, defined by aggregating the payoffs of the three countries. That is, $G\Pi = \Pi^{A} + \Pi^{B} + \Pi^{C}$. As shown in Table 1, among the four regimes under symmetry, $G\Pi$ is the highest when the adversaries *A* and *B* form an FTA than when they form a CU. The reason is that the non-member, third-party country's aggregate payoff is the lowest when the adversaries *A* and *B* form a customs union. The economic intuition behind this finding is that *A* and *B* under *CU*(*A*,*B*) jointly set a higher uniform external tariff than the tariffs they impose individually under *FTA*(*A*,*B*).

8. Concluding Remarks

Voluminous studies on regional trade agreements have contributed to understanding the differences between FTAs and CUs. Moreover, tremendous efforts are devoted to resolving the longstanding debates about the trade-conflict nexus. This paper contributes to the literature by examining the endogeneity of conflict-related arming decisions and Nash tariffs, on the one hand, and comparing differences in implications of trade institutions vs. tariff wars for an interstate conflict, on the other. Paying particular attention to the endogenous arming allocations of two adversaries within a three-country trade model permits us to evaluate aggregate arming or conflict intensity under alternative trade regimes. We show that optimal arming exhibits an increasing pattern for the following regimes: an FTA between two adversaries that leave the third party as a non-member, global free trade, a protectionist regime or a tariff war, and an FTA between a neutral third country and a country that keeps the country's rival as an outsider. This ranking shows different trade regimes' roles in interstate conflicts. An FTA between two adversaries results in lower aggregate arming than worldwide free trade. Aggregate arming is lower under worldwide free trade than under a tariff war. These findings support the liberal peace hypothesis that trade reduces conflict. However, an FTA between an adversary and a neutral third country turns out to be conflict-aggravating as the aggregate arming is the highest (among all the regimes examined). Nevertheless, this conflict-aggravating effect associated with an FTA may not be present under a CU.

Given the growing tensions in the international arena resulting from interstate disputes and resource appropriation, our theoretical findings help identify how different types of trade institutions may affect military buildups. However, we recognize that we present the trade-conflict analysis upon some simplifying assumptions. One possible extension is how differences in production technologies affect the trade equilibrium of two contending countries and their optimal arming decisions. Another extension is introducing the endogeneity of conflict-related destructions into the analysis.[21] In this case, resource and

[21]For studies on armed conflicts that take into account the endogeneity of destructiveness see, e.g., Chang and Luo (2017), and Sanders and Walia (2014).

output destructions affect the production and consumption of final goods, hence the terms of trade and the volumes of imports and exports in equilibrium. It should also be noted that there were discussions concerning whether RTAs are a building block or a stumbling block toward global free trade. This issue would become more complicated in a multilateral world as there are countries in RTAs subject to interstate conflicts. Lastly, our model results are based upon the presumption that conflicting countries are symmetrical in all aspects. One extension is to see how differences in endowments between two enemy countries (i.e., endowment asymmetry) would affect their choice of trade regimes and the resulting conflict-related arming allocations. Specifically, in a three-country world with two asymmetric adversaries, what effects would a preferential trade agreement between a neutral third country and a less-endowed country (or more-endowed country) have on each adversary's arming decision and the overall conflict intensity. These are potentially interesting and important questions for future research.

Appendix

A-1. ***Market equilibrium condition for good a in country A***
Alternatively, we have the following equilibrium condition:

$$(\alpha-\beta P_a^A)+[(\alpha-\beta P_a^B)-(\frac{G^B}{G^A+G^B})3]+(\alpha-\beta P_a^C)=(\frac{G^A}{G^A+G^B})3-G^A-K^A. \qquad \text{(a.1)}$$

The second bracket term on the LHS of equation (a.1) is the consumption of good *a* by country *B*, $(\alpha-\beta P_a^B)$, minus the quantity of the good that *B* appropriates from *A*, $[G^B/(G^A+G^B)]3$. This difference gives the amount of good a that country *B* imports from country *A*. The term on the RHS of equation (a.1) is the quantity of good *a* that country *A* supplies, which is given by Z_a^A in (2). It is easy to verify that equation (a.1) is identical to equation (8).

A-2. ***Market equilibrium condition for good b in country B***
Alternatively, we have the following equilibrium condition:

$$[(\alpha-\beta P_b^A)-(\frac{G^A}{G^A+G^B})3]+(\alpha-\beta P_b^B)+(\alpha-\beta P_b^C)=(\frac{G^B}{G^A+G^B})3-G^B-K^B. \qquad \text{(a.2)}$$

The first bracket term on the LHS of equation (a.2) is the consumption of good *b* by country A, $(\alpha-\beta P_b^A)$, minus the amount of the good that *A* appropriates from *B*, $[G^A/(G^A+G^B)]3$. This difference gives the quantity of good *b* that country *A* imports from country *B*. The term on the RHS of equation (a.2) is the quantity of good *b* that country *B* supplies, as given by Z_b^B in (2). It is easy to verify that equation (a.2) is identical to equation (11).

