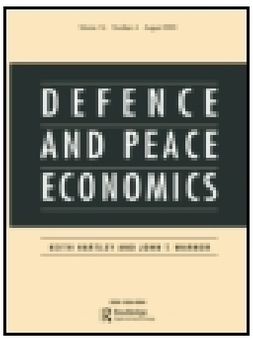

Defence and Peace Economics

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/gdpe20

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To cite this article: Yang-Ming Chang & Manaf Sellak (2021): Endogenous Security, Third-Party Trade, and Interstate Disputes: A Conflict-Theoretic Analysis, Defence and Peace Economics, DOI: 10.1080/10242694.2021.1949830

To link to this article: https://doi.org/10.1080/10242694.2021.1949830

Published online: 19 Jul 2021.

DEFENCE AND PEACE ECONOMICS
https://doi.org/10.1080/10242694.2021.1949830

Routledge
Taylor & Francis Group

RESEARCH ARTICLE

Endogenous Security, Third-Party Trade, and Interstate Disputes: A Conflict-Theoretic Analysis

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ABSTRACT

This paper examines third-party trade and its implications for conflicts between hostile countries not engaging in trade. We present a conflict-theoretic model to analyze two adversaries' endogenous arming decisions when they separately establish a free trade agreement (FTA) with a neutral third-party state. We contrast this multiple FTAs regime with a single FTA regime between one adversary and the third-party state, which excludes the other adversary as a non-member. In our analysis, the benchmark case is a protectionist regime when the bilateral trade between the third-party state and each of the adversaries is a tariff war. Among the three trade regimes, we show that the two adversaries' aggregate arming is the *lowest* under multiple FTAs but is the highest under a single FTA. These results suggest that, despite no trade between two adversary countries, multiple FTAs through third-party trade have the pacifying or appeasing effect of lowering overall military buildups in interstate conflicts.

ARTICLE HISTORY
Received 11 January 2021
Accepted 27 June 2021

KEYWORDS
Free trade agreements; third-party trade; interstate conflict; arming; optimal tariffs

JEL CLASSIFICATION
D74; F15; F51; F52; F53; F55

Introduction

Despite increasingly unpredictable trends of armed conflicts in several parts of the continents,[1] the past several decades have witnessed continuous growth in preferential trade agreements among nations.[2] In regions where enemy countries do not trade with each other, would the institutional settings of free trade agreements (FTAs) through a third-party state constitute an effective mechanism in reducing or aggravating militarized interstate conflicts? What are the differences in third-party trade's political-economic implications under alternative trade regimes (tariff war or preferential trading arrangements) for military tensions and crises between hostile countries in regions? Would the possible trend of moving from preferential trading arrangements back to the protectionist trade regime in a tariff war[3] make the world more safe or dangerous (in terms of overall military buildups) with the presence of interstate disputes? This paper presents a conflict-theoretic analysis of third-party trade and FTAs, hoping to shed some light on these challenging issues.

The role that third-party play in influencing the outcomes of two-party conflicts (interstate and intrastate) has been of interest to policymakers and social scientists. Voluminous academic studies have devoted to analyzing how third-party involvement, intentionally or non-intentionally, affects a two-party conflict's equilibrium outcomes. Regan (1998) remarks that third-party intervention arises when an outside party's national interest is at stake. Balch-Lindsay and Enterline (2000) consider that third parties are strategic actors and may have incentives to prolong intrastate conflicts. Regan (2002) empirically finds that intervention by an outside party attempts to limit

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hostilities. Siqueira (2003) presents a theoretical analysis of third-party intervention in which the third party acts as a peacemaker in reducing conflict, irrespective of the stakes involved in a specific conflict. Amegashie and Kutsoati (2007) postulate that a third party acts as a social planner in maximizing the weighted sum of utilities for the primary parties to the conflict and the non-combatant population; the authors find that third-party intervention can promote peace through biased (i.e., one-sided) intervention efforts. Considering the endogeneity of intervention by a third party in a sequential-move arming game, Chang, Potter, and Sanders (2007) show that intervening actions can reduce or worsen a two-party conflict. Blouin (2018) stresses a third party's strategic role, not affecting two contenders' fighting costs but exerting a credible threat of force in reducing the conflict. Along with other contributions in the conflict literature, these studies investigate an outside party's role, as either a conflict manager or a military supporter, and identify conditions that reduce conflicts through non-economic means.[4]

Another strand in the conflict literature analyzes the possible role that a third party plays through establishing preferential trade agreements with countries involved in conflicts. This research strand expands on the earlier contributions that concentrate primarily on trade between adversary countries engaging in political disputes over productive resources. The liberal political thinking contends that trade between two enemy countries reduces conflicts by increasing armed confrontations' opportunity costs. In contrast, the realist paradigm argues that trade increases the relative power of a country and makes a trading partner less vulnerable, the latter of which may result in a coercion effect. That is, the fear of a country from its contender that converts trade gains (commercial power) into fighting capabilities (military power) constitutes an incentive for engaging in war.[5]

However, actual rivals tend not to trade with each other for various reasons, including predominantly national security threats or concerns over resource appropriation possibilities.[6] One example is the interstate disputes between Israel and Saudi Arabia. The two countries do not trade, nor do they have any diplomatic communication due to the Arab-Israel longstanding conflict.[7] Nevertheless, both countries are strategic allies of the United States of America (a third-party state). Another example is the regional conflict between Algeria and Morocco over the political status of Western Sahara, in which their long borders have been closed since 1994. Since then, the two countries next to each other do not engage in trade across their national boundaries. Interestingly, both countries are European Union's trade partners. Given these observations, we focus our analysis on third-party literature by analyzing how forming FTAs with an outside party affects hostile countries not engaging in trade. Peterson (2011) shows that third-party trade with the country target increases interstate hostility when there is political dissimilarity. The degree of political similarity is measured by how one country views its rival as a threat. Additionally, Peterson (2011) demonstrates empirically that third-party trade with the defender country is conflict-aggravating than a third-party trade with the potential aggressor. Kinne (2014) stresses a third-party state's trade ties with a potential aggressor and war initiator. The author finds that external power may have a higher incentive to reduce hostility between two adversary countries by threatening them through credible signaling (such as sanctions, embargo, or blockades) when such trade ties are relatively more extensive with both adversaries. In analyzing how wars affect third-party trade, Feldman and Sadeh (2018) highlight the importance of differences in third parties' national interests to the primary countries in conflicts. The researchers find that the volume of trade between a non-warring third party and a warring country is positively (resp. negatively) correlated with the degree of similarity (resp. difference) between their national interests.

This paper presents a conflict-theoretic model of third-party trade and FTAs to see what effects they have on military buildups by enemy countries not engaging in trade. What are enemy countries' optimal arming allocations when each adversary forms a free trade agreement (FTA) with a neutral third party, compared to the regime when only one adversary forms an FTA with the third party while excluding the other as a non-member? What are the conflict-related arming allocations when the bilateral trade is a tariff war? To answer these questions from the conflict perspective, we introduce resource predation possibilities into a three-country trade model *à la* Bagwell and Staiger (1997,

1999). We extend the two-country model of Chang and Wu (2020) to allow for third-party trade in different regimes. Our analysis examines the endogenous arming decisions of hostile countries in a multiple-stage game framework. This extension permits us to identify the conditions under which a third-party trade may or may not aggravate a two-party conflict by increasing military buildups. Our analysis compares aggregate arming under three different trade regimes: a protectionist trade regime with Nash tariffs, a trade regime with multiple FTAs, and a single FTA regime.[8] In each regime, a third-party state is involved in bilateral trade with at least one contending country.

We show that each adversary country's arming affects its domestic welfare in three different ways. (i) The first is an export-revenue effect of arming, which affects welfare positively since an increase in military buildup raises the prices and revenues of exports. That is, other things being equal, there is an arming-induced term-of-trade improvement. (ii) The second is a resource-appropriation effect of arming, which improves welfare since an increased arming raises the amount of final goods predated from its rival country for domestic consumption. (iii) The third is an output-distortion effect of arming, which causes domestic welfare to decline since allocating more resources to arming negatively affects domestic production and consumption of civilian goods. We find that these three effects interact simultaneously in determining each of the adversaries' optimal arming levels.

In comparing the endogenous arming decisions of two adversaries under alternative trade regimes, we find the following results. First, third-party trade in multiple FTAs reduces two adversaries' aggregate arming, despite that they do not trade. Third-party trade in multiple FTAs thus has the unintentional impact of lowering military buildups than the protectionist trade regime. Second, third-party trade under a single FTA regime induces the non-member adversary to increase arming. The other adversary, being an FTA member, maintains its arming as that under the tariff war. As a result, aggregate arming is strictly higher under the single FTA regime. This suggests that a single FTA is conflict-aggravating. The economic intuition is that third-party trade in a single FTA diverts relatively more endowed resources from civilian goods to military goods, despite that establishing an FTA is based purely on member countries' economic advantages. The implications are profound: the trend of moving from multiple FTAs to a single FTA regime, or the case of the Nash tariff war, could make the world 'less safe' (in terms of increasing overall military buildups) in the presence of militarized interstate conflicts.

The remainder of the paper is organized as follows. Section 2 presents an endogenous security model to analyze two-party conflict when adversaries have bilateral trade relations with a third-party state. We first discuss the benchmark case when bilateral trade takes the form of a tariff war. Section 3 examines multiple FTAs formed separately between the third-party state and each adversary. Section 4 examines the case of a single FTA. In Section 5, we discuss third-party trade implications for interstate conflicts, and Section 6 concludes.

