N-S Trade with Weak Institutions*†

James E. Anderson
Boston College and NBER

June 22, 2017

Abstract

States with weak institutions can lose from trade with strong states when trade is subject to predation. The happy liberal idea of trade fostering better institutions and peace can be turned on its head. The Ricardian model of trade subject to predation offered here implies imperialism without capital, *contra* Marxists. Weak and poor South trades with strong and rich North. Poor South labor is attracted to predation. Labor market effects of predation and enforcement amplify opposing interests in the terms of trade, potentially obviating the standard gains from trade that allows bargaining solutions to surplus division.

JEL Classification Codes: F13, F14, F16

Keywords: Predation, enforcement, colonialism.

*Presented to a workshop on economic interdependence and war, UC-Irvine, April 21-22, 2017.

†Contact information: James E. Anderson, Department of Economics, Boston College, Chestnut Hill, MA 02467, USA.

Classical political economy told a happy story about trade and institutions: mutual gains from trade were assured (Ricardo, 1817), and trade would stimulate better institutions (Smith, 1776). Against the classical liberal tradition, other observers noted and theorized about examples where reaction to holdup – extortion or theft upon trade – was associated with conflict, often ending in dominance or conquest by the stronger region. The examples suggest opposed interests in limiting holdup, and potential losses from trade to weaker parties. Contemporary use of private security forces to protect the trade of rich firms with poor and weak countries suggests continued relevance of concerns about conflict associated with trade from which weaker countries may lose.

This paper takes a first step toward an economic model of trade between asymmetrically capable states when trade, predation and enforcement are all endogenous. The classic Ricardian trade framework is extended to include endogenous extortion or theft on goods in exchange, organized or not by a Mafia, opposed or not by either state or its non-state agents. The model is otherwise fully classical, with perfect competition and mobile labor. Potential losses from trade are inherent to the trade activity itself, in contrast to well-examined analyses of loss from trade due to labor market failures or economies of scale.

Enforcement against predation normally implies opposed interests in the model: the richer and more capable country benefits from enforcement and the poorer less capable country loses. No mutually beneficial agreement on enforcement is possible in this case. Gains from trade are not guaranteed for South – it is possible that autarky dominates trade with enforcement by North. The mechanism of opposing interests is through the terms of trade, as in the standard model, but terms of trade effects are amplified by the labor market effects of endogenous predation and enforcement. For example, enforcement by North raises South labor supply and reduces North labor supply, causing a terms of trade deterioration for South through the relative size effect. These effects typically dominate the gains due to reducing trade friction in the form of predation.

Predation (extortion or outright theft) is a prominent feature of North-South trade (e.g.,

Anderson and Marcouiller, 2002) now and was even more prominent in the 17th to 19th centuries. See Andrade (2004) for a description of Dutch East India Company activities competing and colluding with pirates against the weak and distant late Ming dynasty power in coastal China. Institutional responses to border predation now and in the past have ranged widely. Tolerance by South and North is one outcome (no enforcement). Tribute (paying potential predators not to predate) is another, seeming more efficient outcome. Enforcement by North, resisted or not by South is another pair of outcomes; and enforcement by South, resisted or not by North is yet another outcome. The theoretical framework of the paper provides explanations of the range of institutional responses to trade in terms of parameters of the model.

Rich North has a capable state. Poor South has a state with weak control over predators who prey on cross border trade. South's weak capability also means imperfect control over a Mafia that may control predation, and imperfect ability to prevent North state or non-state actors from acting with the Mafia or against the predators on South's border. Enforcement that reduces predation on trade harms one party, usually South. North paying off South's Mafia harms the non-Mafia South agents. The divergence of interests suggests conflict, civil war and separatism. North has incentives to intervene – an economic theory of imperialism without capital, *contra* Marxists.

The model of the paper is closest to that of Anderson and Marcouiller (2005). It shares the feature that predation is endogenous with predators drawn from the common labor pool of the poorer country, as well as the feature that potential predation can result in autarky. The present model departs from the pure anarchy of its predecessor by introducing institutions. The model has some similarity to the Resource Curse literature (e.g. Frankel, 2010) in the sense that an exogenously created gain leads to a social loss due to predatory behavior. But the mechanisms here are quite different: the gains (and losses) come through the terms of trade and there is no actual conflict that consumes resources. The results of the model point to economic determinants of conflict between states and within states, and

to intervention by more powerful states in the civil conflict of weaker states. Thus it relates to a wider literature on economic determinants of conflict (Garfinkel and Skaperdas, 2007).

The model suggests new perspectives for the theory of international trade relations. The standard theory (Bagwell and Staiger, 2004) treats trade relations between states of equivalent competency in control of their borders. *Economic* asymmetries associated with country size, market power and levels of economic development lead to asymmetric division of the gains from trade, suggesting trade policies motivated in part by their effect on the terms of trade. International institutions such as the WTO are understood as managing trade relations to minimize terms of trade externalities. The terms of trade play a different and equally powerful role in the present model of North-South trade. Future work may consider international institutional design of North-South relations. It may be that alternative mechanisms would do better for North-South trade relations.

Section 1 is a nontechnical outline of the model. Section 2 begins with frictionless secure trade in a simple Ricardian production model of trade between North and South. South is poorer due to less efficient technology. Cobb-Douglas preferences over the two traded goods are identical. Section 3 introduces potential predation on trade in this setting. Predation is at first competitive (free entry/exit of predators). Alternatively in Section 4, the supply of predators is controlled by a Mafia. Comparative statics of equilibrium differ somewhat between the cases. Section 5 analyzes the interaction of North and South state enforcement incentives. North and South states have conflicting incentives for enforcement in some parameter ranges. The conflicting incentives can lead to several potential outcomes in which North's state imposes its desired outcome. Sections 6 and 7 analyze cases where North's interest aligns with a Mafia in either a tribute payment by North or support for the Mafia against separatism by South.

1 Theory Outline

Internal production and exchange is assumed secure to simplify the model sufficiently to focus on international interaction of governments in enforcement. (Predation on production at local levels induces emergence of local order provision to limit its damage, the subject of a related literature (Grossman, 2002, for example) pushed to the background here along with its emphasis on the efficiency tradeoff between reduction of predation and the tendency for the order providers to enrich themselves at the expense of those protected.)

Start with the familiar 2 good 2 country Ricardian model with identical Cobb-Douglas preferences. As in Anderson and Marcouiller (2005), labor may choose to prey on trade, while in equilibrium the predators come exclusively from the poorer country (South). Predation is either classic theft or, equivalently and more generally, extortion. Departing from Anderson-Marcouiller, costly enforcement is introduced.[1] Key characteristics of the two economies and their iceberg costs of international trade determine the type of order provision that emerges. The familiar asymmetry between North and South in the form of absolute advantage favoring North is potentially amplified by absolute advantage in enforcement.

Predation on trade of either country's exports has similar implications for sources of conflict in trade relations.[2] The incentives of North and South on enforcement are in conflict. The table below reports the results of enforcement on North and South terms of trade for the two polar cases of predation on North exports and on South exports and contrasts them

[1] Anderson-Marcouiller is altered in several other ways as well. Domestic order is assumed such that insurance allows predation risk to be diversified, and predation is on trade falls asymmetrically on the two goods. The predators are assumed to be integrated into the domestic market for exchange of goods.