A-3. ***Comparative static results for the protectionist regime***
Based on the optimal tariffs under the protectionist regime, as shown in equation (22), we have the following results:

$$\frac{\partial\tau_b^{A,PR}}{\partial G^A}=-\frac{8G^B}{7\beta(G^A+G^B)^2}<0,\quad \frac{\tau_b^{A,PR}}{\partial G^B}=-\frac{(G^A+G^B)^2-8G^A}{7\beta(G^A+G^B)^2}<0,\quad 0$$

$$\frac{\partial\tau_a^{B,PR}}{\partial G^A}=-\frac{(G^A+G^B)^2-8G^B}{7\beta(G^A+G^B)^2}<0,\quad \frac{\partial\tau_a^{B,PR}}{\partial G^B}=-\frac{8G^A}{7\beta(G^A+G^B)^2}<0,$$

$$\frac{\partial\tau_a^{C,PR}}{\partial G^A}=-\frac{(G^A+G^B)^2-G^B}{7\beta(G^A+G^B)^2}<0,\quad \frac{\partial\tau_a^{C,PR}}{\partial G^B}=-\frac{G^A}{7\beta(G^A+G^B)^2}<0,$$

$$\frac{\partial\tau_b^{C,PR}}{\partial G^A}=-\frac{G^B}{7\beta(G^A+G^B)^2}<0,\quad \frac{\partial\tau_b^{C,PR}}{\partial G^B}=-\frac{(G^A+G^B)^2-G^A}{7\beta(G^A+G^B)^2}<0,$$

$$\tau_c^{A,PR}-\tau_a^{C,PR}=\frac{G^A+K^A}{7\beta}+\frac{G^B}{7\beta(G^A+G^B)}>0,$$

$$\tau_c^{B,PR}-\tau_b^{C,PR}=\frac{G^B+K^B}{7\beta}+\frac{G^A}{7\beta(G^A+G^B)}>0.$$

A-4. ***Decomposing the* aggregate payoff *effect of arming for a contending country under the protectionist regime***
Under symmetry, we can look at country *A*. The country's aggregate payoff function is:

$$\Pi^A = CS^A + PS^A + TR^A$$
$$= \frac{1}{2\beta}[(\alpha - \beta P_a^A)^2 + (\alpha - \beta P_b^A)^2 + (\alpha - \beta P_c^A)^2] + [P_a^A(Z_a^A) + P_b^A(APP_b^A)] + (\tau_b^A M_b^A + \tau_c^A M_c^A),$$

where $APP_b^A = [G^A/(G^A + G^B)]3$ is the amount of good *b* appropriated by country *A*. Taking the derivative of SW^A with respect to G^A yields

$$\frac{\partial \Pi^A}{\partial G^A} = [-(\alpha - \beta P_a^A)\frac{\partial P_a^A}{\partial G^A} - (\alpha - \beta P_b^A)\frac{\partial P_b^A}{\partial G^A}]$$
$$+[\frac{\partial P_a^A}{\partial G^A} Z_a^A + \frac{\partial Z^A}{\partial G^A} P_a^A + \frac{\partial P_b^A}{\partial G^A}(APP_b^A) + \frac{\partial (APP_b^A)}{\partial G^A} P_b^A]$$
$$+(\tau_b^A \frac{\partial M_b^A}{\partial G^A} + \tau_c^A \frac{\partial M_c^A}{\partial G^A} + M_b^A \frac{\partial \tau_b^A}{\partial G^A} + M_c^A \frac{\partial \tau_c^A}{\partial G^A}).$$

Note that changes in country *A*'s arming do not affect M_c^A and τ_c^A. That is $\partial M_c^A/\partial G^A = 0$ and $\partial \tau_c^A/\partial G^A = 0$. Note also that country *A*'s import demand for good *b* is given by its total consumption of good *b* minus the amount of the good appropriated, i.e., $M_b^A = (\alpha - \beta P_b^A) - A_b$. We incorporate the zero derivatives and this definition into the derivative, after re-arranging terms. This exercise yields

$$\frac{\partial \Pi^A}{\partial G^A} = [Z_a^A - (\alpha - \beta P_a^A)]\frac{\partial P_a^A}{\partial G^A} + [(\tau_b^A \frac{\partial M_b^A}{\partial G^A} + M_b^A \frac{\partial \tau_b^A}{\partial G^A}) - M_b^A \frac{\partial P_b^A}{\partial G^A}] + \frac{\partial Z^A}{\partial G^A} P_a^A + \frac{\partial (APP_b^A)}{\partial G^A} P_b^A. \quad \text{(a.3)}$$

This derivative contains four different terms:

(i) The first term $[Z_a^A - (\alpha - \beta P_a^A)]\frac{\partial P_a^A}{\partial G^A}$ reflects a terms-of-trade effect of arming, which is payoff-increasing since $[Z_a^A - (\alpha - \beta P_a^A)] > 0$ and $\frac{\partial P_a^A}{\partial G^A} > 0$.