A Model of Endogenous Security and Bilateral Trade with A Third Party

Basic Assumptions and the Structure of the Game

We consider a world of three large countries, *A, B*, and *C*, where *A* and *B* are 'enemies' to appropriate each other's resources without trade. Country *C* is a neutral third party and can be considered as the 'rest of the world' (ROW). The third-party state has bilateral trade relations with *A* and *B*. Each country is endowed with *R* units of resource (or intermediate input), which can be used to produce a country-specific good for domestic consumption and exportation to a non-enemy country.

From the international trade perspective, country *C* has three options: (i) forming multiple free trade agreements (FTAs) with each of the adversary countries *A* and *B*, (ii) forming a single FTA with only one of the countries (*A* or *B*) while excluding the other a non-member, or (iii) engaging in bilateral trade without committing to FTAs. In option (iii), there is a protectionist trade regime (i.e. a bilateral trade with Nash tariffs) between *C* and *A*, and between *C* and *B*. We shall show that there is

an arming-induced terms-of-trade improvement associated with military buildups by adversaries *A* and *B* although they do not trade.,[9,10]

We assume that each country specializes in producing a consumption or civilian good in its country name. That is, countries *A, B*, and *C*, produce country-specific goods a, b, and c, respectively. For bilateral trade between *C* and *A* or between *C* and *B*, we consider an import-competing scenario (Bagwell and Staiger 1997, 1999). Country *A* produces good a, appropriates good *b* from country *B*, and imports good *c* from the third-party state *C*. Similarly, country *B* produces good b, appropriate good *a* from country *A*, and import good *c* from the third-party state *C*. The third-party state *C* produces good c, and imports both goods a, and b. We adopt a linear production technology in that one unit of a specific resource (or input) is required to produce one unit of final good in its specialization.

Facing the resource predation possibilities, the enemy countries *A* and *B* allocate certain amounts of their endowed resources to produce weapons for protection. We consider a simple military technology that one unit of an endowed resource produces one armament unit. Let $G^A(>0)$ and $G^B(>0)$ represent the conflict-related arming allocations of the adversaries *A* and *B*, respectively. A country's security policy is a broader concept to include such dimensions as military, economics, environment, energy, and technology. As in the theoretical conflict literature, we assume that each enemy country's security policy is represented by its arming allocation.[11] The proportion that each adversary can retain from its endowed resource in the event of predation is represented by a canonical 'contest success function' (CSF). This function reflects the technology of conflict (see, e.g. Tullock 1980; Hirshleifer 1989; Skaperdas 1996) and is given as follows:

$$\begin{array}{l}\psi^A = \frac{G^A}{G^A+G^B} \text{ and } \psi^B = \frac{G^B}{G^A+G^B} \text{ for } G^A + G^B > 0; \\ \psi^A = \psi^B = \frac{1}{2} \text{ for } G^A = G^B = 0. \end{array} \tag{1}$$

In a fight, ψ^A is the share that country A retains from its own resources and is also the share of resources that country A extracts from country B. Similarly, ψ^B is the share that country B retains from its own resources and is also the share of resources that country B extracts from country A. In the event of fighting, the adversaries *A* and *B* incur exogenous destruction costs. Country *A* loses D^A units of good *a* and country *B* loses D^Bunits of good *b*.[12]

Given the CSFs in (1), we denote X_a^A as the amount of a final good *a* that country *A* produces. In equilibrium, X_a^A has two components: the amount of the good net of arming that country *A* retains after fighting and the amount destroyed in the conflict. We then have:

$$X_a^A = (\frac{G^A}{G^A + G^B})(R - G^A) - D^A, \tag{2a}$$

Similarly, denoting X_b^B as the amount of final good *b* that country *B* produces, we have:

$$X_b^B = (\frac{G^B}{G^A + G^B})(R - G^B) - D^B. \tag{2b}$$

Since country *C* is neutral, it engages in bilateral trade with *A* and *B*. The amount of good *c*produced is equal to its endowed resources *R* under the simple technology assumption.

Regarding consumption preferences over the three country-specific civilian goods, we follow Bagwell and Staiger (1997, 1999) by assuming that market demand for good $i(i = a, b, c)$ in country $j(j = A, B, C)$ is given as[13]

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

whereP_i^j is the price of good *i* in country *j*, $\alpha(>R)$, and $\beta > 0$. Corresponding to (3a), consumer surplus (*CS*) for country*j* is:

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

To calculate each country's producer surplus, we first look at the adversaries, *A* and *B*. Producer surplus for *A* and *B* are given, respectively, as

$$PS^A = P_a^A[(\frac{G^A}{G^A + G^B})(R - G^A) - D^A] + P_b^A[(\frac{G^A}{G^A + G^B})(R - G^B)], \tag{4a}$$

$$PS^B = P_b^B[(\frac{G^B}{G^A + G^B})(R - G^B) - D^B] + P_a^B[(\frac{G^B}{G^A + G^B})(R - G^A)]. \tag{4b}$$

On the RHS of each equation, the first term is the market value of a civilian good that an adversary retains after fighting, net of arming and destruction.[14] The second term is the market value of a different civilian good that an adversary appropriates from its enemy. We impose the assumption that the civilian goods appropriated by contending countries are domestically consumed and not traded.

As for the neutral third-party state, *C*, producer surplus is the market value of good *c*that it produces from its endowment *R*. That is,

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

Under the shadow of appropriations, the enemy countries *A* and *B* maximize their social welfare$(SW^j)$by determining their arming allocations before setting tariffs on imports from country *C*. Country *C* maximizes its social welfare by setting tariffs on imports from *A* and *B*. Following the economics literature, each country's social welfare is the sum of consumer surplus, producer surplus, and tariff revenue. That is,

$$SW^j = CS^j + PS^j + TR^j \; j \in \{A, B, C\}$$

where $CS^j$and PS^j are given in (3)-(5). The amount of tariff revenue, TR^j, hinges on the type of regimes chosen by two trading nations (*A* and *C*, or *B* and *C*), and the adversaries' arming allocations.

To analyze how third-party trade affects conflict-related arming decisions, we consider the following game structure. At stage one, country *C* may commit to forming an FTA with one of the adversary countries or both, or the third-party trade takes the form of a protectionist regime in a tariff war. At stage two, enemy countries *A* and *B* independently determine optimal arming allocations to maximize their social welfare. At stage three, the three countries set their optimal tariffs (zero under an FTA).[15] At stage four, a bilateral trade with the third-party state takes place. To derive the subgame perfect Nash equilibrium for each trade regime, we use backward induction.

Third-party Trade under the Protectionist Regime with Nash Tariffs

Without any cooperative trade arrangements between two trading nations (*C* and each of *A* and *B*), there is a protectionist regime under which each nation sets an optimal tariff for restraining imports from the other. In this case, bilateral trade involves a tariff war. We use the protectionist regime as a benchmark to evaluate equilibrium outcomes under alternative regimes.

We begin with the fourth and last stage of the game, at which country *C* has bilateral relations with *A* and *B*, in the form of a protectionist trade regime. To maintain trade and product specialization patterns, we note the comparative advantage principle that the price of a good in an exporting country plus a specific tariff imposed on the good by an importing country can never be lower than the good's price in the importing country. This principle excludes the possibilities of arbitrage activities in the three-country world (Bagwell and Staiger 1997, 1999). For the good *a* that country *A* produces, we have the following non-arbitrage condition:

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

where τ_a^C is the tariff that country C imposes on each unit of good a. We solve for the equilibrium price of good a in country A by equating the good's aggregate demand with its aggregate supply. That is, trade equilibrium for good a requires that

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

We show in Appendix A-1 that the equilibrium international prices of goods a, b, and c have the following results:

$$P_a^A = \tfrac{1}{2\beta}\{2\alpha - \beta\tau_a^C - [(\tfrac{G^A}{G^A+G^B})(R - G^A) - D^A]\}, P_b^B = \tfrac{1}{2\beta}\{2\alpha - \beta\tau_b^C - [(\tfrac{G^B}{G^A+G^B})(R - G^B) - D^B]\},$$

$$P_c^C = \frac{3\alpha - \beta(\tau_c^A + \tau_c^B) - R}{3\beta}. \tag{9}$$

In the third stage of the game, the three countries independently and simultaneously determine their optimal tariffs. Given that the two adversaries A and B do not trade, country A's total revenue from imposing tariffs, τ_c^A, on good c is:

$$TR^A = \tau_c^A Q_c^A, \tag{10}$$

where Q_c^A is A's import demand. That is, $Q_c^A = (\alpha - \beta P_c^A)$.

The Endogeneity of Security and Tariff Policies in a Trade War with Nash Tariffs

We proceed to analyze the two adversaries' arming decisions and the tariffs that the three countries impose on their imports. Making use of the non-arbitrage condition in (7) and substituting the prices from (9) into CS^A in (3), PS^A in (4), and TR^Ain (10), we calculate country A's social welfare $SW^A(= CS^A + PS^A + TR^A)$ in terms of tariff rates, $\{\tau_c^A, \tau_c^B, \tau_a^C, \tau_b^C\}$, and arming allocations, $\{G^A, G^B\}$. For the scenario of third-party trade between A and C, we show in appendix A-2 that the equilibrium Nash tariffs set by the three countries under the protectionist regime (PR) are:

$$\tau_c^{A,PR} = \tfrac{3}{7\beta}, \tau_c^{B,PR} = \tfrac{3}{7\beta},$$

$$\tau_a^{C,PR} = \frac{1}{3\beta}[(\frac{G^A}{G^A + G^B})(R - G^A) - D^A],$$

$$\tau_b^{C,PR} = \frac{1}{3\beta}[(\frac{G^B}{G^A + G^B})(R - G^B) - D^B]. \tag{11}$$

The results in (11) indicate that the two adversaries' Nash tariffs on their imports from a third-party state are independent of their conflict-related arming allocations and the destruction parameters. This analysis is consistent with our presumption that third party is a politically neutral state such that the tariff policies of the adversaries toward the third-party state are not affected by their arming decisions. In contrast, the third-party state's optimal tariffs on imports from the countries involved in the conflict are contingent upon the conflicting countries' allocations of resources to arms buildups and destruction parameters.

