Globalization and domestic conflict[†]

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ABSTRACT. We examine how globalization affects trade patterns and welfare in the presence of domestic conflict within a country. We do so in a simple model of trade, where a natural resource like oil is contested by competing groups using real resources ("guns"). In comparing autarky to free trade, the gains from trade have to be measured against the possibly higher incentive to invest in guns. We find that importers of the contested resource gain unambiguously. By contrast, countries exporting the contested resource will lose under free trade, unless the international price of the resource is sufficiently high. Regardless of what price obtains in international markets, the country tends to over-export the contested resource relative to the benchmark case where there is no conflict within the country; and, when the international price of the contest resource falls within a certain range, the comparative advantage is reversed relative to that ideal case. Finally, we find that an increase in the international price of the contested resource over an even wider range reduces welfare, an instance of the "natural resource curse."

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1 Introduction

The period since the end of the Cold War has coincided with a time of increasing trade openness, or at least prescriptions to that effect. At the same time, the onset of civil wars and other forms of domestic conflict appears to have subsided in most countries where the Cold War was fought by proxy. For instance, in Angola, a battleground of the Cold War, the war between the government and UNITA ended after an initial escalation. Such conflicts have, however, flared up elsewhere. In Zaire/Democratic Republic of Congo, for example, the past decade or so has witnessed a major civil war; though somewhat dormant at the moment, this conflict could easily reignite in the future. In the Mexican state of Chiapas, the Zapatista revolt, while at a lower intensity level than a normal civil war, has brought mostly indigenous peasants against large landowners. Other examples of civil wars and of lower-level domestic conflicts abound since the end of the Cold War, most notably in Eastern Europe and Central Asia where most economies went essentially from autarky to very open economies. Indeed, by some measures, it would appear that the incidence of such wars and conflicts has increased during this period.[1]

The economic costs of such conflicts are overwhelming. They range from the resources allocated directly to arming and those lost in the destruction of combat, to the indirect losses associated with the reduction in investment and trade, epidemics that would not have occurred otherwise, as well as the costs of taking care of the maimed and infirm for life and of dealing with those who have become specialists in violence with no other skills. Recent studies of these effects, conducted by the World Bank staff, are distilled in Collier et. al. (2003). The indirect cost that can come about from the reduction in trade alone has been estimated by Hess (2003) to be 8 percent of steady-state consumption. These costs are much larger than the potential gains that could be realized from eliminating the business cycle, as calculated in Lucas (1987). In addition, there are other forms of domestic conflict that are less sweeping than full-blown civil wars, but are no less important: strikes and lockouts, military coups, low-level ethnic, religious or class rivalries, as well as rampant basic insecurity that the state is simply

[1] Chapter 4 of Collier et. al (2003) provides an overview and the distribution of civil wars across time. Fearon and Laitin (2003) argue that current prevalence cannot be attributed to the end of the Cold War or any associated changes in the international system, but instead the steady accumulation of post-colonial conflicts since the 1950s. This period can also fairly be characterized as involving increasing trade openness. Sambanis (2004) reviews the evidence on a number of case studies about the causes of civil wars during this period.

unable to curtail. Rodrik (1998, 1999) has argued about the importance of managing such conflicts for successful economic development.

In this paper, we explore the effects of trade openness, or more generally of globalization, on domestic conflict. Does greater openness, by making participants richer and more open to deal-making, reduce conflict? Or, does greater openness induce more wasteful competition and conflict by making many resources and commodities more valuable? We do not have a simple answers to such questions, but we do find conditions under which greater openness reduces conflict and others under which greater openness intensifies conflict.

To admit the possibility of conflict, our approach departs from the traditional economic paradigm in which property rights are perfectly enforceable and contracts are complete. Instead, we suppose a resource that is potentially tradeable is contested by different domestic groups. This is not to say that all domestic conflicts arise from disputes over resources. Rather, such disputes are one of the primary factors that drive different parties to conflict. In Angola, the right to extract oil was a major reason of the continuation of the war between the government and UNITA forces after the end of the Cold war; Zaire's/DRC's rich endowment in various minerals has also been a major factor in the civil war; and, in Chiapas, land and its product are also arguably the central issue. The degree of openness to international markets faced by the contending parties affects not only the stakes (the value of the contested resource) but the opportunity costs as well.

To highlight how openness can influence the opportunity costs and stakes in a most transparent way, we examine conflict under two polar trade regimes: autarky and free trade. One possibility is that free trade induces less arming and thus less domestic conflict, in which case there is no question that free trade is relatively more appealing. However, even when free trade induces more arming and thus more conflict, the familiar gains to trade must be factored into the comparison of the two trading regimes in the final analysis.

A key variable that determines equilibrium arming is the price of the contested resource ("oil") relative to other commodities, including the cost of arming. Under autarky, all prices are determined by domestic endowments. Under free trade, assuming that the country is small, the prices of all goods are determined in international markets. Thus, in the absence of barriers to trade, the size of the country's endowments plays no role in the determination of these prices, but they do affect the country's pattern of trade. When the price of the country's contested resource is lower in international markets than it would be domestically under autarky, importing

the resource takes some pressure off of arming and conflict. Indeed, we find in this case that the contending groups have a smaller incentive to arm. Free trade induces lower arming, generates the well known gains from trade, and is thus unambiguously superior to autarky. At the autarkic price, there are no gains from trade, and the level of conflict under the two regimes are identical. But, as the international price of the contested resource rises above the price of oil that obtains under autarky, thereby raising the stakes of the conflict, a shift from autarky to free trade tends to intensify domestic conflict. In this case, the normal gains from trade are not sufficiently large to compensate for the costs of arming, such that welfare is higher under autarky. But if the international price is sufficiently above the autarkic price, the gains from trade will outweigh the costs of arming.

The range of international prices over which autarky can be superior to free trade widens as the degree of insecurity, a well-defined concept in our model, increases. In addition, that range of prices depends on the country's resource endowment in an intuitive fashion, with a country that is rich in "oil" having a lower threshold that would make the country vulnerable to greater openness. Thus, both endowments and "institutions," the latter in the form of security, determine the effects of globalization.

While the trading regime affects conflict, conflict affects the pattern of trade, and it does so in a significant and interesting way. In particular, for a certain range of international, relative prices, the country's comparative advantage is reversed relative to that which we would observe if there were no domestic conflict in that country. Over that price range, the country is a net-exporter of oil, but absent domestic conflict would be a net-importer. More generally, for prices within and outside that range, domestic conflict diverts the allocation of valuable resources away from the production of other commodities. They become scarcer than the contested resource domestically, and therefore the contested resource ("oil") becomes relatively more abundant domestically, leaving more available for exports than would be in the absence of conflict. By inducing a greater excess supply of the resource under dispute, domestic conflict imparts a positive bias on the country's exports of that good relative to the hypothetical scenario of no conflict. Thus, it is inappropriate to treat a country's trade pattern as invariant to the emergence of domestic conflict. For the many countries that experience civil wars and other forms of domestic conflict, treating their trade patterns as indicative of their true comparative advantage either in empirical studies or for policy purposes would seem to be unjustified.