(ii) The second bracket term $[(\tau_b^A \frac{\partial M_b^A}{\partial G^A} + M_b^A \frac{\partial \tau_b^A}{\partial G^A}) - M_b^A \frac{\partial P_b^A}{\partial G^A}]$ reflects the (net) effect of country *A*'s arming on tariff revenue from the import of good *b* minus import spending. Note that

$$(\tau_b^A \frac{\partial M_b^A}{\partial G^A} + M_b^A \frac{\partial \tau_b^A}{\partial G^A}) = \tau_b^A[-3\frac{G^B}{(G^A + G^B)^2}] + M_b^A[-\frac{8G^B}{7\beta(G^A + G^B)^2}] < 0.$$

We also consider how arming affects the price of good *b* in country *A*, which is $\partial P_b^A/\partial G^A$. This derivative is positive since country *A*'s arming causes country *B* to raise its price for good *b*. The second bracket term $[(\tau_b^A \frac{\partial M_b^A}{\partial G^A} + M_b^A \frac{\partial \tau_b^A}{\partial G^A}) - M_b^A \frac{\partial P_b^A}{\partial G^A}]$ is thus unambiguously negative.

(iii) The third term $\frac{\partial Z_a^A}{\partial G^A} P_a^A$ reflects an output distortion effect since allocating more resources to arming lowers the amount of resources for final good production and consumption, which is payoff-reducing.

(iv) The fourth term $\dfrac{\partial(APP_b^A)}{\partial G^A} P_b^A$ is a resource appropriation effect, which is payoff-increasing.

It follows from (a.3) that we can decompose the effect of country *A*'s arming on its aggregate payoff into four different effects as follows:

$$\frac{\partial \Pi^A}{\partial G^A} = \underbrace{\left[Z_a^A - (\alpha - \beta P_a^A)\right]\frac{\partial P_a^A}{\partial G^A}}_{\text{Export-revenue effect of arming (+)}} + \underbrace{\frac{\partial(APP_b^A)}{\partial G^A} P_b^A}_{\text{Resource-appropriation effect of arming (+)}}$$

$$+ \underbrace{\left[(\tau_b^A \frac{\partial M_b^A}{\partial G^A} + M_b^A \frac{\partial \tau_b^A}{\partial G^A}) - M_b^A \frac{\partial P_b^A}{\partial G^A}\right]}_{\text{Tariff-revenue \& import-spending effect of arming (-)}} + \underbrace{\frac{\partial Z_a^A}{\partial G^A} P_a^A}_{\text{Output-distortion effect of arming (-)}} = 0.$$

A-5. ***Optimal arming is lower under the FTA (A&B) regime than under worldwide free trade***

We evaluate the slopes of SW_i (for $i = A, B$) under the *WFT* regime at the equilibrium arming allocations under the *FTA(A&B)* regime, $\{G^{A,FTA(A\&B)}, G^{B,FTA(A\&B)}\}$. With symmetry that $G^{A,FTA(A\&B)} = G^{B,FTA(A\&B)} = G^{FTA(A\&B)}$, we look at country *A*. Since $\tau_b^A = \tau_a^B = 0$ under the F*TA(A&B)* regime, we have from the aggregate payoff decomposition in (24) that the FOC for country A is:

$$\frac{\partial \Pi^{FTA(A\&B)}}{\partial G^A} = [Z_a^A - (\alpha - \beta P_a^{A,FTA(A\&B)})]\frac{\partial P_a^{A,FTA(A\&B)}}{\partial G^A} + \frac{\partial APP_b^A}{\partial G^A} P_b^{A,FTA(A\&B)}$$

$$+ \frac{\partial Z_a^A}{\partial G^A} P_a^{A,FTA(A\&B)} = 0,$$

where $APP_b^A = [3G^A / (G^A + G^B)]$ is the amount of good *b* appropriated by country *A*. Next, we derive results for each of the terms as shown in country A's FOC. Substituting $\tau_a^{A,FTA(A\&B)} = (3 - G^A - K_A)/8\beta$ from (26a) into $P_a^{A,FTA(A\&B)}$ in (25) yields

$$P_a^{A,FTA(A\&B)} = \frac{3\alpha + G^A + K^A - \beta\tau_a^C - 3}{3\beta} = \frac{8\alpha + 3G^A + 3K^A - 9}{8\beta}, \tag{a.4}$$

which implies that

$$\frac{\partial P_a^{A,FTA(A\&B)}}{\partial G^A} = \frac{3}{8\beta}. \tag{a.5}$$

The appropriation of good *b* by country *A*, $APP_b^A = [3G^A / (G^A + G^B)]$, implies that

$$\frac{\partial APP_b}{\partial G^A} = \frac{3G^B}{(G^A + G^B)^2}. \tag{a.6}$$

Country *A*'s production of good *a*, $Z_a^A = [3G^A / (G^A + G^B)] - G^A - K^A$ implies that

$$\frac{\partial Z_a^A}{\partial G^A} = \frac{3G^B}{(G^A + G^B)^2} - 1. \tag{a.7}$$