[2] Asymmetry between predation on trade on either North's exports or South's exports is potentially more interesting. Think of predation on the approaches to South's port. On the seaward side, North's exports may be exposed to extortion as they near the port. On the landward side, South's exports may be exposed to extortion as they near the port. A plausible simplifying assumption is that the market in the port itself is secure.[3] The polar cases suggest specialization in predation depending on the characteristics of the goods. Asymmetric predation results when some goods are more easily stolen or more attractive to steal. For example, high value to weight or volume ratios makes goods more attractive to predators, all else equal. Perishability and other handling characteristics also affect the relative attractiveness of shipments to predators. While there are some interesting differences, the analysis confirms a deeper similarity. The model development in the text thus focuses on the polar case of predation by poor South on rich North's export. The alternative polar case is analyzed in the appendix: predation by South on South's export.

with the benchmark equilibrium case of no predation. Which cell is actually the equilibrium depends on underlying parameters. Equilibrium with no predation results when trade is sufficiently beneficial for poor South. The cases of interest in this paper are when trade with no enforcement is insecure. The bottom row of the table is the case where enforcement is free for North. Then North chooses enforcement that eliminates predation. In the case of predation on South exports, South loses from elimination of predation. With very costly enforcement, insecure equilibrium is tolerated with no enforcement. With better enforcement capability, E and E^* are interior enforcement efforts of North and South respectively. The remaining cells report the gains or losses in terms of trade for each country from each policy.

Predation On	**North Exports**	**South Exports**
E	North Gains, South Loses	North Gains, South Loses
E*	North ?, South Gains	North Loses, South ?
No Predation	North Gains, South Gains	North Gains, South Loses

The first row reports that North benefits from enforcement that is not too costly, whether predation is on its own export or on its import from South. The second row reports that South enforcement against predation on North exports is in South's interest but may be opposed by North. South enforcement against predation on South's export, even if beneficial to South in some range, will be against North's interest and so opposed by North unless enforcement rises so far that it is against South's interest.

The basic model adds to the Ricardian trade model the activities of predation on trade and enforcement against predation. Two new parameters govern their interaction. One parameter governs the relative effectiveness of predators hunting prey, and another parameter governs the relative efficacy of enforcers against predation. Labor markets clear with the population employed as workers, predators or enforcers. Equal returns are earned in all activities, a key equilibrium indifference condition that governs the amount of predation and the choice of enforcement levels. Depending on parameters, the model may generate secure

trade with no enforcement, insecure trade with no enforcement, and insecure trade with some enforcement provided by an active government, generally the North's government.

With the basic model in place, the comparative statics of equilibrium enforcement can be deduced. Particularly interesting are globalization shocks (falls in international trade costs modeled as iceberg costs) and growth shocks (technological or population). The model implies that reductions in iceberg trade costs intensify the conflict of incentives to enforce between the two countries.

If predators are coordinated (or the ruler in the country from which they come can control entry), it saves resources for the prey to pay tribute to the predators in exchange for safe shipment. Changes in relative enforcement power can shift the cost/benefit balance between a steady stream of tribute payments to a one time expense to eliminate the predators. The US decision to make war on the Barbary statelets in 1801-15, is an example.

2 The Cobb-Douglas Ricardian Trade Model

A very simple general equilibrium trade model suffices as a platform to illustrate the main principles of order provision in the face of predation on trade. A Cobb-Douglas utility function (common to both countries) is combined with a Ricardian technology that differs between countries. One country (North) is richer than the other (South) due to its better technology. (Assigning a richer country is useful later, when predators are introduced, who come only from the South, subject to an equal utility condition in predation and production.) The familiar model and its notation are developed here to set the stage for analysis of insecure trade equilibrium in the next section.

Utility of agents is a function $x_1^{\gamma} x_2^{1-\gamma}$ of consumption bundle (x_1, x_2) in North and $x_1^{*\gamma} x_2^{*1-\gamma}$ in South. The Ricardian technology in North is $a_1 y_1 + a_2 y_2 \leq L$, where L is the supply of effective labor (in good 2 units), y_1 and y_2 are the production levels of goods 1 and 2, and a_1, a_2 are the unit labor requirements. The technology in South is $a_1^* y_1^* + a_2^* y_2^* \leq L^*$.

We assume $a_1/a_2 < a_1^*/a_2^*$ and $a_i < a_i^*,\ \forall i$. With this setup, North specializes in good 1, South in good 2. With economies not too dissimilar in size, both are completely specialized so North produces $y_1 = L/a_1$, South produces $y_2^* = L^*/a_2^*$. Let p denote the equilibrium price of good 1 in terms of good 2. North income in terms of good 2 is $wL = pL/a_1$ and South income in terms of good 2 is $w^*L^* = L^*/a_2^*$. Cobb-Douglas demand implies that $x_1 = \gamma pL/a_1 p = \gamma L/a_1$. North exports are thus $y_1 - x_1 = (1-\gamma)L/a_1$. South produces $y_2^* = L^*/a_2^*$ and consumes $x_2^* = (1-\gamma)L^*/a_2^*$, so it exports $y_2^* - x_2^* = \gamma L^*/a_2^*$. The equilibrium terms of trade for North (under balanced trade) is

$$p = \frac{\gamma}{1-\gamma}\frac{L^*/a_2^*}{L/a_1}. \tag{1}$$

The larger is the South labor supply L^* relative to the North labor supply L, the better are North's terms of trade p. Improvements in South technology (a fall in unit labor requirement a_2^*) have the same effect.

Up to an irrelevant positive constant, indirect trade utility is given by $v(p, L) = p^{1-\gamma}L/a_1$ for North and $v^*(p, L^*) = p^{-\gamma}L^*/a_2^*$. (It is straightforward to confirm that there are mutual gains from trade.) Because of the assumption that South has higher unit labor requirements than North in both goods (an absolute disadvantage in all goods), the South real wage is lower than the North real wage.

These are the building blocks for the model of insecure trade.

3 Trade with Predation

The model of Section 1 has no predation and no enforcement; markets work perfectly at no cost to governments. In this section, potential productive workers may choose predation over production when predation (extortion or theft) pays well enough. Given the low wage South economy it is natural to assume that predators come exclusively from South. Denote predators as raiders R^*. To counter the predators, governments in North and South may

employ enforcers E, E^*. Enforcers are drawn from national active populations N, N^*, hence the labor force is equal to $L = N - E$ in North and $L^* = N^* - E^* - R^*$ in South. Until the next section, the enforcement efforts E, E^* are exogenous and may be equal to zero.