Finally, we find that an increase in the international price of the contested resource, for an even wider range of prices, *reduces* the country's

welfare. This effect is reminiscent of the "natural resource curse"—that is, the tendency for natural-resource abundant countries to have weak economic growth (see, for example, Sachs and Warner 1995 and Ross, 2003).[2]

2 The Basic Setting: Contesting a Resource

Consider a country in which N groups compete for claims to T_0 units of land. Provided that Each group $i = 1, 2, ..., N$ is endowed with T^i and L^i units of secure land and labor, respectively, which can be used to produce consumption goods. For simplicity, we assume here that there is only one potential use for land, the extraction of *oil*, and that one unit of land yields one unit of oil. Labor, however, can be used to produce, also on a one-to-one basis, *butter* as well as *guns*. Let G^i denote group i's level of arming or guns.[3] Then, $L^i - G^i$ (≥ 0) units of labor will be available for the production of butter; therefore, group i's maximal production of butter will be $\max\{L^i - G^i, 0\}$.

Oil and butter are final consumption goods, produced under perfectly competitive conditions. They can be traded domestically or, depending on the trade regime, internationally. Let O^i and B^i represent group i's consumption of oil and butter respectively. The preferences of each group i take the Cobb-Douglas form,

$$U(O^i, B^i) = (O^i)^\alpha (B^i)^\beta \tag{1}$$

where $\alpha \in (0, 1)$ and $\alpha + \beta = 1$.

All groups would like to take control of the contested territory, T_0, for its oil. We rule out the possibility of contracting, whereby the groups could limit arming, and suppose that claims on land can be settled only via overt conflict or, equivalently in our model, under the threat of conflict. The inability to contract on arming can be due to a variety of reasons that are usually associated with weak governance and inadequate institutions of conflict management.[4] Each group will have an incentive to allocate

[2] The particular mechanism we study is similar to that featured in Hodler's (2004) analysis of rivaling groups in a closed economy. Mehlum, Moene, and Torvik (2002) show how the curse is associated only with countries that have weak insitutions. For a mechanism based on electoral politics and for references to the literature, see Robinson, Torvik, and Verdier (2003).

[3] Note that "guns" can stand for any costly appropriative activity that subtracts from useful production and welfare such as ordinary rent-seeking, influence activities, litigation, or enforcement costs.

[4] Skaperdas (2003) describes in more detail various conditions that lead to such incomplete contracting.

resources to arming in order to enhance its probability of winning T_0. But production of guns is costly—to produce more guns a group must forego some production of butter. We will examine how the groups balance these effects at the margin and how trade openness changes the incentives for guns-versus-butter production.

We model intergroup interactions as a winner-take-all contest in which the probability, q^i, that group i will emerge as the winner depends on the relative amount of guns the group possesses. Group i's probability of winning is specified as follows:

$$q^i \equiv q^i\left(G^i, G^{-i}\right) = \frac{G^i}{\sum_{j=1}^{N} G^j} \tag{2}$$

for $\sum_{j=1}^{N} G^j > 0$; otherwise $q^i = \frac{1}{N}$ for all i, where G^{-i} denotes the vector of guns that excludes G^i. According to this specification, group i's probability of winning is increasing in its own allocation to arms, $q^i_{G^i} > 0$, and decreasing in the allocation to arms by all other groups, $q^i_{G^j} < 0$, $j \neq i$.[5]

The timing of actions is as follows:

1. Each group i chooses its allocation of labor to the production to guns, G^i, $i = 1, 2, \ldots, N$. Groups make their choices simultaneously. Let G denote the vector of all groups' gun choices. The implied production of butter for each group i is $\max\{L^i - G^i, 0\}$, for $i = 1, 2, \ldots, N$.

2. Given the choices of guns (G) and the technology of intergroup conflict as described in equation (2), one group emerges as the "winner" of the contest and takes control of the disputed land; if group i is the winner, its land endowment and thus production of oil are $T^i + T_0$; otherwise, its land endowment and production of oil are T^i.

3. Then, given the production of butter and oil by all groups, competitive trade takes place.

We examine the incentives to arm and the resultant welfare of each group under two polar trade regimes: *autarky* and completely *free trade*. Under autarky, there is no trade with the outside world, and prices are determined domestically within an integrated market. Under free trade, assuming that the country is small, prices are given in international markets.

[5] First introduced by Tullock (1980), this functional form has been used extensively in the rent-seeking literature as well as the in literatures on tournaments and conflict. For a discussion of the properties of this and related specifications, see Hirshleifer (1989).

To derive the expected payoffs under these two regimes, we need to first identify the indirect utility functions implied by (1) and describe some of their properties. To proceed, let $\widetilde{T}^i$ denote group i's contingent land endowment. As previously described,

$$\widetilde{T}^i = \begin{cases} T^i + T_0 & \text{if group } i \text{ emerges as the winner in the contest;} \\ T^i & \text{otherwise.} \end{cases}$$

Furthermore, let p denote the relative price of oil measured in units of butter. Under our production structure, the marginal product of guns and the opportunity cost of labor is given by 1. Given our notation, we can write group i's contingent income or revenue function as

$$R^i \equiv R(p, \widetilde{T}^i, L^i - G^i) = p\widetilde{T}^i + L^i - G^i. \tag{3}$$

Abstracting from international transfers of income, aggregate expenditure on butter and oil must be equal to this measure of income or GDP.[6] Imposing this constraint at the group level, group i's contingent indirect utility function implied by (1) can be written as

$$V^i \equiv V(p, R(p, \widetilde{T}^i, L^i - G^i)) = \mu(p)\left[p\widetilde{T}^i + L^i - G^i\right], \tag{4}$$

where $\mu(p) = \beta^\beta(\alpha/p)^\alpha$ represents each group's marginal utility of income. One can verify that group i's contingent demand and supply functions for oil are respectively $\alpha R^i/p$ and $\widetilde{T}^i$; therefore, group i's excess demand function for oil, given the realization of $\widetilde{T}^i$, is

$$M^i = \frac{\alpha R^i}{p} - \widetilde{T}^i, \tag{5}$$

which is positive if the group demands oil and negative if it supplies it.[7]

[6] GDP, as typically measured, includes expenditures on arming. Since such expenditures are non-productive and arms are not directly consumed, their inclusion is inappropriate when GDP is taken to be a measure of welfare (instead of productive capacity). But, given that such expenditures are included and insofar as countries at war tend to make greater expenditures on arms, it should be clear that measured GDP overstates the welfare of warring countries.