Substituting $\tau_b^C = (3 - G^B - K^B)/(8\beta)$ from (26c) into $P_b^{A,FTA(A\&B)}$ in (25) yields

$$P_b^{A,FTA(A\&B)} = \frac{3\alpha + G^B + K^B - \beta\tau_b^C - 3}{3\beta} = \frac{8\alpha + 3G^B + 3K^B - 9}{8\beta}. \tag{a.8}$$

The substitution of the results from (a.4)-(a.8) back into country A's first-order condition implies that

$$\frac{\partial \Pi^{FTA(A\&B)}}{\partial G^A} = \underbrace{\frac{3}{8\beta}\left[(\frac{3G^A}{G^A + G^B} - G^A - K^A) - [\alpha - \beta(\frac{8\alpha + 3G^A + 3K^A - 9}{8\beta})] \right]}_{\text{Export-revenue effect of arming (+)}}$$
$$+ \underbrace{\frac{3G^B}{(G^A + G^B)^2}(\frac{8\alpha + 3G^B + 3K^B - 9}{8\beta})}_{\text{Resource-appropriation effect of arming (+)}} + \underbrace{[\frac{3G^B}{(G^A + G^B)^2} - 1](\frac{8\alpha + 3G^A + 3K^A - 9}{8\beta})}_{\text{Output-distortion effect of arming (-)}} = 0 \tag{a.9}$$

where $G^A = G^B = G^{FTA(A\&B)}$.

Under the *WFT* regime, the slope of country *A*'s aggregate payoff function with respect to its arming is:

$$\frac{\partial \Pi^{WFT}}{\partial G^A} = \frac{\partial P_a^{A,WFT}}{\partial G^A}[Z_a^A - (\alpha - \beta P_a^{A,WFT})] + \frac{\partial (APP_b^A)}{\partial G^A} P_b^{A,WFT} + \frac{\partial Z_a^A}{\partial G^A} P_a^{A,WFT},$$

where

$$P_a^{A,WFT} = \frac{3\alpha + G^A + K^A - 3}{3\beta}, \quad \frac{\partial P_a^{A,WFT}}{\partial G^A} = \frac{1}{3\beta}, \quad P_b^{A,WFT} = \frac{3\alpha + G^B + K^B - 3}{3\beta}, \quad \frac{\partial P_b^{A,WFT}}{\partial G^A} = 0,$$

$$APP_b^A = \frac{3G^A}{G^A + G^B}, \quad \frac{\partial (APP_b^A)}{\partial G^A} = \frac{3G^B}{(G^A + G^B)^2},$$

$$Z_a^A = \frac{3G^A}{G^A + G^B} - G^A - K^A, \quad \frac{\partial Z_a^A}{\partial G^A} = \frac{3G^B}{(G^A + G^B)^2} - 1.$$

After substituting, we have

$$\frac{\partial \Pi^{WFT}}{\partial G^A} = \underbrace{\frac{1}{3\beta}\left[(\frac{3G^A}{G^A + G^B} - G^A - K^A) - [\alpha - \beta(\frac{3\alpha + G^A + K^A - 3}{3\beta})] \right]}_{\text{Export-revenue effect of arming (+)}}$$
$$+ \underbrace{\frac{3G^B}{(G^A + G^B)^2}(\frac{3\alpha + G^B + K^B - 3}{3\beta})}_{\text{Resource-appropriation effect of arming (+)}} + \underbrace{[\frac{3G^B}{(G^A + G^B)^2} - 1](\frac{3\alpha + G^A + K^A - 3}{3\beta})}_{\text{Output-distortion effect of arming (-)}} \tag{a.10}$$

where $G^A = G^B = G^{WFT}$. We evaluate $\partial \Pi^{WFT} / \partial G^A$ in (a.10) at the *FTA(A&B)* equilibrium arming allocations where $G^A = G^B = G^{FTA(A\&B)}$, taking into account the FOC as shown in (a.9). We have the following:

(i) Comparing *the export-revenue effect*

$$\frac{1}{3\beta}\left[(\frac{3G^A}{G^A+G^B}-G^A-K^A)-[\alpha-\beta(\frac{3\alpha+G^A+K^A-3}{3\beta})]\right]$$
$$-\frac{3}{8\beta}\left[(\frac{3G^A}{G^A+G^B}-G^A-K^A)-[\alpha-\beta(\frac{8\alpha+3G^A+3K^A-9}{8\beta})]\right]$$
$$=\frac{[7(G^A)^2+7G^AG^B-21G^A+51G^B+7(G^A+7G^B)K^A]}{576\beta(G^A+G^B)}>0.$$

(ii) Comparing *the resource-appropriation effect*

$$\frac{3G^B}{(G^A+G^B)^2}(\frac{3\alpha+G^B+K^B-3}{3\beta})-\frac{3G^B}{(G^A+G^B)^2}(\frac{8\alpha+3G^B+3K^B-9}{8\beta})=\frac{3G^B}{(G^A+G^B)^2}(\frac{3-G^B-K^B}{24\beta})>0.$$