The specification of the state is simplified to ease the analysis. The state is assumed to act in the interest of its members (including predators who are indistinguishable from productive workers). This extreme public interest model sharpens the distinction between the South state and the Mafia. The state in South or North is able to collect income taxes to pay enforcers at some exogenous marginal cost of funds normalized to 1, reducing effective labor by E or E^*. The exogeneity of the marginal cost of funds avoids the complexity arising from formal analysis of South's most obvious way to raise funds – taxation of trade, either North's exports coming in or South's exports going out. Also avoided is smuggling and predation on tax collectors. The normalization itself is harmless, forming part of an exogenous parameter used below to represent the relative efficiency of North in providing enforcement effort.

The new element in the model is that endogenous predation R^* is in the amount that equalizes the return to South labor in production/trade and predation. The new environment in the model is the interaction of traders, predators and enforcers. The insecure exchange environment resembles that in Anderson and Marcouiller, but has some different features. One important new feature is specialized predation: predators prey on one of the goods as goods approach the market, plausibly it pays to specialize. Another new feature is enforcement. Because R^* is endogenous, so is South's labor $N^* - E^* - R^*$ regardless of enforcement E^*.

The probability of successful shipment is

$$\pi = \mathcal{E} + (1 - \mathcal{E}) \frac{1}{1 + \theta \frac{R^*}{L + L^*}} \tag{2}$$

where the enforcement probability $\mathcal{E}$ is a function of enforcement labor by North and South:

$$\mathcal{E}(E, E^*) = \frac{\epsilon(AE + E^*)}{1 + \epsilon(AE + E^*)}. \tag{3}$$

Parameter $A \geq 1$ is the absolute advantage of North labor in enforcement. In (2) the shippers and predators interact in evasion/pursuit with a logistic success rate $\pi^0 = 1/[1+\theta R^*/(L+L^*)]$ that decreases with the ratio of predators to shippers (Anderson and Marcouiller, 2005) and the relative effectiveness of predators in finding prey, θ. Enforcers defeat a fraction M of successful matches of predators to prey (assumed to always result in loss of shipments) with full recovery of goods. Enforcement success is a logistic function of the effective number of enforcers $AE+E^*$ in (3). The numbers of predators and prey are suppressed as an argument in (3), rationalized as thinking of density of patrols on the limited area of approach to the port where trade occurs. Note that $\mathcal{E}_E(0,0) = 0 = \mathcal{E}_{E^*}(0,0) = \mathcal{E}$, so that coordination of enforcement effort is required to have any effect. That is, institutions are required.

3.1 Competitive Predation

The focus in this section is on predation on North goods (only) by South predators. (North goods may plausibly have higher value to weight than South goods; historically, think of manufactured goods from North exchanged for primary agricultural goods from South.) The appendix treats predation on South goods. (Think of gold or diamond exports.) The switch affects many details but the main implications of the analysis are unaffected.

The analysis shows that with South predation on North exports, North gains from enforcement that is sufficiently effective, and South loses from North's enforcement. If South gains from enforcement, North may gain or lose. These points are formally proved in the Ricardian Cobb-Douglas model below. The intuition should be valid in a wider class of models.

The predators seize $(1-\pi)(y_1-x_1)$ of North exports. They can sell the goods in a thieves

market that we assume is perfectly (for simplicity) integrated with the legitimate domestic market in South. The domestic market price is p. North sellers receive expected price πp. The income of predators is $p(1-\pi)(y_1 - x_1) = (p - \pi p)(y_1 - x_1)$. The left hand side of the equation gives the value of goods taken by predators while the right hand side is in the form of tariff revenue generated by a tax $p - \pi p$ times the quantity imported $y_1 - x_1$.

The integration of predators into the South economy implies that their income is spent in the South economy in exactly the same form as tariff revenue lump sum redistributed to identical consumers, the usual setup in trade policy models. The predators sell their goods in the integrated domestic market at price p in terms of good 2, with a rent per unit (specific tax equivalent) of $p - \pi p$ per unit, effectively like a tariff in that amount. Two key differences between predation and the tariff are: (i) the predators 'ad valorem tax' rate $(1-\pi)/\pi$ is endogenous in contrast to an exogenous tariff, and (ii) more predation means less South output, improving South's terms of trade, all else equal.

The key indifference condition for equilibrium allocation of South labor between predation and production/trade equates the wage in production/trade $1/a_2^*$ with the per capita income from predation:

$$p(1-\pi)(1-\gamma)L/a_1 R^* = 1/a_2^*. \tag{4}$$

Use equation (2) to form an expression for $1-\pi$ and substitute into (4). Use labor market clearance in South $N^* - E^* - R^* = L^*$ and in North $N - E = L$ to substitute for South and North labor. Finally, solve the result for the supply of predators as a function of South price p:

$$R^* = \rho(p, E, E^*) = p(1-\mathcal{E})\frac{\theta}{\theta - 1}\frac{a_2^*}{a_1}(N-E)(1-\gamma) - \frac{N - E + N^* - E^*}{\theta - 1}, \tag{5}$$

where $\mathcal{E}(E, E^*)$ is given by equation (3).

Substitute the right hand side of (5) for R^* in (2) to yield an implicit relationship between

π and p. After simplification this is

$$\Pi(p, E, E^*) = \mathcal{E} + [1 - \mathcal{E}] \frac{N - E + N^* - E^* - \rho(p, E, E^*)}{N - E + N^* - E^* + (\theta - 1)\rho(p, E, E^*)}. \tag{6}$$

In general $\Pi(p, E, E^*)$ is decreasing in p since (5) $\Rightarrow \rho_p > 0$.

The expected price received by North for its exports in insecure equilibrium is given by

$$\pi p = \frac{\gamma}{1 - \gamma} \frac{a_1}{a_2^*} \frac{N^* - E^* - R^*}{N - E} \tag{7}$$

where the right hand side is equivalent to (1), but now the South labor supply is endogenous in p via R^* given by (4).

The equilibrium relative price of North's export p as a function of π solves (7) for p:

$$p = P(\pi, E, E^*) = \frac{c}{\pi + (1 - \mathcal{E})\gamma\theta/(\theta - 1)} \tag{8}$$

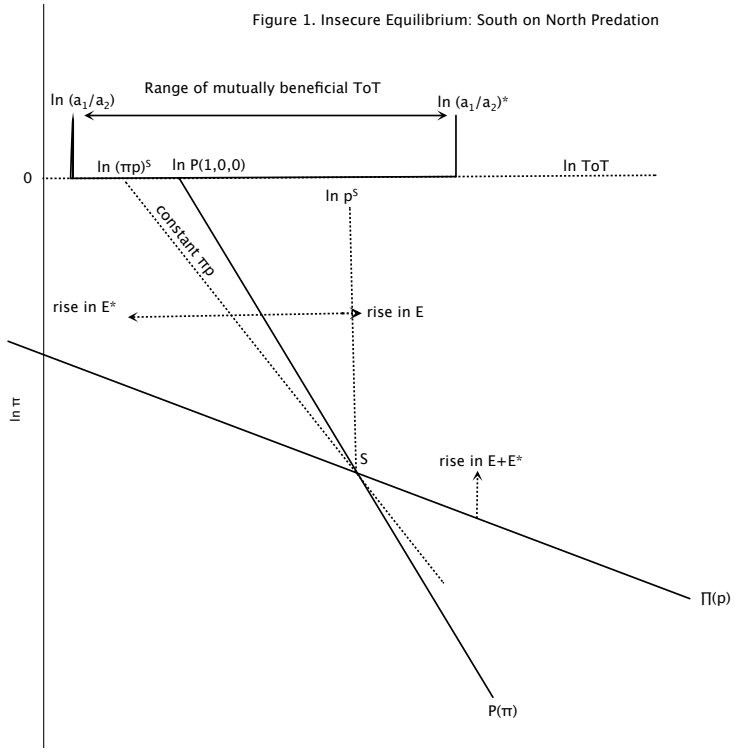
where

$$c = \frac{\gamma}{1 - \gamma} \frac{a_1}{a_2^*(N - E)} \left(\frac{N - E + N^* - E^*}{\theta - 1} + N^* \right).$$