[7] It is worth noting at this point that our assumption that the utility function is homogeneous of degree one implies that each group behaves as if it is risk neutral. To be more precise, for any given choice of guns, each group would be indifferent between engaging in actual conflict where group i's probability of winning the contested land equals q^i and dividing the contested land where group i's share equals q^i. The reader is free to use either interpretation of the model.

Differentiating group i's indirect utility function with respect to the relative price, p, and its guns, G^i, and using Roy's identity yields

$$dV^i = \mu(p)\left[-M^i dp - dG^i\right]. \tag{6}$$

The first term inside the brackets, adjusted by the marginal utility of income $\mu(p)$, represents the welfare effect of an exogenous price increase. The effect is negative if group i's excess demand for oil is positive, and the effect is positive otherwise. The second term inside the brackets represents the marginal cost of producing an additional gun to group i, given $\widetilde{T}^i$. When group i produces more guns, its production of butter must fall, implying less income and a reduction in its overall welfare.[8]

Given the allocation of resources to the production of guns by all groups $i = 1, 2, \ldots, N$, (G), the relative price of oil that solves $\sum_{i=1}^{N} M^i = 0$ is the market-clearing price that will prevail in the country in the absence of international trade (autarky). Denoting that price by p_A, where "A" indicates the value of the variable under "autarky," one can verify that

$$p_A = \frac{\alpha}{\beta}\frac{\sum_{i=1}^{N}(L^i - G^i)}{(T_0 + \sum_{i=1}^{N} T^i)}.$$

To draw out some of the implications of this expression, define the following aggregates: $\bar{T} \equiv T_0 + \sum_{i=1}^{N} T^i$, $\bar{L} \equiv \sum_{i=1}^{N} L^i$, and $\bar{G}_A \equiv \sum_{i=1}^{N} G^i_A$. Then, the autarkic price, p_A, can be written as follows:

$$p_A = \frac{\alpha}{\beta}\left[\frac{\bar{L} - \bar{G}}{\bar{T}}\right]. \tag{7}$$

As revealed by this expression, neither p_A nor $\partial p_A/\partial G^i$ depends on the distribution of endowments and guns across groups. Instead, they depend only on the aggregate quantity of resources and, of course, the parameters of consumer preferences. Note, in particular, that when a greater share of the country's resources are allocated to the production of guns $\bar{G}$, given the aggregate labor endowment $\bar{L}$, the amount of butter produced domestically necessarily falls; hence p_A depends negatively on the aggregate level of guns.

For future reference, it is useful to decompose the economy's aggregate land endowment into that part which is insecure and that which is secure. Specifically, let the *degree of insecurity* be indicated by the ratio $\tau = \frac{T_0}{\bar{T}}$. Then $\tau\bar{T} = T_0$ equals the insecure part of the land endowment, whereas $(1-\tau)\bar{T}$ equals the secure part. Note that, given the choice of guns, the autarkic price is independent of the degree of insecurity.

[8] Notice from (5) that the group's (contingent) excess demand for oil depends on, among other factors, the quantity of labor it allocates to the production of guns.

3 The no-conflict case as a benchmark

Before going on to examine what occurs under conflict, it is helpful for later comparisons as well as for developing some intuition for our results to consider briefly the no-conflict or "Nirvana" case in which property rights are perfectly secure—that is, when there is no dispute over land ($\tau = 0$) such that groups have no incentive to arm ($\bar{G} = 0$). In this hypothetical case, from (7), the autarkic price, denoted by p_A^n, equals:

$$p_A^n = \tfrac{\alpha}{\beta}\bar{L}/\bar{T} = \tfrac{\alpha}{\beta}l \tag{8}$$

where $l \equiv \bar{L}/\bar{T}$ indicates the country's aggregate labor to land endowment ratio. In turn, summing (3) across the N groups shows that, under autarky with complete security, the country's national income is $\bar{R}_A^n = p_A^n\bar{T} + \bar{L} = \frac{l}{\beta}\bar{T}$. Then, using (4), one can verify that aggregate welfare is

$$\bar{W}_A^n = \mu(p_A^n)\bar{R}_A^n = \mu(\tfrac{\alpha}{\beta}l)\tfrac{l}{\beta}\bar{T}, \tag{9}$$

where as previously defined, $\mu(p) \equiv \beta^\beta(\alpha/p)^\alpha$.[9] The welfare of the individual groups can similarly be written as functions of their initial endowments. In the case of identical groups, the welfare of each one would be $\bar{W}_A^n/N$.

Under free trade, the relative price of oil p would be determined in international markets. Under this alternative trading regime, but with the maintained assumption of complete security of land endowments, aggregate welfare, again calculated using (4), would be

$$\bar{W}_T^n(p) = \mu(p)(p\bar{T} + \bar{L}) = \mu(p)(p + l)\bar{T}. \tag{10}$$

Supposing that groups are identical, the welfare of each would be $\bar{W}_T^n(p)/N$. As one can easily verify, $\bar{W}_T^n(p)$ is a convex function of p, reaching its minimum at p_A^n, as depicted in Figure 1. To the left of p_A^n where the international price of oil is lower than the autarkic price, the country would import oil and export butter. To the right of p_A^n, where the international price of oil is higher than the autarkic price, the country would be an exporter of oil and an importer of butter. Clearly, in the hypothetical case where the groups' land endowments are perfectly secure, welfare would be at least as high under free trade as that under autarky.

[FIGURE 1 about here]

[9] With this definition and the solution for the price in the no-conflict case under autarky (8), the country's aggregate welfare in this benchmark case simplifies as $\bar{W}_A^n = \bar{L}^\beta\bar{T}^\alpha$.

4 Conflict under alternative trading regimes

We now consider the case where the groups' land endowments are insecure: $\tau > 0$. First we examine the equilibrium allocation of resources under the regime of autarky and then we move on to the equilibrium allocation under the regime of free trade.

4.1 Autarky

Under autarky, given the country's aggregate level of guns, $\bar{G}_A$, the relative price of oil is given by (7) regardless of the outcome of the conflict over the contested land, T_0. Group i's land endowment will equal $T^i + T_0$ with probability $q^i(G^i, G^{-i})$ and T^i with probability $1 - q^i(G^i, G^{-i})$. Then, from equation (4), group i's expected payoff under autarky will be:

$$W_A^i(G; p_A) = \mu(p_A)\left[p_A(T^i + q^i T_0) + L^i - G^i\right]. \tag{11}$$

We suppose that each group factors in the effect that its own choice of guns has on the relative price, p_A. However, they make their choices simultaneously. Under the assumptions imposed on production, preferences, and the contest success function, a unique Nash equilibrium can be shown to exist.