It follows from (22) that we have the following comparative-static derivatives:

$$\tfrac{\partial\tau_a^{C,PR}}{\partial G^A} < 0,\ \tfrac{\partial\tau_a^{C,PR}}{\partial G^B} < 0,\ \tfrac{\partial\tau_b^{C,PR}}{\partial G^A} < 0,\ \tfrac{\partial\tau_b^{C,PR}}{\partial G^B} < 0,\ \tfrac{\partial\tau_a^{C,PR}}{\partial D^A} < 0,\ \tfrac{\partial\tau_b^{C,PR}}{\partial D^B} < 0, \tag{12}$$

We present the economic implications of these findings in our first proposition:

PROPOSITION 1. *Under the protectionist regime where two enemy countries appropriate each other's resources without trade and each establishes a bilateral trade relationship with a neutral third-party*

state, the third-party state's optimal tariffs are lower (i) the higher the arming allocations of the two adversaries and (ii) the higher the destructiveness of armed conflict.

Proposition 1 shows a neutral third-party state reacts to two adversaries' increased arming allocations by reducing its import tariffs. The economic intuitions are as follows. An increase in arming by each adversary lowers its endowed resource available to produce its country-specific consumption good (a or b) such that the good's international increases. To mitigate the price increase, country C lowers its tariffs.

We proceed to the stage where the two adversaries, A and B, determine optimal arming allocations to maximize their national welfare. Under symmetry in all aspects (resource endowments, production technology) such that $G^{A,PR} = G^{B,PR} = G^{PR}$and $D^A = D^B = D$, we solve for the optimal arming as follows:

$$G^{PR} = \frac{2}{33}\sqrt{16R^2 - 153Ra + 324a^2 + D(144D - 168R + 432a)} + \frac{25}{33}R - \frac{12}{11}a - \frac{8}{11}D. \tag{13a}$$

Using G^{PR} in (13a), we calculate the following two possibilities:

$$\text{(i) } G^{PR} = 0 \text{ when } a \leq \tfrac{17}{36} - \tfrac{4}{9}D; \tag{13b}$$

$$\text{(ii) } G^{PR} > 0 \text{ when } a > \tfrac{17}{36} - \tfrac{4}{9}D. \tag{13 c}$$

We cannot rule out the possible outcome that the equilibrium level of arming is zero, i.e. $G^{PR} = 0$. The inequality condition in (13b) indicates that this possibility arises when the market size (a) for each consumption good is sufficiently small or when the destruction cost parameter is sufficiently high so that arming is 'economically unproductive.' To analyze resource predations between enemy countries in regional conflicts, we rule out the corner solution and look at the scenario with positive arming. That is, $G^{PR} > 0$. The inequality condition in (13 c) indicates that the equilibrium arming level is strictly positive when the market size (which reflects the perceived economic benefit) is sufficiently large and the destruction cost parameter (which reflects the perceived economic cost) is sufficiently low. For simplicity and without loss of generality, we assume that a is greater than R

Considering the inequality in (13 c) that $G^{PR} > 0$, we have the following comparative-static derivatives:

$$\tfrac{\partial G^{PR}}{\partial a} > 0 \text{ and } \tfrac{\partial G^{PR}}{\partial D} < 0.$$

When two enemy countries face higher destruction costs in fighting, increasing arming's opportunity costs dominate the economic gains from trade. As a result, the enemy countries tend to allocate fewer resources to arming. In contrast, the enemy countries allocate more resources to arming when each good's market size is large.

It is necessary to investigate how an adversary country's arming affects its domestic welfare. Using country A as an example (under the assumption of symmetry), we show in Appendix A-4 the following decomposition for the welfare effect of arming:

$$\frac{\partial SW^A}{\partial G^A} = \underbrace{[X_a^A - (a - \beta P_a^A)]\frac{\partial P_a^A}{\partial G^A}}_{\substack{\text{Export}-\text{revenue effect}\\ \text{of arming}\\ (+)}} + \underbrace{\frac{\partial APP_b}{\partial G^A}P_b^A}_{\substack{\text{Resource}-\text{appropriation effect}\\ \text{of arming}\\ (+)}} + \underbrace{\frac{\partial X_a^A}{\partial G^A}P_a^A}_{\substack{\text{Output}-\text{distortion effect}\\ \text{of arming}\\ (-)}} = 0. \tag{14}$$

where $APP_b = [G^A/(G^A + G^B)](R - G^B)$ is the amount of good b that country A appropriates from country B.

Each adversary country's arming has a positive export-revenue effect on its domestic welfare since increasing arming raises its exports' prices and revenues. That is, there is an arming-induced terms-or-trade improvement.[16] Moreover, arming has a positive resource- appropriation effect in enhancing welfare since increasing arming increases the amount of final good appropriated from its rival for domestic consumption. The sum of these two effects constitutes the marginal revenue (MR)

of arming. Nevertheless, arming generates an output-distortion effect that reduces welfare since allocating more resources to fighting lowers civilian goods production for domestic consumption. This third effect constitutes the marginal cost (MC) of arming. These three effects interact simultaneously in determining the welfare-maximizing level of arming for each adversary such that, in equilibrium, the MR of arming equals its MC.

Using the conflict equilibrium outcome in a trade war as the benchmark, we look at how the arming allocations of the enemy countries are affected when the third-party forms an FTA individually with each of the two adversary countries.

Third-Party Trade under Multiple FTAs Regime

This section analyzes how two adversaries' optimal arming decisions are affected by third-party trade that takes multiple FTAs. We use superscript '*M*' to denote the regime with multiple FTAs. We consider a three-stage game. At stage one, the third party (*C*) commits to forming a multiple FTA separately with each of the adversary countries (*A* and *B*). At stage two, the adversaries *A* and *B* independently determine their optimal arming allocations. At stage three, the member countries of an FTA enjoy duty-free access to each other's markets, and bilateral trade with the third-party state takes place. We use backward induction to solve for the sub-game perfect Nash equilibrium under multiple FTAs.

We begin with the third stage of the game by substituting zero tariffs back into equation (9), making use of the non-arbitrage condition in (7), to calculate the goods' prices in their respective markets. This yields:

$$P_a^{A,M} = P_a^{C,M} = \frac{1}{2\beta}\left(2\alpha - \frac{G^A}{G^A+G^B}(R-G^A) + D^A\right), P_a^{B,M} = \frac{\alpha}{\beta} - \frac{G^B}{\beta(G^A+G^B)}(R-G^A),$$
$$P_b^{B,M} = P_b^{C,M} = \frac{1}{2\beta}\left(2\alpha - \frac{G^B}{G^A+G^B}(R-G^B) + D^B\right), P_b^{A,M} = \frac{\alpha}{\beta} - \frac{G^A}{\beta(G^A+G^B)}(R-G^B),$$

$$P_c^{A,M} = P_c^{B,M} = P_c^{C,M} = \frac{3\alpha - R}{3\beta}. \tag{15}$$

At the second stage of the game, each adversary determines an arming allocation that maximizes its domestic welfare. Country *A's* welfare function is: $SW^{A,M} = CS^{A,M} + PS^{A,M}$, where consumer surplus and producer surplus are:

$$CS^{A,M} = \frac{1}{2\beta}[(\alpha - \beta P_a^{A,M})^2 + (\alpha - \beta P_b^{A,M})^2 + (\alpha - \beta P_c^{A,M})^2],$$

$$PS^{A,M} = P_a^{A,M}\left[\left(\frac{G^A}{G^A+G^B}\right)(R-G^A) - D^A)\right] + P_b^{A,M}\left[\left(\frac{G^A}{G^A+G^B}\right)(R-G^B)\right],$$

and the prices of the goods are given in (15). Country *B*'s welfare function is: $SW^{B,M} = CS^{B,M} + PS^{B,M}$, where consumer and producer surplus are:

$$CS^{B,M} = \tfrac{1}{2\beta}[(\alpha - \beta P_a^{B,M})^2 + (\alpha - \beta P_b^{B,M})^2 + (\alpha - \beta P_c^{B,M})^2],$$
$$PS^{B,M} = P_a^{B,M}\left[\left(\tfrac{G^B}{G^A+G^B}\right)(R-G^B) - D^B)\right] + P_b^{B,M}\left[\left(\tfrac{G^B}{G^A+G^B}\right)(R-G^A)\right].$$

The FOCs for *A* and *B* are: $\partial SW^{A,M}/\partial G^A = 0$ and $\partial SW^{B,M}/\partial G^B = 0$, which lead to the Nash equilibrium levels of arming, denoted as $\{G^{A,M}, G^{B,M}\}$.

Under symmetry in all dimensions (resource endowments, production technology, etc.), we have $G^{A,M} = G^{B,M} = G^M$ and $D^A = D^B = D$. We calculate the optimal arming level as

$$G^M = \frac{\sqrt{9R^2 - 112R\alpha + 256\alpha^2 + D(81D - 102R - 288\alpha)}}{13} + \frac{10}{13}R - \frac{16}{13}\alpha - \frac{9}{13}D. \tag{16}$$

Evaluating the derivatives $\partial SW^{A,M}/\partial G^A$ and $\partial SW^{B,M}/\partial G^B$ at the point where $G^A = G^B = G^{PR}$,[17] we have:

$$\frac{\partial SW^{A,M}}{\partial G^A}\Big|_{G^A=G^{PR},\alpha>R,D=0.2} < 0 \text{ and } \frac{\partial SW^{B,M}}{\partial G^B}\Big|_{G^B=G^{PR},\alpha>R,D=0.2} < 0.$$

The strict concavity of each country's social welfare function implies that

$$G^M < G^{PR}. \tag{17}$$

Equation (17) indicates that multiple FTAs (with the neutral third party forming an FTA separately with each of the adversary countries) reduce each adversary's arming.