Log-differentiating (8) yields

$$\frac{\partial \ln P}{\partial \ln \pi} = -\frac{\pi}{\pi + (1 - \mathcal{E})\gamma\theta/(\theta - 1)} \in [0, -1).$$

The analysis of insecure equilibrium is illustrated in Figure 1 below in $(\ln p, \ln \pi)$ space. The $P(\pi)$ and $\Pi(p)$ schedules are drawn as loglinear for simplicity, with slopes on either side of -1. When $E = E^* = 0$ the elasticity of Π with respect to p is indeed in $(0, -1)$ is guaranteed for $\Pi(p)$, as analyzed further below to provide sufficient conditions for insecure equilibrium. Stability is guaranteed in this case.



The diagram is very helpful in understanding the characteristics of equilibrium. The assumption in the diagram is $[\ln(p^S),\ \ln(\pi p^S)] \in [\ln(a_1/a_2),\ \ln(a_1^*/a_2^*)]$. This condition assures mutual gains from trade relative to autarky (in South's case aggregating predators and state). The standard secure Ricardian trade equilibrium is unique if $\Pi(p)$ lies above $P(\pi)$ in the relevant range of feasible terms of trade $[\ln P(1,0,0),\ \ln(a_1^*/a_2^*)]$.

A sufficient condition for insecure equilibrium without enforcement adds intuition.[4] Two requirements must be met: North participation $\pi p \geq a_1/a_2$ and predation $\Pi(p) \leq 1$. The usual participation condition for South $p \leq a_1^*/a_2^*$ is not necessary, as argued below, but may be met.

Proposition 1 *At $E = E^* = 0$ a unique stable insecure equilibrium exists if*

$$\frac{1 + N^*/N}{1 - \gamma} \frac{a_2}{a_2^*} > \theta + 2. \tag{9}$$

Condition (9) assures that a value of p can be found in an interval that satisfies North

[4]Positive enforcement implies extra nonlinearity that greatly complicates the sufficient conditions.

participation and insecure trade. Intuitively, predator effectiveness θ cannot be too large relative to parameters that raise p, the equilibrium value of the goods to be extorted or stolen. Increases in South relative size N^*/N and in preference for North goods γ raise equilibrium p. Rises in a_2/a_2^* similarly act to raise South's relative size and thus p.

Proof: *Sufficiency requires a condition on the relationship of parameters such that the two necessary conditions of North participation and insecure trade hold. Solve (4) for* R^* *at* $E = E^* = 0$ *and substitute in (2) to solve*

$$\Pi(p) = \frac{1 + N^*/N}{(1-\gamma)(1+\theta)a_2^*/a_1}\frac{1}{p} - \frac{1}{1+\theta}.$$

Multiply both sides by p *to give an expression for* πp. *Use North participation* $\pi p \geq a_1/a_2$ *to give*

$$\frac{1 + N^*/N}{(1-\gamma)(1+\theta)}\frac{a_1}{a_2^*} - \frac{p}{1+\theta} \geq \frac{a_1}{a_2}.$$

Manipulate this condition to obtain

$$\frac{1 + N^*/N}{1-\gamma}\frac{a_2}{a_2^*} - (1+\theta) \geq \frac{p}{a_1/a_2}.$$

Insecure trade $\Pi(p) \leq 1$ *implies*

$$\frac{p}{a_1/a_2} \geq \left[\frac{1 + N^*/N}{1-\gamma}\frac{a_2}{a_2^*}\right]\frac{1}{2+\theta}$$

A positive measure interval in which to locate $p/(a_1/a_2)$ *exists if (9) holds. QED.*

If the secure trade South participation condition $p < a_1^*/a_2^*$ is added as a requirement, then a sufficient condition is

$$\frac{a_1^*/a_2^*}{a_1/a_2} \in \left[\frac{1 + N^*/N}{1-\gamma}\frac{a_2}{a_2^*} - (1+\theta), \frac{1 + N^*/N}{1-\gamma}\frac{a_2}{a_2^*}\frac{1}{2+\theta}\right].$$

This sufficient condition for South's participation in insecure trade need not be necessary, as

it would be in standard analysis of trade with frictions. An important possibility arises with equilibrium that drives p above South's autarky price ratio a_1^*/a_2^*. This bad equilibrium is possible when the weak government in South is unable to organize to escape the trap of immiserizing trade. Individual South agents may always switch to production of good 1 and exchange some of it for good 2 in the market.[5] If South agents producing good 1 are able to sell on the same terms as North, earning $\pi^S p^S$, then enough would switch so that autarky would emerge as the equilibrium. In contrast, if North enforcers provide no protection to South producers of good 1, the South producers earn less than $\pi^S p^S$ and continued specialization in good 2 may be their best choice. In this case, coordination of South agents is required to escape to autarky. A weak South government may be unable to manage the required coordination. Section 4 shows that control of predation by a Mafia makes loss from trade relative to autarky much more likely, and makes escape from loss-making trade equilibrium to autarky much less likely.

Proposition 1 assumes away potential problems with initial predation. Implicitly, coordination organized outside the model ensures a large enough starting mass of predators when an insecure equilibrium exists.[6]

3.2 Comparative Statics of Technology and Country Size

Figure 1 aids in the evaluation of comparative statics. The line with slope -1 between $\Pi(p)$ and $P(\pi)$ maintains North's terms of trade πp constant at their equilibrium value associated with point S.

The model gives new answers to standard questions about the effect of changes in technology and relative country size on terms of trade as well as to new questions about the

[5]Strictly speaking, the Ricardian model implies that each agent could incompletely specialize and constitute an infinitesimal autarkic economy. More realistically, specialization is associated with sector specific skills acquisition that make it efficient for individuals to specialize and use the domestic insecure market for autarkic exchange. Anderson and Marcouiller (2005) analyze the pure Ricardian case with individual autarkic incomplete specialization.

[6]Coordination could be managed by a Mafia, analyzed in Section 4. Subsequent conflict over the monopoly rents could end in the competitive free entry equilibrium.

security of trade. Does trade cost decline (globalization) of North's export affect security or the terms of trade? Is export of North to South more secure when South is relatively smaller? Are South's terms of trade better when relatively smaller?