At an interior optimum $G_A^{i*} \in (0, L^i)$, the following condition is satisfied for each group i:

$$\begin{aligned}\frac{\partial W_A^i(G_A^{i*}; p_A)}{\partial G^i} &= \mu(p_A)(q^i_{G^i} p_A T_0 - 1) + \Bigg[\mu'(p_A)\big[p_A(T^i + q^i T_0) \\ &\qquad + L^i - G_A^{i*}\big] + \mu(p_A)(T^i + q^i T_0)\Bigg]\frac{\partial p_A}{\partial G^i} \\ &= \mu(p_A)\left[(q^i_{G^i} p_A T_0 - 1) - \widehat{M}^i \frac{\partial p_A}{\partial G^i}\right] = 0, \end{aligned} \tag{12}$$

where $\widehat{M}^i$ denotes group i's *expected* excess demand for oil. That is,

$$\widehat{M}^i = -\frac{\mu'(p_A)}{\mu(p_A)}\left[p_A(T^i + q^i T_0) + L^i - G_A^{i*}\right] - (T^i + q^i T_0),$$

derived analogously to (5) using Roy's identity. The first term inside the brackets in the last line of (12) represents the net expected marginal benefit of guns, keeping the autarkic price p_A constant. As described earlier, the production of an additional gun enhances group i's chances of taking control of the disputed land, T_0 and the oil contained therein. As long as the relative price of oil p_A is not too low, this expected net benefit is positive. The second

term inside the brackets represents the indirect effect that an additional gun would have on group i's expected payoff through its effect on the relative price of oil. The sign of this indirect effect depends on whether the group is a net buyer $\widehat{M}^i > 0$ or seller $\widehat{M}^i < 0$ of oil.

When groups are identical, no one group can expect to be a net seller or buyer of oil. Hence, each group's expected excess demand for oil must equal zero: $\widehat{M}^i = 0$, for all i.[10] In this case, groups behave *as if* they can have no influence on the country's autarkic price. That is to say, the equilibrium quantity of guns satisfies the condition, $q^i_{G^i} p_A T_0 - 1 = 0$.[11] That quantity of guns and the implied autarkic price are respectively

$$G^*_A = \frac{(N-1)T_0 p^*_A}{N^2} = \frac{\alpha\tau(N-1)\bar{L}}{\beta N^2 + \alpha\tau N(N-1)} \tag{13a}$$

$$p^*_A = \frac{\alpha N l}{\beta N + \alpha\tau(N-1)}. \tag{13b}$$

for $i = 1, 2, \ldots, N$, where as previously defined $\tau \equiv \frac{T_0}{\bar{T}} > 0$ indicates the *degree of insecurity*. Not surprisingly, the optimizing choice of guns, G^*_A, is positively related to the autarkic price of land and oil. The autarkic price itself, p^*_A, is increasing in the aggregate labor endowment, $\bar{L}$, and is decreasing in the degree of insecurity, τ, and in the number of groups in competition, N. In addition, p^*_A is strictly less than the autarkic price under "Nirvana", p^n_A. The ratio of the two prices, given by

$$\frac{p^*_A}{p^n_A} = \frac{\beta N}{\beta N + \alpha\tau(N-1)} < 1, \tag{14}$$

is also decreasing in the degree of insecurity τ as well as in the number of groups, N. These findings are due to labor being an essential input into the production of guns, a property that, under conflict, diverts resources away from the production of butter and therefore increases the relative price of butter, which is the inverse of the price of oil.

[10] Interpreting the conflict over T_0 as a winner-take-all contest, there will be ex post heterogeneity and thus the groups would be expected to trade after the conflict outcome is realized. In particular, the group that takes control of the land and thus oil would be expected to be a net seller of oil, whereas all other groups would be expected to be net buyers. When we interpret q^i as shares instead of probabilities, the assumption that groups are identical ex ante would imply that they are identical ex post. Hence, there would be no trade: $M^i = \widehat{M}^i = 0 \; \forall \; i$.

[11] Even if groups were not identical, this condition would be the relevant one, provided that each group were a price taker in its choice of guns.

Proceeding to the more general case which allows for asymmetries, we sum the conditions in (12) across all N groups to obtain

$$\begin{aligned}\sum_{i=1}^{N}\frac{\partial W_A^i}{\partial G^i} &= \mu(p_A)\left[p_A T_0\sum_{i=1}^{N}q_{G^i}^i - N - \left(\sum_{i=1}^{N}\widehat{M}^i\right)\frac{\partial p_A}{\partial G^i}\right] \\ &= \mu(p_A)\left[p_A T_0\left(\sum_{i=1}^{N}q_{G^i}^i\right) - N\right] = 0. \qquad (15)\end{aligned}$$

The second line in the expression above follows from the domestic market-clearing condition, $\sum_{i=1}^{N}\widehat{M}^i = 0$. By the specification of the conflict technology in (2), we have $q_{G^i}^i = \left[\bar{G} - G^i\right]/(\bar{G})^2$, implying that (15) can be rewritten as follows:

$$\sum_{i=1}^{N}\frac{\partial W_A^i}{\partial G^i} = \mu(p_A)\left[p_A T_0\frac{N-1}{\bar{G}} - N\right] = 0.$$

We can now combine (7) and the above expression to obtain solutions respectively for the aggregate quantity of guns and autarkic price in an interior Nash equilibrium:

$$\bar{G}_A^* = \frac{\alpha\tau(N-1)\bar{L}}{\beta N + \alpha\tau(N-1)} < \bar{L} \qquad (16a)$$

$$p_A^* = \frac{\alpha N l}{\beta N + \alpha\tau(N-1)}. \qquad (16b)$$

The solutions above reveal that, in the Nash equilibrium under autarky when the resource constraint $L^i - G_A^{i*} \geq 0$ does not bind for any group $i = 1, 2, \ldots, N$, both the market-clearing price and the aggregate quantity of guns are independent of the distribution of endowments across groups.

Under the maintained assumption that all groups achieve an interior optimum, substitution of the aggregate solutions (16) into (12), after simplifying, yields the following solution for group i's equilibrium production of guns under autarky:

$$G_A^{i*} = \frac{\bar{G}_A^*}{N}\left[\frac{\beta\bar{T} + \alpha(N-1)(\alpha L^i - \beta p_A^* T^i)}{\beta\bar{T} + \alpha\,(N-1)\,(N-\alpha)\left(\tau\bar{T}/N^2\right)}\right]. \qquad (17)$$

The interior autarkic equilibrium, then, is fully described by this expression, the equilibrium aggregate quantity of guns, $\bar{G}_A^*$, shown in (16a) and the equilibrium relative price of oil, p_A^*, shown in (16b). For future reference,

we denote group i's equilibrium expected payoff under this regime by W_A^{i*}. When groups are identical, aggregate welfare is:

$$\bar{W}_A^* = \mu\left(\frac{\alpha N l}{\beta N + \alpha\tau(N-1)}\right)\frac{\bar{T}Nl}{\beta N + \alpha\tau(N-1)}, \tag{18}$$

where $\mu(\cdot)$ represents the marginal utility of income as defined earlier. It is straightforward to show that autarkic aggregate welfare in the absence of conflict, $\bar{W}_A^n$, is always greater than autarkic aggregate welfare under conflict, $\bar{W}_A^*$. As such, when groups are identical, the welfare of any individual group would be lower under conflict as well.[12]