As in Garfinkel, Syropoulos, and Yotov (2020), we define the "intensity of conflict" (denoted by *CI*) as the aggregate amount of arming allocated to fighting by adversaries.[18] That is, $CI = G^A + G^B$. It follows directly from (17) that

$$CI^M < CI^{PR}. \tag{18}$$

These results lead to the following proposition:

PROPOSITION 2. *If the third-party state establishes an FTA separately with each of two adversaries, the adversaries reduce their conflict-related arming allocations although they do not trade. As a result, third-party trade under multiple FTAs has lower aggregate arming than bilateral trade wars with Nash tariffs.*

A move from the protectionist regime to third-party trade with multiple FTAs provides an economic incentive for enemy countries to cut back on their arming allocations. Consequently, the overall intensity of conflict decreases. To explain the economic intuition behind this result, we use the social-welfare decomposition approach developed in Section 2. The slope of each adversary's social welfare function with respect to its arming level under the protectionist regime is strictly negative, as indicated in (17). The strict negativity of the welfare function's slope is because the output-distortion effect, which measures the marginal cost of arming, exceeds the export-revenue effect plus the predation effect, which measures the marginal revenue.[19]

An alternative way to explain the result in Proposition 2 is as follows: When an outside party decides to form a free trade agreement with each one of two enemy countries, they both enjoy economic benefits on the terms of trade. This outcome emerges since tariffs are relatively lower under the multiple FTAs than under the protectionist regime. Moreover, multiple FTAs offer both of the enemy countries the benefit of having a bigger bilateral trade market despite that the two adversaries do not trade. These two economic benefits are more significant than the cost of appropriating each other's resources.

The conflict-reducing effect resulting from the FTAs can be explained by the fact that the enemy countries (i) generate symmetric benefits from trading through the third-party state and (ii) do not alter the 'balance of power' in terms of arming allocations. In terms of conflict resolution, proposition 2 implies how multiple FTAs via third-party trade can have a conflict-reducing effect since the institutional settings of free trade agreements generate benefits to both of the enemy countries and allow them to maintain their balance of power symmetrically. Put alternatively, third-party trade in the settings of multiple FTAs is conflict-reducing.

Third-Party Trade under the Single FTA Regime

The next step of the analysis is to see how the two adversaries' arming decisions are affected when the third-party state forms a single FTA with only one adversary, either A or B. The issue of interest concerns how the two adversaries (one is an FTA member, whereas the other is a non-member) decide on their conflict-related arming allocations.

Similar to the analysis under the protectionist regime, we consider a four-stage game structure to characterize the sub-game perfect Nash equilibrium for the single FTA formed between countries *A* and *C*, denoted as the *S* regime. At stage one, country C commits to forming an FTA only with country *A*. At stage two, the enemy countries *A* and *B* independently and simultaneously decide on their arming allocations that maximize their domestic welfare. At stage three, *A* and *C* set zero tariffs

$(\tau_c^A = \tau_a^C = 0)$ on their imports from each other and, in the meanwhile, country C sets an optimal tariff τ_b^Con imports from country B. Country B sets an optimal tariff τ_c^B, on imports from C. At stage four, Countries A and B separately engage in trade for final goods with country C.

Making use of equation (9), the non-arbitrage condition in (7), and considering the conditions that $\tau_c^A = \tau_a^C = 0,$ we calculate the equilibrium market prices of goods *a, b*, and *c* as follows:

$$P_a^{A,S} = P_a^{C,S} = \tfrac{1}{3\beta}\{2\alpha - [(\tfrac{G^A}{G^A+G^B})(R-G^A) - D^A]\}, P_a^{B,S} = \tfrac{\alpha}{\beta} - \tfrac{G^B}{\beta(G^A+G^B)}(R-G^A),$$

$$P_b^{B,S} = \frac{1}{2\beta}\{2\alpha - [(\frac{G^B}{G^A+G^B})(R-G^B) - D^A] - \beta\tau_b^C\},$$

$$P_b^{C,S} = \frac{1}{2\beta}\{2\alpha - [(\frac{G^B}{G^A+G^B})(R-G^B) - D^A] + \beta\tau_b^C\},$$

$$P_c^{A,S} = P_c^{C,S} = \tfrac{3\alpha-\beta\tau_c^B-R}{3\beta}, P_c^{B,S} = \tfrac{3\alpha+2\beta\tau_c^B-R}{3\beta}. \tag{19}$$

We proceed to the third stage where country B sets an optimal tariff τ_c^B on good *c* and country C sets an optimal tariff τ_b^C on good *b*. Given that country A does not engage in trade with its enemy B but forms an FTA with country C, there are zero tariffs for the FTA members: $\tau_c^A = \tau_a^C = 0$. Utilizing the prices in (19) and the social welfare function in (6), we determine the welfare-maximizing tariff, $\tau_c^{B,S},$ that the country B imposes on good *c*. The amount of good *c* imported for consumption is: $Q_c^{B,S} = \alpha - \beta P_c^{B,S},$ where $P_c^{B,S}$ is given in (19). This yields

$$Q_c^{B,S} = \alpha - \beta P_c^{B,S} = \frac{R - 2\beta\tau_c^{B,S}}{3}.$$

Consumer and producer surpluses are:

$$CS^{B,S} = \frac{1}{2\beta}[(\alpha - \beta P_a^{B,S})^2 + (\alpha - \beta P_b^{B,S})^2 + (\alpha - \beta P_c^{B,S})^2],$$

$$PS^{B,S} = P_b^{B,S}[(\frac{G^B}{G^A+G^B})(R-G^B) - D^B] + P_a^{B,S}[(\frac{G^B}{G^A+G^B})(R-G^A)].$$

Country B's social welfare function is: $SW^{B,S} = CS^{B,S} + PS^{B,S} + \tau_c^{B,S}Q_c^{B,S}$. Calculating the FOC for country B yields:

$$\frac{\partial SW^{B,S}}{\partial \tau_c^{B,S}} = \frac{R - 8\beta\tau_c^{B,S}}{9} = 0.$$

Solving for the optimal tariff for country B yields

$$\tau_c^{B,S} = \frac{R}{8\beta}. \tag{20a}$$

Next, we calculate the welfare-maximizing tariff that country C imposes on good *b*. Note that the amount of good *b* imported for consumption is: $Q_b^{C,S} = \alpha - \beta P_b^{C,S},$ where $P_b^{C,S}$ is given in (19). After substitution, we have

$$Q_b^{C,S} = \frac{1}{2}[(\frac{G^B}{G^A+G^B})(R-G^B) - D^B - \beta\tau_b^{C,S}] = 0.$$

Consumer and producer surpluses are:

$$CS^{C,S} = \tfrac{1}{2\beta}[(\alpha - \beta P_a^{C,S})^2 + (\alpha - \beta P_b^{C,S})^2 + (\alpha - \beta P_c^{C,S})^2] \text{ and } PS^{C,S} = RP_c^{C,S},$$

where the goods' prices are given in (19). Country C's social welfare function is: $SW^{C,S} = CS^{C,S} + PS^{C,S} + \tau_b^{C,S} Q_b^{C,S}$. To solve for the socially optimal tariff, we make use of the FOC: $\partial SW^{B,S} / \partial \tau_c^{B,S} = 0$, which yields:

$$\tau_b^{C,S} = \frac{1}{3\beta}[(\frac{G^B}{G^A + G^B})(R - G^B) - D^B]. \tag{20b}$$

We proceed to the second stage of national security, at which countries A and B independently and simultaneously determine their optimal arming allocations. Substituting the optimal tariffs from (20b) back into the social welfare functions of A and B, we have their FOCs:

$$\frac{\partial SW^{A,S}}{\partial G^A} = 0 \text{ and } \frac{\partial SW^{B,S}}{\partial G^B} = 0.$$

Evaluating the derivative of $SW^{A,S}$ with respect to G^A at the point where $G^A = G^{A,PR}$ yields[20]

$$\frac{\partial SW^{A,S}}{\partial G^A}|_{G^A = G^{A,PR}} < 0.$$

The strict concavity of the social welfare function then implies that

$$G^{A,S} < G^{A,PR}. \tag{21a}$$

Equation (21a) indicates that the FTA-member country allocates fewer resources to arming relative to the scenario under the protectionist trade regime.

Moreover, we have the following result when evaluated at the point where $G^B = G^{B,PR}$:

$$\frac{\partial SW^{B,S}}{\partial G^B}|_{G^B = G^{B,PR}} > 0,$$

which implies that

$$G^{B,S} > G^{B,PR} \tag{22b}$$

Equation (22b) implies that the non-member country allocates more resources to arming relative to the protectionist regime.

We further evaluate the derivative of $SW^{A,S}$ with respect to G^A at the point where $G^A = G^{A,M}$, which yields a zero value:

$$\frac{\partial SW^{A,S}}{\partial G^A}|_{G^A = G^{A,M}} = 0.$$

This result implies that

$$G^{A,S} = G^{A,M}. \tag{23a}$$

Equation (23a) indicates that the FTA-member allocates the same level of arming, regardless of whether there is a single FTA or there are multiple FTAs.

Moreover, we have the following derivative when evaluated at the point where $G^B = G^{B,M}$:

$$\frac{\partial SW^{B,S}}{\partial G^B}|_{G^B = G^{B,M}} > 0,$$

which implies that

$$G^{B,S} > G^{B,M} \tag{23b}$$

Relative to the regime with multiple FTAs, equation (23b) implies that the non-member or excluded adversary (country B) finds it welfare-improving to allocate more of its resources to arming.