Note first that a decline in North's export cost to South is equivalent to a fall in a_1 in the model. By (5) the fall in a_1 raises predation R^* and thus shifts $\Pi(p)$ down. The net effect can neutralize the normal effect of the fall in a_1 shifting $P(\pi)$ to the left. North's terms of trade πp must fall, as in the standard secure trade case. What is novel is that South need not benefit from a terms of trade improvement. The improvement in technology is dissipated by a rise in predation. The contrast is sharp with secure trade, where the benefit of a fall in trade cost or a rise in North's productivity normally is split between North and South.

Next consider relative country size. The numerator of (8) giving $P(\pi, \cdot)$ is larger the larger is South's relative size, shifting $P(\pi)$ to the right. Larger relative size of South reduces R^* by (5), raising $\Pi(p)$. On balance South may not lose because the improved security of trade offsets standard effect that growth reduces a country's terms of trade. North necessarily gains an improvement its terms of trade πp, as in the standard model.

Finally, consider South growth in the form of a fall in a_2^*. From (5) the rise in the opportunity cost of predation reduces R^* and thus shifts up $\Pi(p)$. The fall in a_2^* shifts $P(\pi)$ to the right, by (8). On balance, South may not experience a terms of trade deterioration while North must definitely benefit from a rise in πp.

3.3 Comparative Statics of Enforcement

The arrows in the Figure illustrate the effects of changes in enforcement efforts E and E^*. The $P(\pi)$ schedule shifts left as E^* rises and right as E rises due to the terms of trade effect of reducing labor supply in North and South. The effect of enforcement on $\Pi(p)$ is given by differentiating (6) using (3) and (5). Enforcement acts directly via $\mathcal{E}$ to reduce R^* in (5). But indirectly, enforcement lowers R^* because enforcement reduces productive labor and thus lowers the payoff to predation. The net effect depends on the effectiveness of enforcement

parameter ϵ, *inter alia*. The arrows are drawn with the understanding that enforcement will never be used unless the net effect is to reduce predation. Thus $\Pi_E > 0, \Pi_{E^*} > 0$. The effect of North enforcement on P is given by differentiating (8) with respect to E:

$$P_E = \frac{p\gamma\theta/(\theta-1)}{\pi + (1-\mathcal{E})\gamma\theta/(\theta-1)}.$$

The comparative statics of North enforcement are obtained from differentiating (6) and (8) with respect to E:

$$\frac{d\ln\pi}{dE} = \frac{\Pi_E + \Pi_p P_E}{\pi(1-\Pi_p P_\pi)} \tag{10}$$

$$\frac{d\ln p}{dE} = \frac{P_E + P_\pi \Pi_E}{p(1-\Pi_p P_\pi)} \tag{11}$$

The denominator above is positive, as previously shown. The first term in the numerator of the right hand side of each equation is the direct effect of North enforcement on security and South's inverse terms of trade p respectively. The second term is the cross effect. The direct security effect of enforcement operates through the predator/prey relationship (2). The direct terms of trade effect of enforcement is a market size effect, as the productive labor force in North relative to South falls.

North's terms of trade change is $d\ln\pi p = d\ln\pi + d\ln p$, the sum of equations (10) and (11). North's terms of trade improve because

$$\left(1 + \frac{\Pi_p p}{\pi}\right) P_E/p + \left(1 + \frac{P_\pi \pi}{p}\right) \Pi_E/\pi > 0.$$

The bracketed terms are positive, as previously established, and both $\Pi_E > 0$ and $P_E > 0$. In contrast, South's terms of trade deteriorate with North's enforcement because $P_E + P_\pi \Pi_E > 0$. To see this, evaluate the total derivative of (8):

$$P_E + P_\pi \Pi_E = \frac{p\gamma\theta/(\theta-1)}{\pi + (1-\mathcal{E})\gamma\theta/(\theta-1)}(1-\mathcal{E}_E).$$

$\mathcal{E}_E < 1$ for $(\epsilon - 1)/\epsilon < E + E^*$, the realistic range for positive enforcement.

In contrast, South's enforcement effort improves South's terms of trade and may also improve North's terms of trade. The analysis substitutes $P_{E^*} < 0$ for $P_E > 0$ and $\Pi_{E^*} > 0$ for $\Pi_E > 0$ in (10)-(11).

The analysis here differs substantially from simple intuition about predation on trade. Predation is like a tax on trade with the revenue going to the predators. Reducing this loss intuitively should help both seller and buyer. To make the contrast stark, suppose that enforcement was free, so that raising $\mathcal{E}$ did not remove labor from productive activity. Then $P_E = P_{E^*} = 0$, and both South and North have terms of trade improve from enforcement. South predators switching to productive labor are paid their value of marginal product in either activity, so there is no net effect at the margin. Reducing predation removes a pure source of inefficiency with the gains split between North and South. The free enforcement example reveals that it is the combination of costly enforcement and predation that makes trade relations more conflicted than in standard trade policy analysis. (In contrast, the appendix shows that with predation on South exports, the application of costless enforcement makes trade relations conflicted. Covering both cases, the source of conflict is the combination of enforcement and predation.)

The implication of the diagram and the comparative statics in (10)-(11) is that North's enforcement harms South via a negative terms of trade effect and South's enforcement ordinarily harms North via a negative terms of trade effect. This arises due to the withdrawal of labor for policing from the productive labor force and the further withdrawal of productive labor into predation in South. South enforcement may improve the security of trade enough to raise North terms of trade πp despite lowering p.

A particularly stark implication of the analysis is that, starting from an insecure trade equilibrium, the model can generate an enforcement equilibrium that is worse for South than autarky. Strictly from the formal logic of the model, it is possible that reverse specialization in South with secure exchange between locals could begin and would dominate insecure

exchange through South's port. But internal exchange would be exposed to predation too, and startup costs would inhibit its evolution. Given this plausible reality, nothing in the model prevents point S being associated with a price to the right of a_1^*/a_2^*. The ability to escape this bad equilibrium to autarky presumes a powerful enough South state to be able to coordinate the choice of autarky, as noted in the discussion following Proposition 1.

4 Mafia Predation

An important alternative to free entry predation is a Mafia that controls the entry/exit of predators. Assume the Mafia is a price taker, but understands the predator/prey determination of the probability of success 2. The Mafia maximizes its profit, the difference between the wage bill R^*/a_2^* and the expected revenue from extortion/theft. To deter entry the Mafia must enlist a fixed size force F^* (the gang) assumed to be paid at the market rate $1/a_2^*$. Mafias organize only for insecure markets exceeding a critical size because the market must be large enough to allow a non-negative profit. North trades only if Mafia dominated South offers terms of trade $\pi^M p^M \geq a_1/a_2$ as in the competitive entry case. The conditions for existence of insecure equilibrium change and some qualitative properties of equilibrium change.

The labor market indifference equilibrium condition (4) is replaced by the Mafia first order condition

$$p(1-\pi)(1-\gamma)\frac{L}{a_1 R^*}\frac{1-\pi}{1-\mathcal{E}} = 1/a_2^*. \tag{12}$$

The preceding analysis of equilibrium predation differs in some details from the free entry case, but much of Figure 1 and its intuition still applies.