The following proposition summarizes our main findings thus far:

Proposition 1 *(Autarky) Suppose that barriers preclude trade between countries, but groups within a given country may trade freely.*

(i). *The autarkic price under conflict (p_A^*) is strictly less than the autarkic price in the absence of conflict (p_A^n) and is decreasing in the degree of insecurity (τ). Furthermore, the ratio of p_A^* to p_A^n, as shown in equation (14), is also decreasing in the degree of insecurity.*

(ii). *Autarkic aggregate welfare in the absence of conflict, $\bar{W}_A^n$, is always higher than autarkic aggregate welfare under conflict, $\bar{W}_A^*$.*

4.2 Free trade

Under free trade, each group can trade, without restrictions, butter and oil at a relative price p which is determined in international markets. Moreover, we suppose that this price cannot be influenced by any group or by the country as a whole. In other words, the country can be considered "small".[13] Using equation (4), the expected payoff of group i in this case equals

$$W_T^i(G;p) = \mu(p)\left[p(T^i + q^i T_0) + L^i - G^i\right], \tag{19}$$

[12] With variation across groups, there is no unique set of comparisons because, for each set of secure endowments and contested land, there is no unique set of land endowments that could be assigned to the no-conflict case.

[13] Supposing that the groups and the country as a whole are large enough to affect international prices, and that they recognize their effects in their strategic decisions would unnecessarily complicate our derivations without qualitatively changing our results. Skaperdas and Syropoulos (2002) allow for a strong effect of individual players on prices in a model similar to the one of this paper.

where as defined above G represents the vector of gun choices by all groups $i = 1, 2, \ldots, N$. At the symmetric interior optimum we have:

$$\frac{\partial W_T^i(G_T^*; p)}{\partial G^i} = \mu(p)(q_{G^i}^i pT_0 - 1) = 0,$$

from which we can solve for the equilibrium production of guns under trade when labor endowments are not perfectly secure:

$$G_T^* = \frac{(N-1)pT_0}{N^2} = \frac{(N-1)p\tau\bar{T}}{N^2}, \tag{20}$$

for all i, where $\tau \equiv \frac{T_0}{\bar{T}}$. Note that, even when the secure land endowments are not identically distributed across groups, this equilibrium is symmetric. That is, provided the relevant resource constraint is satisfied, groups of different sizes will produce the same quantity of guns.

What relevant resource constraints do we have in mind? Since the groups under free trade have, by assumption, access to international markets, it seems reasonable that they would be able to trade the right to obtain guns beyond what can be obtained domestically (that is, beyond L^i) against the production of oil that can be obtained from the group's land endowment (T^i) alone, or even against the oil that could be expected to be obtained from the expected contested land endowment (T_0). As Collier et. al. (2003, p. 77) state: "A particularly remarkable recent development is for rebel groups to raise finance by selling the advance rights to the extraction of minerals that they currently do not control, but which they propose to control by purchasing armaments financed through the sale of extraction rights." Former President of the Democratic Republic of Congo, Lawrence Kabila, financed his rebellion against Mobutu Sese Seko with such a scheme. Similarly, Ross (2003, p. 33) cites reports according to which former President of Congo-Brazzaville Denis Sassou-Nguesso was able to come to power by financing his private militias through pledges of future oil contracts. During the past decade, it has become far easier than it had been in the past to buy arms in international markets. Indeed, international private security firms offer comprehensive packages that include everything from tactical advisors to whole units complete with attack helicopters and jets. Such military "imports" have been decisive in countries like Sierra Leone and Angola (see Davis 2000 and Singer 2003).

With the possibility of such financial assistance and assuming that groups are sufficiently similar, the symmetric equilibrium in (20) always obtains in

the free-trade regime.[14] With this weak financing constraint, then, group i's equilibrium expected payoff under free trade, $W_T^i(p)$, can be shown to equal:

$$W_T^i(p) = \mu(p)\left[p\left(T^i + \frac{T_0}{N^2}\right) + L^i\right], \tag{21}$$

which is convex in p, reaching its minimum at

$$p_{\min}^i = \frac{\alpha}{\beta}\left[\frac{N^2 L^i}{N^2 T^i + T_0}\right]. \tag{22}$$

Thus, in this symmetric equilibrium where G_T^* is given by (20) for all i, variation in endowments across groups will generate variation in welfare under free trade, and variation in this minimum point. Again, for ease of comparison, we focus on the case of identical groups, implying that aggregate welfare and the (unique) minimum price become respectively

$$\bar{W}_T(p) = \mu(p)\left[p(1 - \frac{N-1}{N}\tau) + l\right]\bar{T} \tag{23a}$$

$$= \bar{W}_T^n(p) - \mu(p)p\frac{N-1}{N}\tau\bar{T} \tag{23b}$$

$$p_{\min} = \frac{\alpha N l}{\beta N - \beta\tau(N-1)} \tag{23c}$$

Then, the properties described below follow straightforwardly.

Proposition 2 *(Free Trade) Suppose the competing groups are identical.*

(i). *The international price that minimizes the country's aggregate welfare under trade and conflict* ($p_{\min}$) *is strictly greater than the autarkic (and minimum) price in the absence of conflict* (p_A^n)*, and is increasing in the degree of insecurity* τ*. Furthermore, the ratios*

$$\frac{p_{\min}}{p_A^n} = \frac{\beta N}{\beta N - \beta\tau(N-1)} \quad \textit{and} \quad \frac{p_{\min}}{p_A^*} = \frac{\beta N + \alpha\tau(N-1)}{\beta N - \beta\tau(N-1)}$$

[14] Specifically, if land endowments as well as expected contested land capture can be used as collateral to obtain guns beyond L^i, the condition for (20) to obtain is $p^{-1} \geq (N-1)T_0/N^2L^i - (T^i + q_iT_0)/L^i$ for all i. Provided that the groups are sufficiently similar, the right-hand-side of this inequality would be less than 0 and, therefore, the constraint would not bind for all positive prices p. As the price for oil increases, the conflict over land intensifies and this condition becomes stronger. Of course, this is not the only relevant constraint. A stronger constraint, one that would be relevant in the absence of the opportunities provided, for example, by the international private security firms, is that the relative price be sufficiently low such that the production of guns does not exhaust any group's labor endowment, $G_T^* \leq L^i$. To be more precise, the condition for (20) to be an equilibrium is that $p^{-1} \geq \frac{(N-1)T_0}{N^2L^i}$ for all i

are both increasing in the degree of insecurity, τ.

For any given international price p, aggregate welfare under conflict, $\bar{W}_T(p)$, is strictly lower than aggregate welfare in the absence of conflict, $\bar{W}_T^n(p)$. Furthermore, the higher is the degree of insecurity, the lower is $\bar{W}_T(p)$.