(iii) Comparing *the output-distortion effect*

$$[\frac{3G^B}{(G^A+G^B)^2}-1](\frac{3\alpha+G^A+K^A-3}{3\beta})-[\frac{3G^B}{(G^A+G^B)^2}-1](\frac{8\alpha+3G^A+3K^A-9}{8\beta})$$
$$=-\frac{[(G^A)^2+(G^B)^2+2G^AG^B-3G^B](3-G^A-K^A)}{24\beta(G^A+G^B)^2}<0$$

Putting together the three effects, (i)-(iii), we have under symmetry ($G^A=G^B=G^{FTA(A\&B)}$) that

$$\left.\frac{\partial\Pi^{WFT}}{\partial G^A}\right|_{G^A=G^B=G^{FTA(A\&B)}}=\frac{[31(G^{FTA(A\&B)})^2-93G^{FTA(A\&B)}+31G^{FTA(A\&B)}K-36K+108]}{576\beta G^{FTA(A\&B)}}>0.$$

The strict concavity of the aggregate payoff function implies the optimal arming under the *FTA(A&B)* regime is <u>lower</u> than that of the global free trade regime. That is, $G^{FTA(A\&B)}<G^{WFT}$. Starting from the *FTA(A&B)* regime, a move to the *WFT* regime will encourage each contending country to increase arming since the export-revenue effect plus the resource-appropriation effect (i.e., the marginal revenue of arming) exceed the output-distortion effect (i.e., the marginal cost of arming).

A-6. *Optimal arming allocations of two adversary countries that form a CU*

For a CU between countries *A* and *B*, denoted as the *CU(A&B)* regime, we have $\tau_b^{A,CU(A\&B)}=\tau_a^{B,CU(A\&B)}=0$. At the trade policy stage, *A* and *B* jointly determine a common external optimal tariff, denoted as $\tau_c^{m,CU(A\&B)}$, on their imports of good *c*. Country *C* sets an optimal tariff structure, $\{\tau_a^C,\tau_b^C\}$, on its imports of good *a* and *b*. Making use of the price equations in (9), (12) and (15) and considering that $\tau_b^{A,CU(A\&B)}=\tau_a^{B,CU(A\&B)}=0,$ the equilibrium prices under the *CU(A&B)* regime are:

$$P_a^{A,CU(A\&B)}=P_a^{B,CU(A\&B)}=\frac{3\alpha-\beta\tau_a^C-(3-G^A-K^A)}{3\beta},$$
$$P_b^{A,CU(A\&B)}=P_b^{B,CU(A\&B)}=\frac{3\alpha-\beta\tau_b^C-(3-G^B-K^B)}{3\beta},$$
$$P_a^{C,CU(A\&B)}=\frac{3\alpha+2\beta\tau_a^C-(3-G^A-K^A)}{3\beta},\ P_b^{C,CU(A\&B)}=\frac{3\alpha+2\beta\tau_b^C-(3-G^B-K^B)}{3\beta},$$
$$P_c^{A,CU(A\&B)}=\frac{3\alpha+\beta\tau_c^{m,CU(A\&B)}-3}{3\beta},\ P_c^{B,CU(A\&B)}=\frac{3\alpha+\beta\tau_c^{m,CU(A\&B)}-3}{3\beta},$$

$$P_c^{C,CU(A\&B)} = \frac{3\alpha - 2\beta\tau_c^{m,CU(A\&B)} - 3}{3\beta}.$$

In determining their common external tariff on the import of good *c*, countries *A* and *B* jointly maximize their aggregate payoffs: $\Pi^{A\&B,CU(A\&B)} = \Pi^{A,CU(A\&B)} + \Pi^{B,CU(A\&B)}$, where

$$\Pi^{A,CU(A\&B)} = CS^{A,CU(A\&B)} + PS^{A,CU(A\&B)} + \tau_c^{m,CU(A\&B)} M_b^{A,CU(A\&B)}, \tag{a.11}$$

$$\Pi^{B,CU(A\&B)} = CS^{B,CU(A\&B)} + PS^{B,CU(A\&B)} + \tau_c^{m,CU(A\&B)} M_b^{B,CU(A\&B)}. \tag{a.12}$$

The FOC for aggregate payoff maximization implies that the common external tariff on good *c* is:

$$\tau_c^{m,CU(A\&B)} = \frac{6}{5\beta}. \tag{a.13}$$

Country *C* determines an optimal tariff structure, $\{\tau_a^C, \tau_b^C\}$, to maximize its domestic aggregate payoff :

$$\Pi^{C,CU(A\&B)} = CS^{C,CU(A\&B)} + PS^{C,CU(A\&B)} + \tau_a^{C,CU(A\&B)} M_a^{C,CU(A\&B)} + \tau_b^{C,CU(A\&B)} M_b^{C,CU(A\&B)}.$$