Equilibrium predation is less than with free entry. In Figure 1 the $\Pi(p, E, E^*)$ function shifts up and is *positively* sloped in contrast to the free entry of predators case. Solve (12) for R^* and substitute the resulting expression into (2) to yield (after solving the quadratic

equation for the positive root π)

$$\Pi^M(p) = 1 + \theta/2 - \frac{1}{2}\sqrt{\theta^2 + 4\frac{1+N^*/N}{1-\gamma}\frac{a_1}{a_2^*}\frac{1}{p}}. \tag{13}$$

$\Pi^M(p)$ is increasing in p. (13) sets $\mathcal{E} = 0$, inessentially.

$P(\pi, E, E^*)$ is more steeply sloped and shifts to the right ($F^* + R^*$ falls if the Mafia is to break even or better). Relative to competitive predation, North's terms of trade improve and South's terms of trade deteriorate. The Mafia now earns a profit $\mathcal{M}$. A capable South state has an incentive to attack the Mafia, because even if the Mafia offered its entire profit to the South state, this offer does not cover the loss from the terms of trade deterioration. North, in contrast, has an incentive to protect the Mafia from attack by the South state.

Profit $\mathcal{M}$ is equal to Mafia total revenue minus total cost, wages $1/a_2^*$ paid to $R^* + F^*$. Substitute the profit maximizing level of R^* solved from (12) into the Mafia profit to yield:

$$\mathcal{M}(p, \pi) = p\pi(1-\pi)(1-\gamma)L/a_1 - F^*/a_2^* \geq 0,$$

where the inequality is the necessary condition for Mafia participation. The Mafia participation condition can alternatively be expressed as

$$\frac{p}{a_1/a_2} \geq \frac{1}{\pi^M(1-\pi^M)}\frac{F^*/N}{1-\gamma}\frac{a_2}{a_2^*}. \tag{14}$$

The smallest feasible value of $p/(a_1/a_2)$ for Mafia participation is given when (14) holds with equality.

North participation requires

$$\Pi^M(p)\frac{p}{a_1/a_2} \geq 1.$$

Using (14), the combination of Mafia and North participation implies

$$\frac{F^*/N}{1-\gamma}\frac{a_2}{a_2^*} \geq 1 - \Pi^M(p).$$

Evaluate Π^M using (13) at $p = a_1^*/a_2^*$ as the highest feasible price consistent with South benefit relative to autarky. Then:

Proposition 2 *Mafia-controlled predation equilibrium on North exports exists with South benefit relative to autarky if*

$$\frac{F^*/N}{1-\gamma}\frac{a_2}{a_2^*} > \frac{1}{2}\left[-\theta + \sqrt{\theta^2 + 4\frac{1+N^*/N}{1-\gamma}\frac{a_1}{a_1^*}}\right].$$

The condition in Proposition 2 is over-sufficient because it may be feasible to drive p lower than South's autarky terms of trade.

The implications of Proposition 2 in terms of the model are intuitive. The right hand side of the inequality is decreasing in θ. Higher θ reduces $\Pi(p)$ given p, thus implying higher equilibrium p to satisfy the North participation condition. Higher F^*/N requires higher p to meet the Mafia participation condition

$$\frac{p\Pi^M(p)[1-\Pi^M(p)}{a_1/a_2} > \frac{F^*/N}{1-\gamma}\frac{a_2}{a_2^*}.$$

4.1 Comparative Statics of Trade with Mafia Predation

The comparative statics of security with a Mafia follow readily. Changes in F^* have no effect on equilibrium p, π but shift $\mathcal{M}$ in the opposite direction. The comparative statics of enforcement have exactly the same sign pattern as in the competitive case. The comparative statics of discrete changes introduce the possibility of flipping from a Mafia equilibrium to a competitive one, or vice versa. Local directions of change inform the possibilities and are developed below.

The local comparative statics of Mafia predation with respect to trade costs and technology change differ from the competitive case and more closely resemble the secure trade case. Symmetric trade cost changes have no effect on the effective a_1/a_2^*, while asymmetric rises in North's export cost relative to South will increase the effective a_1/a_2^*. Rises in N^*/N

and a_1/a_2^* raise equilibrium p and have ambiguous effect on equilibrium π. North's terms of trade πp improve and South's terms of trade $1/p$ deteriorate. Rises in θ reduce π, harm North's terms of trade and have ambiguous effect on South's terms of trade. The table below summarizes results for the Mafia and competitive cases.

	Competitive	**Case**	**Mafia**	**Case**
Rise in:	$N^*/N, a_1/a_2^*$	θ	$N^*/N, a_1/a_2^*$	θ
πp	+	-	+	-
π	?	?	?	-
p	?	?	+	?

5 Optimal Enforcement and Interaction

Enforcement is worthwhile to North or South states if it increases utility. Enforcement must be paid for by labor drawn from production, a cost to be set against the benefit of enforcement.

North utility is $V(p\pi, E) = (p\pi)^{1-\gamma}(N-E)/a_1$ with South predation on North exports and $(p/\pi)^{1-\gamma}(N-E)/a_1$ with South predation on South exports. Let $\tilde{p}, \tilde{\pi}$ denote the equilibrium p, π pairs for any given levels of enforcement, depicted in Figures 1 and 2 as the intersection points. The comparative statics in the preceding sections have signed the derivatives of the reduced form functions $\tilde{p}(E, E^*)$ and $\tilde{\pi}(E, E^*)$. South's reduced form utility is $p^{-\gamma}(N^* - E^*)/a_2^*$ whether predation is on North goods or South goods.

The rate of change of North's utility with respect to own enforcement against South on North predation is

$$\frac{d\ln V}{dE} = (1-\gamma)\frac{d\ln(\tilde{p}\tilde{\pi})}{dE} - \frac{1}{N-E} \tag{15}$$

The right hand side gives the net benefit of shifting the fraction $1/(N-E)$ of North's population from production and trade to enforcement that reaps an improvement in the terms of trade. Costless initial enforcement ($N - E \to \infty$) would always be beneficial for