Part (ii) of Proposition 2 is to be expected as insecurity induces arming that reduces welfare. The interpretation and significance of part (i) will become evident in the comparisons we undertake in the next section.

5 Comparing the two trading regimes under conflict

Having characterized the allocation of resources under the two trading regimes, we are now ready to compare autarky to free trade in terms of both arming and welfare. For tractability we will only consider the case of identical groups. The comparison reveals two key forces at play here: (i) the well known gains from trade that favor trade over autarky, as was demonstrated above in the benchmark case without conflict; and (ii) the induced effects of trade on the groups' incentive to fight over the contested resource, which may or may not favor the trade over autarky.

Consider first the level of arming. Note that, whereas guns under autarky depend only on the endowments and other parameters of the model as shown in (13a), guns under free-trade critically depend on the relative price p and negatively so as shown in (20). Using (13a) and (20), we calculate the ratio of guns in the two regimes, θ, which provides a convenient summary measure:

$$\theta \equiv \frac{G_A^*}{G_T^*} = \frac{p_A^*}{p}.$$

As this expression shows, the groups' optimizing allocation to guns under anarchy is lower than that under free-trade if and only if the international relative price of guns is higher than its domestic autarkic price.

The logic here is straightforward: A high price of oil induces more guns production both because guns are cheaper to produce and because land and oil are more valuable in international markets and thus induce more competition for the capture of the contested land. When the international price p is higher than the autarkic price p_A^* ($\theta < 1$), the groups and the country as a whole import butter and export oil. By contrast, when p is lower than p_A^* ($\theta > 1$), butter is more valuable in the international market than it is domestically, and oil is less valuable internationally than it is in

the domestic market. The groups and the country, therefore, export butter and import oil, and they use less labor in the production of guns than they would under autarky.

Moving on to the relative appeal of free trade, note that the payoffs under autarky would equal the payoffs under trade if the international price were the same as the autarkic price: $\bar{W}_T(p_A^*) = \bar{W}_A^*$. Since $\bar{W}_T(p)$ is convex in p and obtains its minimum at $p_{\min}$, how welfare under free trade, $\bar{W}_T(p)$, ranks relative to welfare under autarky, $\bar{W}_A^*$, depends on how $p_{\min}$ is related to the autarkic price p_A^*. In particular, if these two prices were to coincide, then the expected payoffs under autarky would fall below the expected payoffs under trade everywhere except at that minimum price. However, from Proposition 2 part (i) we have $p_{\min} > p_A^n$ and from Proposition 1 part (i) we have $p_A^n > p_A^*$. Therefore, we must have $p_{\min} > p_A^*$, implying that there exists some range of international prices for which the groups are better off under autarky than under trade.

[FIGURE 2 about here]

But we can be more precise in characterizing this range of prices. In particular, given the convexity of $\bar{W}_T(p)$, there exists another price $p' > p_{\min}$ defined uniquely by the condition, $\bar{W}_T(p') = \bar{W}_A^*$. Therefore, as illustrated in Figure 2, for all $\tilde{p} \in (p_A^*, p')$, the expected payoffs under free trade are lower than the payoffs expected under autarky ($\bar{W}_T(\tilde{p}) < \bar{W}_A^*$), whereas for prices outside that interval the payoffs expected under trade are at least as high as those expected under under autarky.

We summarize the key implications of our analysis as they relate to the welfare comparison of the two regimes in the following proposition:

Proposition 3 *(Relative Appeal of Free Trade) Suppose the competing groups are identical.*

(i). *When the international price of oil p is lower than p_A^* or higher than p', welfare under free trade is higher than welfare under autarky.*

(ii). *When the international price of oil is between p_A^* and p', welfare under autarky is higher than welfare under free trade.*

(iii). *The price p' is increasing in the degree of insecurity τ. The ratio $\frac{p'}{p_A^*}$ is increasing the degree of insecurity τ as well. Thus, the range of prices for which autarky dominates trade is increasing in the degree of insecurity.*

When the international price for oil p is lower than its autarkic price (p_A^*), the production of guns under trade is lower. In this case, removing the barriers to trade reduces the groups' incentives to fight over the contested resource, implying that domestic conflict is less intense. With this benefit *and* the familiar gains from trade, there should be no doubt that welfare is higher than it would be under autarky. However, as the international price of oil rises, domestic conflict intensifies, becoming just as severe as it is under autarky once the international price reaches the price that would obtain under autarky ($p = p_A^*$); at the same time, the gains from trade fall to zero. It is at this point, as shown in Figure 2, where welfare under autarky is identical to that under trade.

As the international price continues to rise above the autarkic price, domestic conflict intensifies further; while the gains from trade rise above zero, those gains are not sufficiently large to compensate for the higher burden of guns; thus, as the international price of oil rises above its autarkic price, welfare under trade falls below that which could be obtained under anarchy. Yet, as Proposition 3 indicates, even further increases in the international price will eventually make free trade relatively more appealing. That is to say, when the international price of oil becomes sufficiently high ($p > p'$), the gains from winning the valuable land and selling the oil in the global marketplace become very large and begin to outweigh the (normalized) opportunity cost of guns.

Part (iii) of the Proposition, the proof of which is given in the Appendix, establishes that the range of international prices for which autarky is superior to trade ($p \in (p^*, p')$) expands as insecurity (τ) increases, an intuitively plausible but non-trivial property. Figure 3 illustrates this property and also shows how an increase in the degree of insecurity shifts the welfare curve, assuming trade, down.

[FIGURE 3 about here]

One can also verify that the prices p_A^*, p_A^n, and $p_{\min}$ are increasing in the labor-to-land endowment ratio $l \equiv \frac{\bar{L}}{\bar{T}}$. That is to say, the labor-to-land endowment ratio affects these critical prices by effectively shifting all the curves, in the figures we have shown, to the right. A higher l makes the range of international prices (those below p_A^*) for which free trade is superior larger since the country is an importer of oil and an exporter of butter over that range.[15]

[15] The effect of l on p' is generally ambiguous. But, for large enough $l \equiv \bar{L}/\bar{T}$, p' is also increasing in l.

Another interesting implication, which follows from our previous discussion and is illustrated in Figure 2, concerns the welfare effect of an increase in the international price of the contested resource.

Proposition 4 *(Resource Curse) Suppose the competing groups are identical. Then, for international prices between p_A^* and $p_{\min}$, aggregate welfare under free trade, $\bar{W}_T^*(p)$, is decreasing in the international price p.*

This finding is reminiscent of what others (including, but not limited to, Sachs and Warner 1995 and Ross 2003) have called the "resource curse," but is based on a different logic. In particular, as suggested earlier, for $p \in [p_A^*, p_{\min})$, increases in the international price of the contested resource induce a greater degree of domestic conflict. While the familiar gains from trade increase with increases in p over this range, these increases are swamped by the large increases in the burden of guns.