The FOCs for country *C* imply that the optimal tariffs are:

$$\tau_a^{C,CU(A\&B)} = \frac{(3 - G^A - K^A)}{8\beta} \text{ and } \tau_b^{C,CU(A\&B)} = \frac{(3 - G^B - K^B)}{8\beta} \tag{a.14}$$

We proceed to the security stage at which *A* and *B* independently and simultaneously determine their optimal arming decisions. Substituting the optimal tariffs from (a.13) and (a.14) into the aggregate payoff functions in (a.11) and (a.12), we have the FOCs for *A* and *B*: $\frac{\partial \Pi^{A,CU(A\&B)}}{\partial G^A} = 0$ and $\frac{\partial \Pi^{B,CU(A\&B)}}{\partial G^B} = 0.$

Denote the Nash equilibrium levels of arming as $\{G^{A,CU(A\&B)}, G^{B,CU(A\&B)}\}$. Under symmetry in all dimensions, have $G^{A,CU(A\&B)} = G^{B,CU(A\&B)} = G^{CU(A\&B)}$. Calculating the optimal arming yields

$$G^{CU(A\&B)} = \frac{\sqrt{4096\alpha^2 - 3159 + K(1521K + 4992\alpha - 3510)}}{78} - \frac{32\alpha}{39} - \frac{K}{2} + \frac{3}{2}.$$

It is easy to verify that $G^{FTA(A\&B)} = G^{CU(A\&B)}$. Evaluating the slope $\partial \Pi^{A,CU(A\&B)} / \partial G^A$ at the point where $G^A = G^{A,PR}$, we have

$$\left.\frac{\partial \Pi^{A,CU(A\&B)}}{\partial G^A}\right|_{G^A = G^{A,PR}} < 0,$$

which implies that $G^{A,CU(A\&B)} = G^{B,CU(A\&B)} = G^{CU(A\&B)} < G^{A,PR}$.

A-7. ***CU formed between one contending country and a neutral third country***

For the scenario where there is a CU between countries *A* and *C*, denoted as the *CU(A&C)* regime, we have $\tau_c^{A,CU(A\&C)} = \tau_a^{C,CU(A\&C)} = 0$. At the trade policy stage, countries *A* and *C* jointly determine a common external tariff, denoted as $\tau_b^{m,CU(A\&C)}$, on their imports of good *b*. Simultaneously, country *B* sets an optimal tariff structure, $\{\tau_a^B, \tau_c^B\}$, on its imports of goods *a* and *c*. Making use of the price equations in (9), (12) and (15) and considering that $\tau_c^{A,CU(A\&C)} = \tau_a^{C,CU(A\&C)} = 0$, the equilibrium prices under the *CU(A&C)* regime are:

$$P_a^{A,CU(A\&C)} = P_a^{C,CU(A\&C)} = \frac{3\alpha - \beta\tau_a^B - (3 - G^A - K^A)}{3\beta},$$

$$P_c^{A,CU(A\&C)} = P_c^{C,CU(A\&C)} = \frac{3\alpha - \beta\tau_c^{b,CU(A\&C)} - 3}{3\beta},$$

$$P_a^{B,CU(A\&C)} = \frac{3\alpha + 2\beta\tau_a^B - (3 - G^A - K^A)}{3\beta}, \ P_b^{A,CU(A\&C)} = \frac{3\alpha + \beta\tau_b^{m,CU(A\&C)} - (3 - G^B - K^B)}{3\beta},$$

$$P_b^{B,CU(A\&C)} = \frac{3\alpha - 2\beta\tau_b^{m,CU(A\&C)} - (3 - G^B - K^B)}{3\beta},$$

$$P_b^{C,CU(A\&C)} = \frac{3\alpha + \beta\tau_b^{m,CU(A\&C)} - (3 - G^B - K^B)}{3\beta}, \ P_c^{B,CU(A\&C)} = \frac{3\alpha + 2\beta\tau_c^B - 3}{3\beta}.$$

In determining their tariff on the import of good *b*, countries *A* and *C* set a common external tariff that maximizes their aggregate payoff: $\Pi^{AC,CU(A\&C)} = \Pi^{A,CU(A\&C)} + \Pi^{C,CU(A\&C)}$ where

$$\Pi^{A,CU(A\&C)} = CS^{A,CU(A\&C)} + PS^{A,CU(A\&C)} + \tau_b^{m,CU(A\&C)} M_b^{A,CU(A\&C)},$$
$$\Pi^{C,CU(A\&C)} = CS^{C,CU(A\&C)} + PS^{C,CU(A\&C)} + \tau_b^{m,CU(A\&C)} M_b^{C,CU(A\&C)}.$$

The FOC for the joint payoff maximization problem is: $\partial\Pi^{AC,CU(A\&C)} \big/ \partial\tau^{m,CU(A\&C)} = 0$. Solving for the optimal common external tariff yields

$$\tau_b^{m,CU(A\&C)} = \frac{2G^B(3 - G^A - G^B) - 3G^A - 2K^B(G^A + G^B)}{5\beta(G^A + G^B)}. \qquad \text{(a.15)}$$