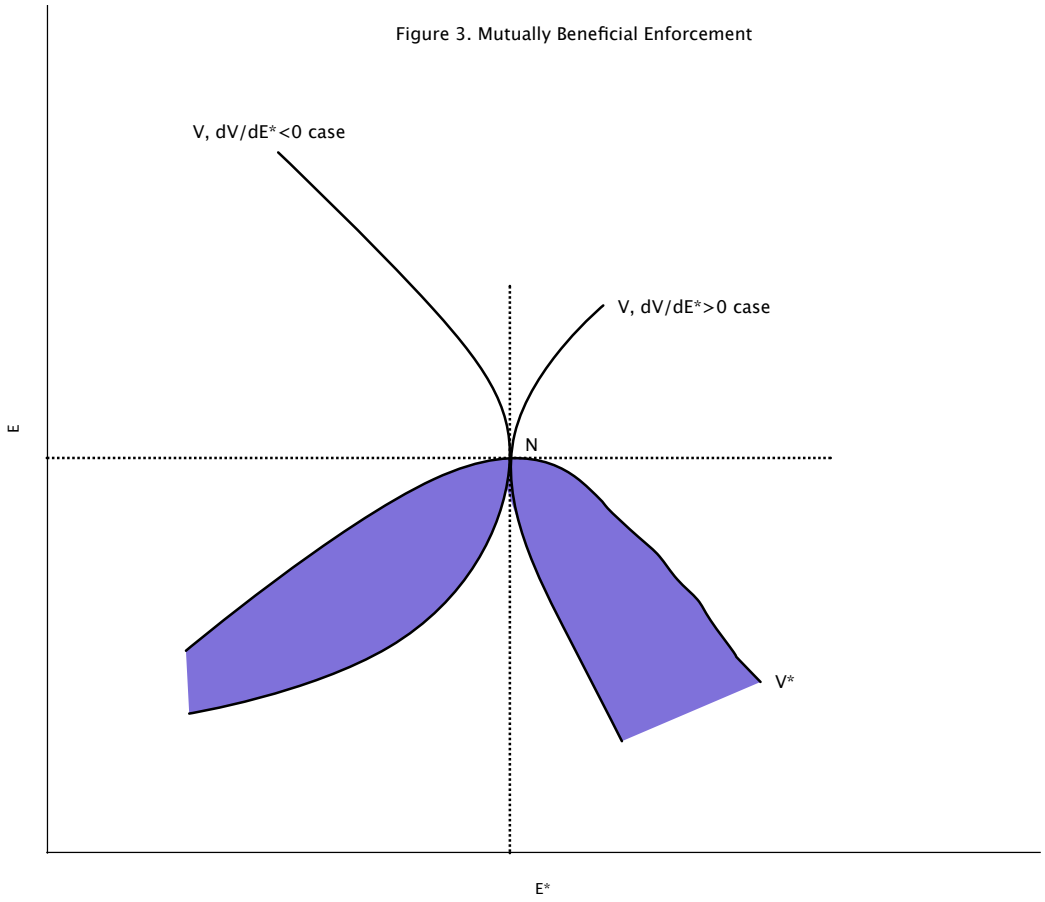
North, as in the classic optimal tariff analysis of terms of trade motives for tariffs. Allowing for costly enforcement, as with costly collection of tariffs, raises the bar for initial active policy to be desirable. Allowing for North labor to be relatively more effective with high A lowers the bar for North enforcement to be desirable.

The rate of change of South's utility with respect to own enforcement is

$$\frac{d\ln V^*}{dE^*} = -\gamma\frac{d\ln\tilde{p}}{dE} - \frac{1}{N^* - E^*}. \tag{16}$$

The first term is always positive when predation is on North exports, and may be negative or positive when predation is on South exports. For South on South predation, North's marginal payoff (15) changes to replace $\tilde{p}\tilde{\pi}$ with $\tilde{p}/\tilde{\pi}$. The analysis is essentially similar. South's payoff to own enforcement has the same form as in (16). In both cases the terms of trade derivatives change to reflect the changing cases.

Turning to the interaction of enforcement policies, suppose that North finds initial enforcement to be welfare improving. South may or may not find enforcement to be welfare improving. Figure 3 below depicts enforcement space at Nash equilibrium. Point N has $E > 0$ and $E^* \geq 0$. South always loses from North enforcement, so South's utility rises as E falls. In contrast, North may gain or lose with South enforcement when predation is on North exports. This results in two different iso-utility curves for North in Figure 3. The shaded lens of mutually beneficial enforcement pairs that dominate Nash equilibrium thus lies either down and to the right of N (when South enforcement is beneficial to North) or down and to the left (when South enforcement harms North). When predation is on South exports, North always loses from South enforcement, and the lens of mutually beneficial enforcement pairs lies down and to the left of point N.



When both countries engage in positive enforcement against predation on North's export or on South's export, point N implies too much enforcement. As with tariffs, the terms of trade motive for enforcement results in excessive enforcement in equilibrium. Because of the waste involved in removing productive labor, Nash equilibrium resembles the beggar-thy-neighbor trade policy model of 1930's unemployment situations. Negotiated agreement on enforcement resembles tariff negotiations. So far, so familiar.

In contrast, consider the implications of point N lying at $E^* = 0$. In this case, the lens of mutually beneficial enforcement policies is infeasible. Within the scope of the model, South can do nothing; its best move is to accept North's equilibrium enforcement choice. Outside the model, conflict is suggested. South may choose resistance to impede or destroy E. The other possibility is that North benefits from South enforcement against predation on North's export, so the lens of mutually beneficial enforcement slopes down and to the right from N

located at $E > 0, E^* = 0$. North can afford to pay South to enforce while reducing its own enforcement. This equilibrium may be achieved with some conflict but suggests a degree of benign paternalistic coordination resembling colonialism in some historical forms.

A remaining possibility is that North enforcement is so comparatively cheap and effective that elimination of predation is optimal. In that case South gains too, as the initial table reported. But this is true only for the case of predation on North's export. South loses when predation on South's export is eliminated.

Succeeding subsections draw out the implications of the incentives to enforce or to resist enforcement.

5.1 Comparative Statics of Optimal Enforcement

Shifts in technology or trade costs alter the equilibrium values of π and p, and change the enforcement incentives. Symmetric trade cost changes have no effect on the equilibrium while utility of both parties rises uniformly as the trade cost falls. If iceberg costs from North to South fall, in contrast, the equilibrium shifts. The price of North's export becomes $p\pi/\tau$, utility is $V = (p\pi/\tau)^{1-\gamma}(N-E)/a_1 = (p\pi)^{1-\gamma}(N-E)/\tau^{1-\gamma}$. The equilibrium price is

$$p\pi = \frac{\gamma}{1-\gamma}\frac{N^* - E^* - R^*}{N-E}\frac{\tau a_1}{a_2^*}.$$

Effectively, a fall in τ is like a productivity improvement (fall in a_1) in North. The fall in τ thus raises R^* from (5). Both forces lower $p\pi$, hence $P(\pi)$ in Figure 1 shifts left; $P_\tau < 0$. The rise in R^* due to the fall in τ lowers $\Pi(p)$ in Figure 1; $\Pi_\tau < 0$. While the directions of change of $\ln p$ and $\ln \pi$ are indeterminate, the same steps used to sign $dp\pi/dE$ reveal that $dp\pi/d\tau < 0$: North's terms of trade deteriorate due to its effective growth in size.

Interior Nash equilibrium enforcement is a rather implausible outcome and technically intricate in this setting. A plausible special case is where South does not choose to enforce, $E^* = 0$ in Nash equilibrium. Then the knock on effect of a fall in trade costs from North

to South is ordinarily an increased incentive for resistance to North enforcement by South because utility falls with a rise in E.

6 Tribute

An alternative to enforcement by North is payment of tribute to the predators not to prey on the goods. Intuitively, this should be a good solution if the predators are subject to an authority (the Mafia) that can enforce the agreement. Tribute equilibrium can only arise when markets are sufficiently large to cover the fixed cost F^*/a_2^* of organizing the Mafia.