It is important to note, in relation to the resource curse, that national income under free trade, which is given by

$$\bar{R}_T^*(p) = [p(1 - \tfrac{N-1}{N}\tau) + l]\bar{T},$$

is everywhere increasing in the international price p, even over that range for which welfare is falling. Thus, particularly for $p \in [p_A^*, p_{\min})$, it would seem that our measure of income tends to overstate welfare. But, there is no reason to believe that commonly used measures of aggregate income (e.g., GDP) do any better. If anything, there is reason to believe that they do worse. Specifically, our theoretical construct, in contrast to conventionally used measures based on national income and product accounts, excludes expenditures on arming. Thus, the conventional measures of national income would tend to overstate welfare by even more than our theoretical measure. But the point here is not to "advocate" our theoretical measure. Instead, the point is to note that reports of income founded on conventional income accounting might not be able to identify fully the extent of the natural resource curse, and the curse itself might be not only more severe but also more pervasive, affecting more countries than currently believed.[16]

A final implication of the analysis that we draw out here is that conflict also affects the pattern of trade. Specifically, when $p \in (p_A^*, p_A^n)$, the

[16] Candidates for this designation would be countries that have, for example, low ranks in term of the UNDP's Human Development Index (HDI) compared to their rank in terms of GDP. Such countries appear to fall into one of either two categories: those that are significant oil exporters (like Saudi Arabia or Angola) and those that have significant domestic cleavages (like Algeria and South Africa). See the table for HDI in: `http://hdr.undp.org/reports/global/2003/indicator/index.html`.

presence of insecure land endowments reverses the direction of the country's comparative advantage relative to the hypothetical scenario where land endowments are perfectly secure. To illustrate this effect, we calculate the country's aggregate excess demand for oil under free trade, in the hypothetical case of no conflict ($\bar{M}_T^n(p)$) and the more realistic case of conflict ($\bar{M}_T^*(p)$), using (5),

$$\bar{M}_T^n(p) = \beta\left[\frac{p_A^n}{p} - 1\right]\bar{T} \tag{24a}$$

$$\bar{M}_T^*(p) = \beta\left[\frac{p_A^*}{p} - 1\right]\bar{T}. \tag{24b}$$

For both cases, $\bar{M}_T(p)$ is positive when the country imports oil and negative when it exports oil. As (24a) reveals, in the absence of conflict, the country would export butter and import oil whenever $p < p_A^n$. But (24b) shows that if, at the same time, $p > p_A^*$, then under trade with conflict, the country would export oil and import butter. This sharp divergence of trade patterns depending on the presence of domestic conflict is a result of the diversion of resources (specifically labor in this model) away from the production of butter to the production of guns under conflict.[17] From Proposition 1 part (i), it can be seen that, the range of prices for which the country's comparative advantage reverses under conflict relative to the hypothetical case of no-conflict is wider for countries having a greater degree of insecurity τ. But the effects of insecurity trade patterns is not limited to cases where the price falls within that particular range. Equation (24b) shows that a country's excess demand for oil is increasing in p_A^*, which Proposition 1 part (i) indicates is decreasing in the degree of insecurity. Thus, the degree of insecurity, τ, generally reduces the country's excess demand for oil. We summarize these findings in the following proposition:

Proposition 5 *(Trade Pattern Effects) The domestic demand for oil is decreasing in the degree of insecurity τ, and the country over-exports oil (relative to the hypothetical no-conflict case). When the international price of oil is between p_A^* and p_A^n, there is a reversal in the country's comparative advantage (relative to the no conflict case) with the country exporting oil instead of butter.*

[17] It does not depend on the particular production structure we have employed. Domestic conflict's sharp effect on the country's trade pattern would remain intact as long as there is a difference in the factor intensities in the production of arms and oil.

In oil-exporting countries where there is domestic conflict over that same resource we would expect these exports to be higher than those that would obtain in the absence of conflict. If, for example, the resources expended on Nigeria's civil wars and the various other forms of domestic conflict that have been present there over the years were instead used in production, the local economy would have absorbed more of the oil production and less of it would have been exported.

6 Concluding Remarks

Since 1945, 127 civil wars that have killed at least 1,000 people have emerged in 73 countries. The total number of casualties as a direct result of these wars are conservatively estimated to be at least 16.2 million.[18] The accompanying direct and indirect economic costs have also been immense; it bears repeating that these costs are much bigger than the costs of eliminating business cycles as calculated by Lucas (1987). These wars have not abated since the end of the Cold War; they have spread into Eastern Europe and Central Asia (Collier at. al, 2003, Ch.4), and many pre-existing wars last longer than they had in the past (Fearon and Laitin, 2003). Furthermore, low-level insurgencies, civil unrest, and more conventional forms of domestic conflict are present in an additionally large number of countries, and these have their own added costs (Rodrik, 1999).

Our results suggest that globalization in the presence of domestic conflict is not the unmitigated good that it was shown to be within the context of traditional trade models in which all endowments are perfectly secure. Although for importers of oil and other natural resources opening up the economy brings the regular benefits of trade and reductions in conflict, for exporters of the same resources opening the economy to trade can very well induce a large diversion of productive resources to conflict that more than offsets the familiar gains from trade. Welfare can even be decreasing while the price of the exported resource is increasing, and the country in conflict might be exporting a good that it would be importing in the absence of conflict.

The increase in domestic conflict observed in the post-war period is also correlated with the emergence of weak new post-colonial and post-communist states that have been unable to develop the legal infrastructure, enforcement, and institutions that would manage the various conflicts. As

[18] See Fearon and Laitin (2003, p.75) who use the data from Singer and Small (1994). That period had a lot fewer interstate wars with much fewer casualties than civil wars, in contrast to the first 45 years of the twentieth century.

even the strong states of high-income countries are said to be weakening in many of the same dimensions (see, e.g., Van Creveld, 1999), it is doubtful that the governance of security can be significantly improved in low-income countries without qualitative changes in the way the international economy is governed.