Given the definition that conflict intensity is measured by the sum of resources allocated to the production of guns, we have from (23a) and (23b) that

$$CI^S = G^{A,S} + G^{B,S} \text{ and } CI^M = G^{A,M} + G^{B,M}.$$

These results imply that

$$CI^S > CI^M. \tag{24}$$

We thus have:

PROPOSITION 3. *Relative to the multiple FTAs between a third-party state with each of adversary countries, a single FTA between the third party and only one adversary induces the other non-member adversary to allocate more resources to arming. In contrast, the member country allocates the same level of arming. As a result, aggregate arming is higher under the single FTA regime than under multiple FTAs. The single FTA regime is thus conflict-aggravating.*

The results in Proposition 3 can be explained by the welfare decomposition approach as shown in Section 2. The slope of the non-member country's welfare function with respect to its arming under multiple FTAs is strictly positive as explained in Appendix A-6. The derivative's strict positivity arises since the sum of the export-revenue effect and the resource- predation effect, which measures the marginal revenue of arming, outweighs the output-distortion effect, which measures the marginal cost of arming.

For the case in which a third party forms an FTA with only one of the contending countries, the excluded member's terms of trade deteriorate. A single FTA regime generates less benefit to the excluded country than the multiple FTAs between a third party and the adversary countries. Additionally, the excluded country has a lower degree of market access. The resulting losses generate an incentive for the non-member adversary to increase arming and appropriate activities to mitigate the losses (due to the third party's decision to form a single FTA).

Another way to explain Proposition 3 is that the single FTA regime alters the enemy countries' relative power. The excluded member becomes more vulnerable and has the fear to face coercive activities from its rival, which is a member country of the FTA. The fear is that the economic gains to the rival country could increase arming towards appropriation activities. Consequently, the non-member adversary country finds it better off by allocating more of its resources to arming. Proposition 3 has an important implication on how a third-party state's free trade arrangement with only one of two enemy countries (A and B) worsens their conflict intensity, even though the third party (C) maximizing its social welfare does not care about A and B's fighting. Alternatively, third-party trade in the form of a single FTA regime is conflict-aggravating, despite its political neutrality.

Implications: Roles of Third-Party Trade and FTAs in Intrastate Conflicts

It is instructive to discuss some real-world cases of countries conflicting with each other over valuable resources and a third-party state's role. Note that hostile countries tend not to trade (see, e.g. Gowa 1995; Copeland 2015), especially when they are at war.

There is considerable regional concern over the conflict between Algeria and Morocco. International relations between Algeria and Morocco experienced war and crisis over the political status of Western Saraha (i.e. the 1963 Sand War, the Western Sahara War of 1975–1991). It came as no surprise that the Western Sahara conflict resulted in closing Algerian-Morocco borders in 1994. Since then, the two countries next to each other do not engage in trade across their national boundaries.

On the Moroccan side, its government established a free trade agreement with the E.U. in 2000. On the Algerian side, its government established a free trade agreement with the E.U. five years later in 2005. This Morocco-Algeria-EU framework appears to resemble the three-country model of conflict and trade in which two hostile countries do not trade while each one establishes an FTA with a third party. It seems that both countries' free trading arrangements with the European Union

nations help reduce the political hostility between the two adversaries. Despite that the Morocco-Algeria borders remain closed; the Moroccan government intends to re-establish peaceful talks with Sahara's movement has gradually received more substantial support from the Algerian government. Our theoretical model predicts that any breakup of the third party's FTA with Morocco would induce the latter to engage in more aggressive behavior toward Algeria or in solving the political status of Western Sahara. Any breakup of the third party's FTA with Algeria would encourage the country to allocate resources away from civilian goods' production to the military buildup in interstate disputes.

The Israel-Saudi Arabia-USA framework appears to resemble the three-country model of conflict and trade discussed in the paper. The trade agreement between the United States and each of the two countries constitutes a platform in that it offers both countries an opportunity to engage in more trading activities with the U.S. as a third party rather than engaging in any form of armed conflict. Our model implies that any commitment to breaking up the FTA with Saudi Arabia could motivate the latter to engage in more aggressive policies toward solving the Arab-Israel Conflict. Despite no trade between the two conflicting countries, multiple FTAs that are established between each of the countries with the U.S. should be preferred over a move to a single FTA or a protectionist trade regime with Nash tariffs (i.e. a trade war), viewed from the perspective of reducing conflict intensity in interstate disputes.

Concluding Remarks

This paper presents an endogenous security model of conflict and trade to analyze the impacts that a third-party state has on interstate disputes by establishing trading institutions separately with each of two enemy countries. In contrast to the third-party intervention literature that an outside party is frequently taken to be 'biased' in two-party conflicts, we consider that the outsider is neutral when analyzing two adversaries' endogenous arming decisions in a three-country framework. The analyses have implications concerning how third-party trade and bilateral FTAs affect the adversaries' military buildups in conflicts. In the benchmark case with a tariff war, we show that an adversary country's arming encompasses three different effects on its domestic welfare. The first is an export-revenue effect of arming, which affects welfare positively. The second is a resource-appropriation effect of arming, which enhances welfare. The third is an output-distortion effect of arming, which affects welfare negatively. The three effects jointly determine an adversary country's optimal arming level, where the marginal revenue of arming equals its marginal cost.

We further compare enemy countries' arming allocations and their effects under different trade regimes. Forming FTAs between a third-party state with each of the adversaries results in a lower level of aggregate arming, despite that the adversaries do not trade. Multiple FTAs, not between two enemy countries but as purely economic institutions through third-party trade, can reduce military buildups and have a stronger conflict-reducing effect than the protectionist regime. The regime with a single FTA between a third party and only one adversary induces the excluded adversary to increase its arming. In interstate disputes, a single FTA is conflict-aggravating, whereas multiple FTAs are conflict-reducing. The proliferation of preferential trading agreements, which strategically include certain countries but exclude their political rivals as non-member states, are fundamentally conflict-aggravating. In other words, building international economic relationships through selective trade regionalism may end up increasing the intensity of regional conflicts. Further, our analysis suggests that the trend of moving from multiple FTAs back to a single FTA or the protectionist regime could worsen regional conflicts.

Some caveats and potentially interesting extensions of the model should be mentioned. Given that this paper is theoretical, the model's policy implications should be taken as suggestive. Several simple assumptions have been made in deriving the model's reduced-form solutions. These include linear demands, and constant destruction costs. Next, we assume that free trade agreements between an adversary and a neutral third country are exogenous and binding. That is, no one will consider reneging on them. This assumption allows us to simplify the analysis by assuming away

time-consistency issues. In the 'worst-case scenario' where there is a reneging problem, the outcome would be a trade war with Nash tariffs. The analysis of this paper is static and hence ignores the dynamic aspects of conflicting interactions over time. Finally, it should also be mentioned that our analytical results are derived under the assumption that country-specific products are not substitutes. We borrow this assumption from the peacetime three-country trade model developed by Bagwell and Staiger (1997, 1999). The possibility of product substitution may lead to the scenario where one adversary country produces more efficiently (at lower cost) one (substitutable) good than the its enemy. This case of production efficiency asymmetry can alter the equilibrium results in terms of arming of either country, especially in the case of Multiple FTAs set by the third-party state towards the adversaries. If one adversary is the most efficient country to produce a differentiated product, the country would not be incited to favor its export activity and may allocate a greater proportion of its endowed resource for arming (to guard its production). While the enemy country would be then incited to favor its arming activity due to its relative disadvantage in production. This is an interesting and important topic for future research.

Notes

1. See, e.g. *The Global Risks Report of 2018*, World Economic Forum.
2. Bagwell, Bown, and Staiger (2016) present a systematic review of issues related to preferential trade agreements, as well as on the perils and promise facing the world trading system.
3. An example of the move is the United Kingdom's decision to leave the European Union.
4. Some third-party interventions have the objective of conflict management (i.e. United Nations peacekeeping missions). Such an ideal motivation may not drive all third-party actions. Regan (1998) links interventions by external powers to their national interests and considers it the 'paradigm of realism' and the dominant philosophy in international politics. For other studies on third-party interventions see, e.g. Cetinyan (2002), Rowlands and Carment (2006), Chang and Sanders (2009), Grigorian (2010), Sanders and Walia (2014), Sawyer, Cunningham, and Reed (2015), Chang et al., (2015), Cunningham (2016), and Chang, Luo, and Zhang (2018).
5. For studies that analyze the correlation between trade and conflict, see, e.g. Polachek (1980), Mansfield and Pollins (2001), Reuveny (2002), Polachek and Seiglie (2007), and Glick and Taylor (2010). Polachek (1980) shows that strengthening the extent of trade openness between contending countries is conflict-reducing. This result is echoed by Oneal and Russett (1999). Kim and Rousseau (2005) find that the pacifying effect of greater trade openness can be neutral. Other studies, such as Barbieri (1996), find that extensive links through trade may increase armed conflicts. Barbieri and Levy (1999) show that war does not significantly impact trade between adversaries. There is no consensus on the trade-conflict nexus. See Copeland (2015) for a systematic survey of the literature on trade and conflict in international relations.
6. See, e.g. Gowa (1995) and Copeland (2015). For example, Israel and most Arab countries do not trade; Saudi Arabia and Iran do not trade, nor do Morocco and Algeria.
7. For studies on the Arab-Israel Conflict see, e.g. the book edited by Fawcett (2016).
8. For studies on economic integration through establishing FTAs without resource conflicts see, e.g. Bhagwati and Panagariya (1996), Bagwell and Staiger (1997, 1999), Baier and Bergstrand (2004, 2007), Egger and Larch (2008), Chang and Xiao (2013, 2015), and Braymen, Chang, and Luo (2016).
9. This differs from the small open economy assumption in the traditional international economic analysis that stresses trade between 'small' countries who cannot affect their exportables' world prices. The international trade models developed by Bagwell and Staiger (1997, 1999) are examples of trade between large open economies. Chang and Sellak (2019) analyze the behavior of conflict over external territories between two 'large' countries whose arming decisions affect the world prices of their exportable products.
10. Polachek (1980) is among the first to contend that conflict is supposed to affect terms of trade between nations.
11. See, e.g. Amegashie and Kutsoati (2007), Garfinkel, Skaperdas, and Syropoulos (2008), Sanders and Walia (2014), Chang and Luo (2017), McGuire (2020), and Garfinkel, Syropoulos, and Yotov (2020).
12. As in Garfinkel, Syropoulos, and Zylkin (2020), we assume that the destruction cost parameter is constant. We also impose the conditions that destruction costs are not too high such that the amounts of civilian goods produced (net of arming and those amounts being appropriated) by two adversaries are positive.
13. Similar to the analysis in Bagwell and Staiger (1997, 1999), we assume away income effects in demand for each good and substitutability between traded goods. There is implicitly a freely traded numeraire good that leads to the derivation of linear demands. The linear demand assumptions make it tractable to derive optimal arming and Nash tariffs under resource predation possibilities for the symmetric cases. We do not attempt to present a general analysis due to its complexity. After solving the trade-conflict equilibrium in Section 2.2, we show in