Similarly, country *B* determines an optimal tariff structure, $\{\tau_a^B, \tau_c^B\}$, to maximize its domestic aggregate payoff:

$$\Pi^{B,CU(A\&C)} = CS^{B,CU(A\&C)} + PS^{B,CU(A\&C)} + \tau_a^{B,CU(A\&C)} M_a^{B,CU(A\&C)} + \tau_c^{B,CU(A\&C)} M_c^{B,CU(A\&C)}$$

Making use of the FOCs for country *B*, we solve for its optimal tariffs:

$$\tau_a^{B,CU(A\&C)} = \frac{G^A(3 - G^A - G^B) - 6G^B - K^A(G^A + G^B)}{8\beta(G^A + G^B)} \text{ and } \tau_c^{B,CU(A\&C)} = \frac{3}{8\beta}. \qquad \text{(a.16)}$$

We proceed to the security stage at which countries *A* and *B* independently and simultaneously make their arming decisions. Country *A* determines an optimal arming, denoted as $G^{A,CU(A\&C)}$, that maximizes its aggregate payoff:

$$\Pi^{A,CU(A\&C)} = CS^{A,CU(A\&C)} + PS^{A,CU(A\&C)} + \tau_b^{m,CU(A\&C)} M_b^{A,CU(A\&C)}.$$

Evaluating the slope $\partial\Pi^{A,CU(A\&C)} \big/ \partial G^A$ at the point where $G^A = G^{A,PR}$, we have

$$\left.\frac{\partial\Pi^{A,CU(A\&C)}}{\partial G^A}\right|_{G^A = G^{A,PR}} > 0.$$

The strict concavity of the aggregate payoff function implies that $G^{A,CU(A\&C)} > G^{A,PR}$.

Country *B* determines an optimal arming, denoted as $G^{B,CU(A\&C)}$, that maximizes its aggregate payoff: $\Pi^{B,CU(A\&C)} = CS^{B,CU(A\&C)} + PS^{B,CU(A\&C)} + \tau_c^B M_c^{B,CU(A\&C)} + \tau_a^B M_a^{B,CU(A\&C)}$. Evaluating Evaluating the slope $\partial\Pi^{B,CU(A\&C)} \big/ \partial G^A$ at the point where $G^B = G^{B,PR}$, we have

$$\left.\frac{\partial\Pi^{B,CU(A\&C)}}{\partial G^B}\right|_{G^B = G^{B,PR}} < 0,$$

which implies that $G^{B,CU(A\&C)} < G^{B,PR}$.

References

Bagwell, K., & Staiger, R.W. (1997). Multilateral cooperation during the formation of free trade areas, *International Economic Review*, *38*, 291–319.

Bagwell, K., & Staiger, R. W. (1999). Regionalism and multilateral tariff cooperation. In: J. Piggott & A. Woodland (Eds.), *International Trade Policy and the Pacific Rim*. Palgrave Macmillan.

Bagwell, K., Bown, C.P., & Staiger, R. W. (2016). Is the WTO passé?, *Journal of Economic Literature, 54*, 1125–1231.

Baier, S. L., & Bergstrand, J. H. (2004). Economic determinants of free trade agreements, *Journal of International Economics*, *64*, 29–64.

Baldwin, R. E., (1997). The Causes of regionalism, *World Economy*, *20*, 865–888.

Baldwin, R. E., & Jaimovich, D. (2012). Are free trade agreements contagious?, *Journal of International Economics*, *88*, 1–16.

Barbieri, K. (1996). Economic interdependence: A path to peace or a source of interstate conflict?, *Journal of Peace Research*, *33*, 29–49.

Barbieri, K., & Levy. J. S. (1999). Sleeping with the enemy: The impact of war on trade, *Journal of Peace Research*, *36*, 463–479.

Bergstrand, J. H., Egger, P. H., & Larch, M. (2016). Economic determinants of the timing of preferential trade agreement formations and enlargements, *Economic Inquiry*, *54*, 315–341.

Chang, Y.-M., & Luo, Z. (2017). Endogenous destruction in conflict: Theory and extensions, *Economic Inquiry*, 55, 479–500.

Chang, Y.-M., Potter, J., & Sanders, S. (2007). War and peace: Third-party intervention in conflict," *European Journal of Political Economy*, *23*, 954–974.

Chang, Y.-M., & Sanders, S. (2009). Raising the cost of rebellion: The role of third-party intervention in intrastate conflict, *Defence and Peace Economics*, *20*, 149–169.

Chang, Y.-M., & Sellak, M. (2019). A game-theoretic analysis of international trade and political disputes over external territories, *Public Choice*, *179*, 209–228.

Chang, Y.-M. & Sellak, M. (2022). A theory of competing interventions by external powers in intrastate conflicts: Implications for war and armed peace," *Applied Economics*, *54*, 3811–3822.

Chang, Y.-M., Sanders, S., & Walia, B. (2015). The costs of conflict: A choice-theoretic, equilibrium analysis, *Economics Letters*, *131*, 62–65.