A Appendix

Proof of Proposition 3, part (iii). As noted earlier, p' is defined by $W_T(p') = W_A^*$, which, using (18) for W_A^* and (23a) for $W_T(p')$, can be written as

$$\left[\frac{\beta N l}{\beta N + \alpha\tau(N-1)}\right]^{\beta} - \frac{\alpha}{p'^{\alpha}}\left[p'(1-\tau\tfrac{N-1}{N}) + l\right] = 0.$$

Total differentiation of this expression eventually yields:

$$\begin{aligned} \frac{\partial p'}{\partial \tau} &= -\frac{p'^{\alpha} A}{B} \\ \text{where} \quad A &\equiv p'^{\beta}\frac{N-1}{N} - \beta p_A^{*\beta}\frac{N-1}{\beta N + \alpha\tau(N-1)} \\ B &\equiv \frac{\alpha l}{p'} - \beta\left[1-\tau\tfrac{N-1}{N}\right]. \end{aligned}$$

Since $p' > p_A^*$, we must have

$$A > p_A^*\left[\frac{N-1}{N} - \beta\frac{N-1}{\beta N + \alpha\tau(N-1)}\right] = p_A^*\frac{N-1}{N}\left[1 - \frac{\beta N}{\beta N + \alpha\tau(N-1)}\right].$$

Clearly, the right hand side of the equality above is necessarily greater than 0, implying that $A > 0$. In addition, we have

$$p' > p_{\min} = \frac{\alpha N l}{\beta N - \beta\tau(N-1)} = \frac{\alpha l}{\beta(1-\tau\frac{N-1}{N})},$$

which implies $p'\beta\left[1-\tau\frac{N-1}{N}\right] > \alpha l$, or equivalently that $B < 0$. With the inequalities $A > 0$ and $B < 0$, we must have that the price p' is increasing in the degree of security τ: $\frac{\partial p'}{\partial \tau} > 0$. From this result combined with Proposition 1, part (i), that p_A^* is decreasing in τ, it follows that the ratio, $\frac{p'}{p_A^*}$, is increasing in τ. $\|$

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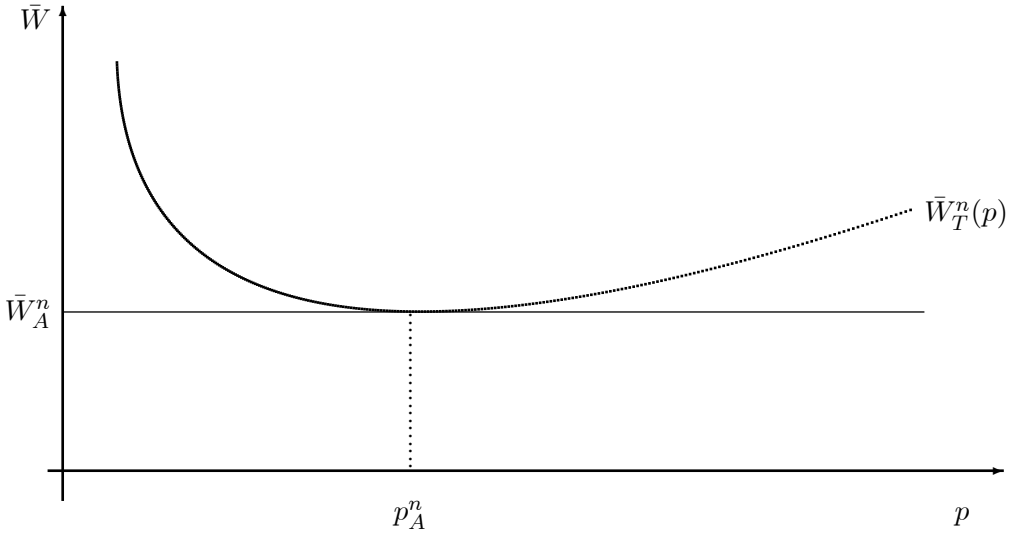

Figure 1: Free trade without conflict

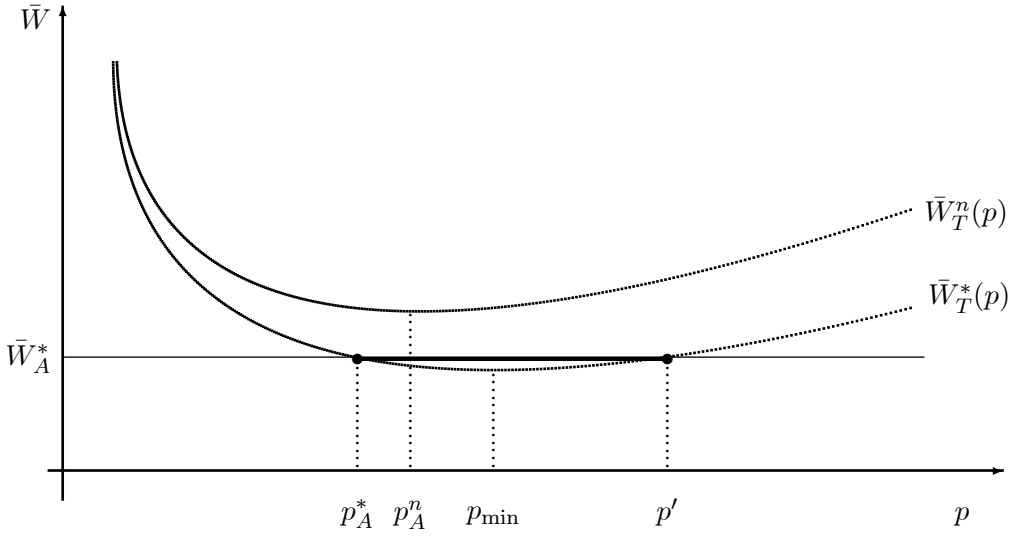

Figure 2: Free trade with conflict

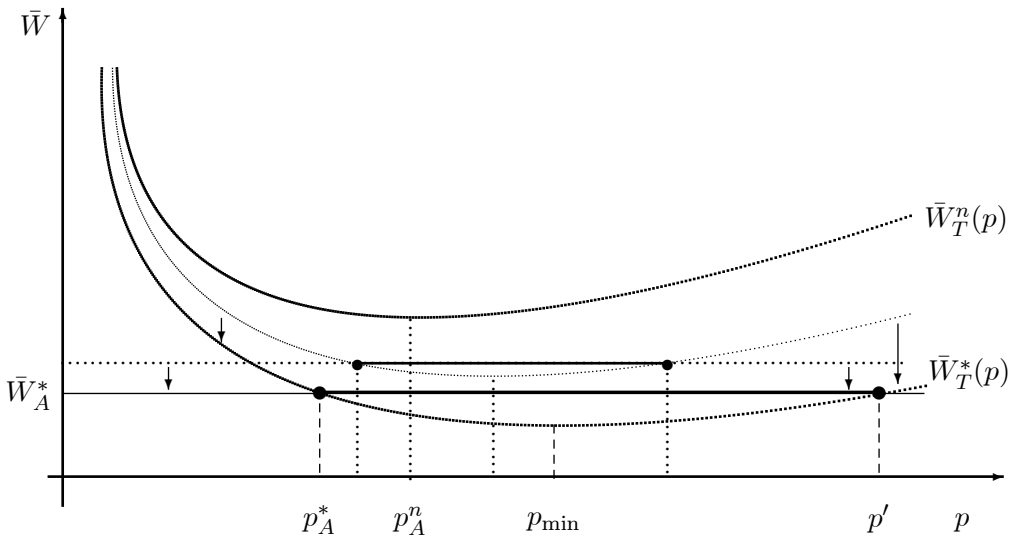

Figure 3: When the degree of insecurity rises