Appendix A-3 that the partial equilibrium analysis can be closed by introducing a traded numeraire good and that the trade balance conditions will not qualitatively alter this paper's primary results.

14. See X_a^A in (2a) for country A and X_b^B in (2b) for country B.
15. In adopting the sequential-move game structure where arming allocations are determined before setting Nash tariffs, we adopt the plausible assumption that two enemy countries' arming decisions *prioritize* tariff policies in their decision-making under the shadow of conflict. An alternative approach is a game where Nash tariffs are set before arming allocations. This game structure is analytically unsolvable due to its complexity.
16. In our analysis of welfare decomposition, arming induces a terms-of-trade improvement in that it causes export prices and revenues to go up. This incentivizes a further increase in arming. This result parallels the positive effect that greater counterterror effort has on the relative price of manufactured goods (i.e. a terms-of-trade externality), which may cause counterterror effort to be excessive, as shown by Bandyopadhyay, Sandler, and Younas (2020).
17. Note that we assign some plausible values for K(i.e.,$K = 0.2$), R $= 1$ in evaluating the derivative.
18. See also Garfinkel, Skaperdas, and Syropoulos (2008). In their footnote 13, the authors indicate 'the intensity of conflict as reflected in the production of guns.'
19. We show in Appendix A-5 the detailed derivations of the results.
20. Note that we assign some plausible values for K(i.e.,$K = 0.2$), and $R = 1$ in evaluating the derivative.

Disclosure statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Nor do the authors have any financial and personal relationships with other organizations or people that could inappropriately influence or bias their work.

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Appendix

A-1. The equilibrium international prices of goods a, b, and c under the protectionism regime

We begin with the fourth and last stage of the game, at which country *C* has bilateral relations with *A* and *B*, in the form of a protectionist trade regime. We have the non-arbitrage condition:

$$P_a^A + \tau_a^C = P_a^C, \tag{a.1}$$

where τ_a^C is the tariff that country *C* imposes on each unit of good *a*. We solve for the equilibrium price of good *a* in country *A* by equating the good's aggregate demand with its aggregate supply. That is, trade equilibrium for good *a* requires that

$$(\alpha - \beta P_a^A) + (\alpha - \beta P_a^C) = \left(\frac{G^A}{G^A + G^B}\right)(R - G^A) - D^A. \tag{a.2}$$

Substituting P_a^C in terms P_a^A from (a.1) back into the equilibrium condition in (a.2), we solve for the market price of good *a* in country *A*:

$$P_a^A = \frac{1}{2\beta}\{2\alpha - \beta\tau_a^C - [\left(\frac{G^A}{G^A + G^B}\right)(R - G^A) - D^A]\}. \tag{a.3}$$

Using P_a^A in (a.3) and the non-arbitrage condition in (a.1), we calculate the market price of good *a* in country *C*:

$$P_a^C = \frac{1}{2\beta}\{2\alpha + \beta\tau_a^C - [\left(\frac{G^A}{G^A + G^B}\right)(R - G^A) - D^A]\}. \tag{a.4}$$

We determine the market price of good *a* in country *B* by setting the amount of good *a* that country *B* appropriates to be equal to its domestic demand for the good. That is$(\alpha - \beta P_a^B) = \left(\frac{G^B}{G^A + G^B}\right)(R - G^A)$,
which implies that

$$P_a^B = \frac{1}{\beta}[\alpha - \left(\frac{G^B}{G^A + G^B}\right)(R - G^A)]. \tag{a.5}$$

The non-arbitrage condition for good *b* that country *B* manufactures, and exports is:

$$P_b^B + \tau_b^C = P_b^C, \tag{a.6}$$

where τ_b^C is the tariff rate that country *C* imposes on good *b*. Trade equilibrium requires that

$$(\alpha - \beta P_b^B) + (\alpha - \beta P_b^C) = \left(\frac{G^B}{G^A + G^B}\right)(R - G^B) - D^B. \tag{a.7}$$

Substituting P_b^C in terms of P_b^B from (a.6) back into the equilibrium condition in (a.7), we solve for the market price of good *b* in country *B*:

$$P_b^B = \frac{1}{2\beta}\{2\alpha - \beta\tau_b^C - [(\frac{G^B}{G^A + G^B})(R - G^B) - D^B]\}. \tag{a.8}$$

Using P_b^B in (a.8) and the non-arbitrage condition in (a.6), we have the market price of good b in country C:

$$P_b^C = \frac{1}{2\beta}\{2\alpha + \beta\tau_b^C - [(\frac{G^B}{G^A + G^B})(R - G^B) - D^B]\}. \tag{a.9}$$

Similarly, we determine the market price of good b in country A by equating the amount of good b that country A appropriates with its domestic demand for the good:

$$(\alpha - \beta P_b^A) = (\frac{G^A}{G^A + G^B})(R - G^B),$$

which implies that

$$P_b^A = \frac{1}{\beta}[\alpha - (\frac{G^A}{G^A + G^B})(R - G^B)]. \tag{a.10}$$

As for good c in country C, trade equilibrium requires that

$$(\alpha - \beta P_c^A) + (\alpha - \beta P_c^B) + (\alpha - \beta P_c^C) = R, \tag{a.11}$$

where P_c^A and P_c^Bsatisfy the non-arbitrary conditions:

$$P_c^C + \tau_c^A = P_c^A \text{ and } P_c^C + \tau_c^B = P_c^B. \tag{a.12}$$

Making use of (a.11) and (a.12), we calculate the market prices of good c in the three countries:

$$P_c^A = \frac{3\alpha + 2\beta\tau_c^A - \beta\tau_c^B - R}{3\beta}, P_c^B = \frac{3\alpha - \beta\tau_c^A + 2\beta\tau_c^B - R}{3\beta}, P_c^C = \frac{3\alpha - \beta(\tau_c^A + \tau_c^B) - R}{3\beta}. \tag{a.13}$$

A-2. the equilibrium Nash tariffs set by the three countries under the protectionist regime (PR)

In the third stage of the game, we solve for the socially optimal tariffs individually and independently set by the three countries on their imports. Making use of the non-arbitrage condition in (a.1) and substituting the price equations from (a.3)-(a.13), country A determines an optimal tariff, τ_c^A, on good c to maximize domestic welfare, $SW^A(= CS^A + PS^A + TR^A)$. To solve for country A's socially optimal tariff, we make use of the first-order condition (FOC): $\partial SW^A/\partial\tau_c^A = 0$, which yields

$$\tau_c^A = \frac{\tau_c^B + R}{8\beta}. \tag{a.14}$$

As for country B, its total revenue from imposing tariffs, τ_c^B, on goods c is:

$$TR^B = \tau_c^B Q_c^B, \tag{a.15}$$

where Q_c^B is B's import demand. That is, $Q_c^B = (\alpha - \beta P_c^B)$. Making use of the non-arbitrage condition and substituting the price equations from (a.3)-(a.13) into CS^B, PS^B, and TR^Bin (a.15), we calculate country B's social welfare $SW^B(= CS^B + PS^B + TR^B)$ in terms of tariff rates, $\{\tau_c^A, \tau_c^B, \tau_a^C, \tau_b^C\}$, and the arming allocations, $\{G^A, G^B\}$. In the third-party trade between B and C, country B determines an optimal tariff, τ_c^B, on good c to maximize its domestic welfare, SW^B. To solve for country B's socially optimal tariff, we make use of the FOC: $\partial SW^B/\partial\tau_c^B = 0$, which yields

$$\tau_c^B = \frac{\tau_c^A + R}{8\beta}. \tag{a.16}$$

Country C's total revenue from imposing tariffs, $\{\tau_a^C, \tau_b^C\}$, on goods a and b is:

$$TR^C = \tau_a^C Q_a^C + \tau_b^C Q_b^C, \tag{a.17}$$

where Q_a^C and Q_b^C are given, respectively, as

$$Q_a^C = (\alpha - \beta P_a^C) \text{ and } Q_b^C = (\alpha - \beta P_b^C). \tag{a.18}$$