Chang, Y.-M., & Wu. S.-J. (2020). Insecure resources, bilateral trade, and endogenous predation: A game-theoretic analysis of conflict and trade, *Southern Economic Journal*, *86*, 1337–1371.

Findlay, R., & O'Rourke, K.H. (2010). War, trade and natural resources: A historical perspective. In *The Oxford Handbook of the Economics of Peace and Conflict*, Oxford University Press. https://doi.org/10.1093/oxfordhb/9780195392777.013.0023

Freund, C., & Ornelas, E. (2010). Regional trade agreements. *Annual Review of Economics*, *2*, 139–166**.**

Garfinkel, M., Skaperdas, R.S., & Syropoulos, C. (2015). Trade and insecure resources, *Journal of International Economics*, *95*, 98–114.

Gleditsch, K. S., & Pickering, S. (2014). Wars are becoming less frequent: A response to Harrison and Wolf, *Economic History Review*, *67*, 214–230.

Glick, R., & Taylor, A.M. (2010). Collateral damage: Trade disruption and the economic impact of war, *Review of Economics and Statistics*, *92*, 102–127.

Hadjiyiannis, C., Heracleous, M.S. & Tabakis, C. (2016). Regionalism and conflict: Peace creation and peace diversion, *Journal of International Economics*, *102*, 141–159.

Harrison, M., & Wolf, N. (2012). The frequency of wars, *Economic History Review*, *65*, 1055–1076.

Hirshleifer, J., (1989). Conflict and rent-seeking success functions: Ratio vs. difference models of relative success, *Public Choice*, *63*, 101–112.

Hirshleifer, J. (1991). The technology of conflict as an economic activity, *American Economic Review Papers and Proceedings*, *81*, 130–134.

Kim, Y. S., & Rousseau, D.L. (2005). The classical liberals were right (or half wrong): New tests of the 'liberal peace,' 1960-1988, *Journal of Peace Research*, *42*, 523–543.

Liu, X., & Ornelas, E. (2014). Free trade agreements and the consolidation of democracy, *American Economic Journal*: *Macroeconomics*, *6*, 29–70.

Mansfield, E. D., & Bronson, R. (1997). Alliances, preferential trading arrangements, and international trade, *American Political Science Review, 91*, 94–107.

Mansfield, E. D., & Pevehouse, J.C. (2000). Trade blocs, trade flows, and international conflict, *International Organization*, *54*, 775–808.

Martin, P., Mayer, T., & Thoenig, M. (2008). Make trade not war?, *Review of Economic Studies*, *75*, 865–900.

Martin, P., Mayer, T., & Thoenig, M. (2012). The geography of conflicts and regional trade agreements, *American Economic Journal*: *Macroeconomics* 4, 1–35.

McGuire, M. C. (2000). Trade and the predatory state: Ricardian exchange with armed competition for resources - A diagrammatic exposition, *Public Choice*, *182*, 459–494.

Oneal, J. R., & Russett, B. (1999). Assessing the liberal peace with alternative specifications: Trade still reduces conflict, *Journal of Peace Research*, *36*, 423–442.

Polachek, S. W. (1980). Conflict and trade, *Journal of Conflict Resolution*, *24*, 55–78.

Regan, P. (1998). Choosing to intervene: Outside intervention in internal conflicts, *Journal of Politics*, *60*, 754–759.

Reuveny, R., & Kang, H. (1998). Bilateral trade and political conflict/cooperation: Do goods matter?, *Journal of Peace Research*, *35*, 581–602.

Rowlands, D., & Carment, D. (2006). Force and bias: Towards a predictive model of effective third party intervention, *Defence and Peace Economics*, *17*, 435–456.

Rose, A. K. (2004). Do we really know that the WTO Increases trade?, *American Economic Review*, *94*, 98–114.

Sanders, S., & Walia, B. (2014). Endogenous destruction in a model of armed conflict: Implications for conflict intensity, welfare, and third-party intervention, *Journal of Public Economic Theory, 16*, 604–609.

Siqueira, K. (2003). Conflict and third-party intervention. *Defence and Peace Economics, 14*, 389–400.

Skaperdas, S. (1996). Contest success functions, *Economic Theory*, *7*, 283–290.

Tullock, G. (1980). Efficient rent seeking, In: *Towards a Theory of the Rent-Seeking Society*, edited by J. Buchanan, R. Tollison, & G. Tullock, Texas A&M University Press, Texas.

Vicard, V. (2009). On trade creation and regional trade agreements: Does depth matter?, *Review of World Economics*, *145*, 167–187.

Viner, J. (1950). *The Customs Union Issue*. Carnegie Endowment for International Peace.

Whalley, J. (1998). Why do countries seek regional trade agreements?. In: *The Regionalization of the World Economy* (pp. 63–90), edited by J. A. Frankel, University of Chicago Press, Chicago.

World Economic Forum, *The Global Risks Report of 2018*, 13th Edition, Geneva.