Plugging market prices from (a.3)-(a.14) into CS^C, PS^C, and TR^C, we determine country C's tariff structure, $\{\tau_a^C, \tau_b^C\}$, for maximizing its social welfare $SW^C(= CS^C + PS^C + TR^C)$. In calculating the optimal tariffs, we take as given the arming allocations of the adversaries at the second stage and their tariff rates at the third stage of the four-stage game. Country C's FOCs, which are $\partial SW^C/\partial\tau_a^C = 0$ and $\partial SW^C/\partial\tau_b^C = 0$, imply that the optimal tariffs are:

$$\tau_a^C = \frac{1}{3\beta}[(\frac{G^A}{G^A + G^B})(R - G^A) - D^A] \text{ and } \tau_b^C = \frac{1}{3\beta}[(\frac{G^B}{G^A + G^B})(R - G^B) - D^B]. \tag{a.19}$$

It follows from equations (a.14), (a.16), and (a.19) that the equilibrium Nash tariffs set by the three countries under the protectionist regime (PR) are:

$$\tau_c^{A,PR} = \tfrac{3}{7\beta}, \tau_c^{B,PR} = \tfrac{3}{7\beta},$$

$$\tau_a^{C,PR} = \frac{1}{3\beta}[(\frac{G^A}{G^A + G^B})(R - G^A) - D^A],$$

$$\tau_b^{C,PR} = \frac{1}{3\beta}[(\frac{G^B}{G^A + G^B})(R - G^B) - D^B]. \tag{a.20}$$

A-3. *The trade balance conditions are satisfied by introducing a traded numeraire good*

Our partial equilibrium model can be closed by including a traded numeraire good *Z*. This analysis is consistent with the methodological approach adopted in the three-country model of Bagwell and Staiger (1997, footnote 6, p. 295). The authors remark that a numeraire good, consumed in positive amounts by each consumer, is sufficiently abundant in each country. In this case, the marginal utility of income is fixed at one, and the partial equilibrium analysis of the non-numeraire sectors is appropriate. Trade in the numeraire good is then determined by the requirement of the overall trade balance. In what follows, we present a detailed analysis of the endogenous predation model of conflict and trade.

We first look at country *A*'s balance of trade (BOT) condition or its national budget constraint:

$$P_a^A Q_a^A + P_b^A Q_b^A + P_c^A Q_c^A + Q_z^A = P_a^A X_a^A + P_b^A (APP)_b + \tau_c^A M_c^A \ + X_z^A$$

where P_i^A, Q_i^A, and X_i^A are, respectively, market price, consumption, and production of good $i \in \{a, b, c, z\}$in *A*, $(APP)_b$ represents the amount of good *b* that country *A* appropriates from its rival for domestic consumption. The left-hand side of the BOT condition is country *A*'s total spending, and the right-hand side is its total market value of production and predation, which represents *A*'s national budget. It follows from the BOT condition that country *A*'s excess demand for good *Z* is:

where, according to the results as derived in Section 2.7 for country *A*, we have:

After substituting, we have the following result:

$$ED_z^A = -\tfrac{1}{2\beta}(\tfrac{1}{2}X_a^A - \tfrac{1}{2}\beta\tau_a^C)(X_a^A - 2\alpha + \beta\tau_a^C) + \tfrac{1}{9\beta}(\beta\tau_c^B - 2\beta\tau_c^A + R)(\beta\tau_c^A - 3\alpha + \beta\tau_c^B + R)\,.$$

Similarly, country *B*'s BOT condition is:

$$P_a^B Q_a^B + P_b^B Q_b^B + P_c^B Q_c^B + Q_z^B = P_b^B X_b^B + \ P_a^B (APP)_a + \tau_c^B M_c^B + X_z^B$$

where P_i^B, Q_i^B, and X_i^B are, respectively, market price, consumption, and production of good $i \in \{a, b, c, z\}$in *B*, $(APP)_a$ is the amount of good *a* that country *B* appropriates from its rival for domestic consumption. It follows from country *B*'s BOT condition that its excess demand for good *Z* is:

$$ED_z^B = Q_z^B - X_z^B = P_b^B(X_b^B - Q_b^B) + P_a^B(APP_a - Q_a^B) + \tau_c^B M_c^B - P_c^B Q_c^B$$

where, according to the results as derived in Section 2.7 for country *B*, we have:

$$\begin{aligned} P_b^B(X_b^B - Q_b^B) &= \tfrac{(2\alpha - X_b^B - \beta\tau_b^C)}{2\beta}[X_b^B - \alpha + \beta(\tfrac{2\alpha - X_b^B - \beta\tau_b^C}{2\beta})] \\ &= -\tfrac{1}{2\beta}(\tfrac{1}{2}X_b^B - \tfrac{1}{2}\beta\tau_b^C)(X_b^B - 2\alpha + \beta\tau_b^C), \end{aligned}$$

After substituting, we have the following result:

$$ED_z^B = -\tfrac{1}{2\beta}(\tfrac{1}{2}X_b^B - \tfrac{1}{2}\beta\tau_b^C)(X_b^B - 2\alpha + \beta\tau_b^C) + \tfrac{1}{9\beta}(\beta\tau_c^A - 2\beta\tau_c^B + R)(\beta\tau_c^A - 3\alpha + \beta\tau_c^B + R)\,.$$

As for country *C*'s BOP condition, it is:

$$P_a^C Q_a^C + P_b^C Q_b^C + P_c^C Q_c^C + Q_z^C = RP_c^C + \tau_b^C M_b^C + \tau_a^C M_a^C + X_z^C.$$

It follows that country *C*'s excess demand for good *Z* is:

$$ED_z^C = Q_z^C - X_z^C = P_c^C(R - Q_c^C) + \tau_b^C M_b^C + \tau_a^C M_a^C - (P_a^C Q_a^C + P_b^C Q_b^C)$$

where, according to the results as derived in Section 2.7 for country *C*, we have:

After substituting, we have the following result:

$$ED_z^C = \tfrac{1}{3\beta}(\tfrac{1}{3}\beta\tau_c^A + \tfrac{1}{3}\beta\tau_c^B - \tfrac{2}{3}R)(\beta\tau_c^A - 3\alpha + \beta\tau_c^B + R)$$
$$+ \tfrac{1}{4\beta}(X_b^B - \beta\tau_b^C)(X_b^B - 2\alpha + \beta\tau_b^C) + \tfrac{1}{4\beta}(X_a^A - \beta\tau_a^C)(X_a^A - 2\alpha + \beta\tau_a^C).$$

Taking the summation of the excess demands ED_z^A, ED_z^B and ED_z^C, after arranging terms, yields:

This result indicates that the presence of a third good closes the partial equilibrium model and that the three countries' trade balance conditions are satisfied automatically. Thus, in line with Bagwell and Staiger (1997) analysis, the partial equilibrium analysis of the non-numeraire sectors is appropriate.

A-4. *Decomposing the welfare effect of arming for each adversary country*

Under the assumption of symmetry, we look at the welfare effect of country *A's* arming and show that the effect contains three different components. Country *A*'s overall welfare under the protectionist regime is:$SW^{A,PR} = CS^{A,PR} + PS^{A,PR} + TR^{A,PR}$,

which implies that

$$SW^{A,PR} = \frac{1}{2\beta}[(Q_a^{A,PR})^2 + (APP_b)^2 + (Q_c^{A,PR})^2] + P_a^{A,PR}X_a^{A,PR} + P_b^{A,PR}APP_b + \tau_c^{A,PR}Q_c^{A,PR},$$

noting that APP_b represents the amount of good *b* that country *A* appropriates from its rival for domestic consumption. Taking the derivative of $SW^{A,PR}$ with respect to G^A yields:

$$\frac{\partial SW^{A,PR}}{\partial G^A} = \frac{1}{\beta}(\frac{\partial Q_a^{A,PR}}{\partial G^A}Q_a^{A,PR} + \frac{\partial APP_b}{\partial G^A}APP_b + \frac{\partial Q_c^{A,PR}}{\partial G^A}Q_c^{A,PR}) + (\frac{\partial P_a^{A,PR}}{\partial G^A}X_a^{A,PR} + \frac{\partial X_a^{A,PR}}{\partial G^A}P_a^{A,PR})$$
$$+ (P_b^{A,PR}\frac{\partial APP_b}{\partial G^A} + APP_b\frac{\partial P_b^{A,PR}}{\partial G^A}) + (\tau_c^{A,PR}\frac{\partial Q_c^{A,PR}}{\partial G^A} + \frac{\partial \tau_c^{A,PR}}{\partial G^A}Q_c^{A,PR}).$$

For several terms on the right-hand side of the above equation, we note the following:

(i) $\frac{\partial Q_a^{A,PR}}{\partial G^A} = -\beta\frac{\partial P_a^{A,PR}}{\partial G^A}$;

(ii) $\frac{\partial(\tau_c^{A,PR}Q_c^{A,PR})}{\partial G^A} = \frac{\partial \tau_c^{A,PR}}{\partial G^A}Q_c^{A,PR} + \tau_c^{A,PR}\frac{\partial Q_c^{A,PR}}{\partial G^A} = 0$since both$\tau_c^{A,PR}andQ_c^{A,PR}$areindependent of G^A;

(iii) $\frac{\partial P_b^{A,PR}}{\partial G^A} = -\frac{1}{\beta}\frac{\partial APP_b}{\partial G^A}$ Since$P_b^{A,PR} = \frac{1}{\beta}[\alpha - \frac{G^A}{G^A+G^B}(R - G^B)]$ and

$$APP_B = \frac{G^A}{G^A + G^B}(R - G^B).$$

Taking into account the conditions (i)-(iii), we simplify the derivative of $SW^{A,PR}$ with respect to G^Ainto three terms:

$$\frac{\partial SW^{A,PR}}{\partial G^A} = \frac{\partial P_a^{A,PR}}{\partial G^A}(X_a^{A,PR} - Q_a^{A,PR}) + \frac{\partial APP_b}{\partial G^A}P_b^{A,PR} + \frac{\partial X_a^{A,PR}}{\partial G^A}P_a^{A,PR}.$$

The impact that arming has on overall welfare has three different effects:

(1) The first term, $\frac{\partial P_a^{A,PR}}{\partial G^A}(X_a^A - Q_a^{A,PR})$, shows the export-revenue effect of arming;

(2) The second term, $\frac{\partial APP_b}{\partial G^A}P_b^{A,PR}$, is the resource-appropriation effect of arming;

(3) The third term, $\frac{\partial X_a^{A,PR}}{\partial G^A}P_a^{A,PR}$, is the output-distortion effect of arming.

A-5. Optimal arming is lower under multiple FTAs than under the protectionism regime

We adopt the approach by evaluating the slope of the $SW^{A,M}$ when there are multiple FTAs at the equilibrium arming allocations under the protectionist regime. The slope of the $SW^{A,M}$ is:

$$\frac{\partial SW^{A,M}}{\partial G^A} = \frac{\partial P_a^{A,M}}{\partial G^A}(X_a^{A,M} - Q_a^{A,M}) + \frac{\partial APP_b}{\partial G^A}P_b^{A,M} + \frac{\partial X_a^{A,M}}{\partial G^A}P_a^{A,M}.$$

We then conduct a comparison for each effect (that is, each term) separately as follows:

(i) Comparing the export-revenue effect of arming

We evaluate the following expression:

$$\left[\frac{\partial P_a^{A,M}}{\partial G^A}(X_a^{A,M} - Q_a^{A,M}) - \frac{\partial P_a^{A,PR}}{\partial G^A}(X_a^{A,PR} - Q_a^{A,PR})\right] \tag{a.21}$$

at the point where $G^{A,PR} = G^{B,PR} = G$, noting the following:

$$P_a^{A,PR} = \frac{G^A(2G^A - 2R + 3a) + 3aG^B + 2D^A(G^A + G^B)}{3\beta(G^A + G^B)}, \tag{a.22}$$

$$P_a^{A,M} = \frac{2a - (\frac{G^A}{G^A+G^B})(R - G^A) - D^A}{2\beta}, \tag{a.23}$$

$\frac{\partial P_a^{A,M}}{\partial G^A} = \frac{(G^A)^2 + G^B(2G^A - R)}{2\beta(G^A+G^B)^2}$, $\frac{\partial P_a^{A,PR}}{\partial G^A} = \frac{2[G^A(G^A+2G^B) - RG^B]}{3\beta(G^A+G^B)^2}$.

After substituting (a.22) and (a.23) back into (a.21), we have:

$$\left[\frac{\partial P_a^{A,M}}{\partial G^A}(X_a^{A,M} - Q_a^{A,M}) - \frac{\partial P_a^{A,PR}}{\partial G^A}(X_a^{A,PR} - Q_a^{A,PR})\right] = \frac{(R - 3G)(G + 2D - R)}{288G\beta} > 0. \tag{a.24}$$

(ii) Comparing the resource- appropriation effect of arming

We evaluate the following expression:

$$\left[\frac{\partial APP_B}{\partial G^A}(P_b^{A,M} - P_b^{A,PR})\right] \tag{a.25}$$

at the point where $G^{A,PR} = G^{B,PR} = G$. Since

$$P_b^{A,M} = P_b^{A,PR} = \frac{1}{\beta}\left(a - \frac{G^A}{G^A + G^B}(R - G^B)\right)$$

,

we have from (a.5) that

$$\frac{\partial APP_B}{\partial G^A}(P_b^{A,M} - P_b^{A,PR}) = 0. \tag{a.26}$$

(iii) Comparing the output-distortion effect of arming

We evaluate the following expression:

$$\left[\frac{\partial X_a^A}{\partial G^A}(P_a^{A,M} - P_a^{A,PR})\right] \tag{a.27}$$

at the point where $G^{A,PR} = G^{B,PR} = G,$ noting that

$$\frac{\partial X_a^A}{\partial G^A} = \frac{\partial(\frac{G^A}{G^A+G^B}(R - G^A) - D^A)}{\partial G^A} = -\frac{G^A(G^A + 2G^B) - RG^B}{(G^A + G^B)^2}.$$

Substituting the results from (a.22) and (a.23) into (a.27), taking into account the above derivative, we have:

$$\left[\frac{\partial X_a^A}{\partial G^A}(P_a^{A,M} - P_a^{A,PR})\right] = \frac{(R - 3G)(G + 2D - R)}{48G\beta} < 0 \tag{a.28}$$

Taking the summation of the differences in the three effects as shown in (a.24), (a.26), and (a.28) yields:

$$\frac{(R - 3G)(G + 2D - R)}{288G\beta} + \frac{(R - 3G)(G + 2D - R)}{48G\beta} = \frac{5(R - 3G)(G + 2D - 5)}{288G\beta} < 0$$

.

That is,

$$\frac{\partial SW^{A,M}}{\partial G^A}|_{G^A=G^B=G^{A,PR}=G^{B,PR}=G} < 0.$$

The strict concavity of the welfare function implies that $G^{A,M} < G^{A,PR}$. Thus, a move from the protectionism regime to the multiple FTAs regime induces both adversary countries to reduce their arming. This result arises since the sum of the export-revenue effect and the resource-predation effect, which measures the marginal revenue of arming, exceeds the output-distortion effect, which measures the marginal cost of arming.

A-6. Conflict intensity under single FTAs exceeds that under multiple FTAs

We evaluate the slope of $SW^{B,S}$ when there is a single FTA, at the equilibrium arming allocations under multiple FTAs. Between the two alternative regimes, we then conduct a comparison for each effect separately as follows:

(i) Comparing the export-revenue effect of arming

We evaluate the following expression:

$$\left[\frac{\partial P_b^{B,S}}{\partial G^B}(X_b^{B,S}-Q_b^{B,S})-\frac{\partial P_b^{B,M}}{\partial G^B}(X_b^{B,M}-Q_b^{B,M})\right] \tag{a.29}$$

at the point where $G^{B,M}=G^{A,M}=G$, noting the following:

$$P_b^{B,M}=\frac{1}{2\beta}[2\alpha-(\frac{G^B}{G^A+G^B}(R-G^B)-D^B)],$$

$$\frac{\partial P_b^{B,M}}{\partial G^B}=\frac{G^B(2G^A+G^B)-RG^A}{2\beta(G^A+G^B)^2},\ \tau_b^{C,S}=\frac{1}{3\beta}[(\frac{G^B}{G^A+G^B}(R-G^B)-D^B)],$$

$$P_b^{B,S}=\frac{2\alpha-(\frac{G^B}{G^A+G^B}(R-G^B)-D^B)-\beta\tau_b^{C,S}}{2\beta},$$

$$\frac{\partial P_b^{B,S}}{\partial G^B}=\frac{G^B(2G^A+G^B)-RG^A}{3\beta(G^A+G^B)^2}.$$

After substituting the above equations into (a.29), after rearranging terms, we have the following result:

$$\left[\frac{\partial P_b^{B,S}}{\partial G^B}(X_b^{B,S}-Q_b^{B,S})-\frac{\partial P_b^{B,M}}{\partial G^B}(X_b^{B,M}-Q_b^{B,M})\right]=-\frac{5(R-3G)(G+2D-R)}{288G\beta}. \tag{a.30}$$

(ii) Comparing the resource-appropriation effect of arming:

We evaluate the following expression:

$$\left[\frac{\partial APP_a}{\partial G^B}(P_a^{B,S}-P_a^{B,M})\right] \tag{a.31}$$

at the point where $G^{A,PR}=G^{B,PR}=G$. Given that

$$P_a^{B,M}=P_a^{B,S}=\frac{1}{\beta}\left(\alpha-\frac{G^B}{G^A+G^B}(R-G^A)\right)$$

,

we have from (a.31) that

$$\frac{\partial APP_a}{\partial G^B}(P_a^{B,S}-P_a^{B,M})=0. \tag{a.32}$$

(iii) Comparing the output-distortion effect of arming:

We evaluate the following expression:

$$\left[\frac{\partial X_b^B}{\partial G^B}(P_b^{B,S}-P_b^{B,M})\right] \tag{a.33}$$

at the point where $G^{A,M}=G^{B,M}=G,$ noting that

$$\frac{\partial X_b^B}{\partial G^B}=\frac{\partial(\frac{G^B}{G^A+G^B}(R-G^B)-D^B)}{\partial G^B}=-\frac{G^B(G^B+2G^A)-RG^A}{(G^A+G^B)^2}.$$

Substituting the above equation into (a.33), we have the following result:

$$\left[\frac{\partial X_b^B}{\partial G^B}(P_b^{B,S}-P_b^{B,M})\right]=\frac{(R-3G)(G+2D-R)}{48\beta G}. \tag{a.34}$$

The summation of the differences in the three effects as shown in (a.30), (a.32), and (a.34) leads to

$$-\frac{5(R-3G)(G+2D-R)}{288G\beta}+\frac{(R-3G)(G+2D-R)}{48\beta G}=\frac{5(R-3G)(G+2D-R)}{288\beta G}>0$$

.
That is,

$$\frac{\partial SW^{B,S}}{\partial G^{A}}|_{G^{A}=G^{B}=G^{A,M}=G^{B,M}=G}>0.$$

The positive sign indicates that

$$G^{B,S}>G^{B,M}$$

.
A move from the multiple FTAs to the single FTA induces the non-member adversary (Country *B*) to increase its arming since the sum of the export-revenue effect plus the resource-predation effect, which is the marginal revenue of arming, dominates the output distortion effect, which is the marginal cost of arming.