A tax equivalence intuition for the tribute situation seems natural: insecurity is like a tax on trade, tax incidence is shared, so paying off the predators should help both buyer and seller. The equivalence is false because the interest of South's government and Mafia diverge. First, tribute frees the Mafia from paying predators to collect the extortion payments. They now earn their pay from productive work, but the real income of the workers falls because of the terms of trade effect (more South productive labor worsens terms of trade via the size effect). Divergence of interest holds even when the South government and the Mafia split the tribute paid (as with the revenue from Mafia extortion without tribute analysis of Section 4). Splitting tribute with the South government is consistent with a Nash Bargaining equilibrium in the face of a government threat to break up the Mafia, or more weakly to raise its fixed cost F^*. Because of the terms of trade deterioration of South, the sum of Mafia profit plus South income falls in real terms, hence the Mafia cannot pay enough to South's government to induce it to prefer the Tribute equilibrium.

Divergence of interest occurs more dramatically and consequentially when North offers tribute directly to the Mafia along with a promise to help defend the Mafia from its government. In this case South's government is too weak to prevent the Tribute agreement, and moreover loses its previous share of the Mafia profit. This scenario is plausible for cases where North's exports flow through a port where the Mafia is strong and South's govern-

ment in the hinterland is weak. When predation is on South's export good directly, North's defense of the export sector in the interior looks less plausible but resembles current news accounts of resource extraction sites protected mercenary armies paid by the North firms doing the extraction. In either case, South's combined real income falls with the Tribute equilibrium. Effectively the Mafia becomes the state in this equilibrium.

The analysis compares South welfare when paid tribute, releasing erstwhile raiders into productive employment, with South welfare under the initial insecure extortion equilibrium. The South government receives some fraction f of the Mafia profit in the extortion equilibrium and may or may not do so in the Tribute equilibrium. South welfare is defined as the combination of workers and Mafia profits for simplicity.

The terms of trade under tribute at the full rate of extortion is

$$p^T = \frac{\gamma}{1-\gamma}\frac{(N^* - F^*)/a_2^*}{N/a_1}.$$

South gets utility $V^{*T} = (p^T)^{-\gamma}(N^* - F^*)/a_2^*$ in the Tribute equilibrium. In the extortion equilibrium under the Mafia, South gets $V^{*M} = (p^M)^{-\gamma}(N^* - F^* - R^*)/a_2^*$. Then $V^{*T}/V^{*M} = (p^T/p^M)^{-\gamma}$. The sum of Mafia and labor real income in South must fall under the Tribute equilibrium, hence the Mafia cannot afford to pay the South government enough to accept the Tribute equilibrium.

A sufficiently powerful South government will prevent the Tribute equilibrium from arising, preferring extortion equilibrium. A weaker South government will not only fail to prevent the loss of real income from the terms of trade deterioration, it will also lose its share of the Mafia profit as the Mafia makes a deal with the North.

The Nash bargaining solution for the Mafia's deal with the North is the payment T that the Mafia receives to guarantee secure trade ($R^* = 0 \Rightarrow \pi = 1$) to North. Mafia profit is $\mathcal{M}(T) = T - F^*/a_2^*$. It must exceed the Mafia's initial profit $\mathcal{M}^0 = p^M\pi^M(1-\pi^M)(1-\gamma)L/a_1 - F^*/a_2^*$. The Mafia gain from the tribute equilibrium is $T/a_1 - p^M\pi^M(1-\pi^M)(1-$

$\gamma)L/a_1$. North's gain is $(p^T)^{1-\gamma}(N-T)/a_1 - (p^M)^{1-\gamma}N/a_1$. The Nash bargaining solution for the tribute payment (suppressing the irrelevant $1/a_1$) solves

$$\max_T [T - p^M \pi^M (1-\pi^M)(1-\gamma)L/a_1]^{\omega} [(p^T)^{1-\gamma}(N-T) - (p^M)^{1-\gamma}N]^{1-\omega}$$

where $\omega \in (0,1)$ is the bargaining parameter. The first order condition yields:

$$T^{NB} = (1-\omega)p^M \pi^M (1-\pi^M)(1-\gamma)L/a_1 + \omega N \left[1 - \left(p^M/p^T\right)^{1-\gamma}\right]$$

The analysis is much the same when predators prey on South's export. Tribute equilibria are associated with the release of predators into production, driving down South's terms of trade. A strong enough South government prefers the extortion equilibrium to the Tribute equilibrium. A weak government loses both terms of trade and its share of the Mafia profit.

7 Separatism

Another possibility is that South's state retreats to a sectional government in the hinterland, Separatist region. Separatist has a port through which to supply North. Free entry predation prevails in Separatist. The Mafia remains in control in its region. Labor moves freely between Mafia and Separatist and between predation and productive labor in Separatist but consumes where it earns.

Equal utility of workers between Mafia region M and Separatist region S requires a common terms of trade p. If S has the same relative efficiency of predators θ as M, and the same efficiency of its port, the equilibrium turns out to require a common π as well as p, so North's terms of trade πp are the same in both regions.

Separatism lowers M profits (it controls less trade in the M-S equilibrium) and benefits workers/predators in South. Thus separatism promotes conflict between region M and region S. As for North, it loses from separatism because more of South's labor force moves to

predation, causing a decline in North's terms of trade. Thus North has an incentive to intervene in the civil conflict in South on the side of M.

The formal analysis verifies these intuitive implications. The terms of trade for North selling to M and S potentially differ with the relative sizes of the South regions' labor forces L^M and L^S respectively and also the relative size of predation in each. The integrated South labor market implies $L^* = L^M + L^S = N^* - E^* - R^M - F - R^S$ and $p^M = p^S$ with South wage $1/a_2^*$.

Denote the fraction of North exports to South going to M as z. Then the equilibrium terms of trade for M are

$$\pi^M p^M = \frac{\gamma}{1-\gamma}\frac{L^M/a_2^*}{zL/a_1},\ \pi^S p^S = \frac{\gamma}{1-\gamma}\frac{L^S/a_2^*}{(1-z)L/a_1}.$$

Taken together with $p^S = p^M$, these terms of trade conditions imply

$$\frac{\pi^M z}{\pi^S(1-z)} = \frac{L^M}{L^S}.$$

The Mafia first order condition and the competitive entry condition for Separatist predation in combination implies that

$$\frac{(1-\pi^M)^2 z}{(1-\pi^S)(*1-z)} = \frac{R^M}{R^S}.$$

The ratio of the second equation to the first, using the structure (2) adapted for multiple regions implies:

$$\frac{(1-\pi^M)^2/\pi^M}{(1-\pi^S)/\pi^S} = \frac{R^M/L^M}{R^S/L^S}. \tag{17}$$

This structure implies that with equal predator relative efficiency and equal trade costs $\pi^M < \pi^S$ and $R^M/L^M < R^S/L^S$.

The equilibrium depends on a trade friction between regions M and S. Frictionless arbitrage between M and S requires that North's terms of trade are equal in both locations. This implies $\pi^M = \pi^S$, inconsistent with the equilibrium above. One or the other port would

get all the trade, more plausibly port M because of Mafia capability and also because North has an incentive to intervene on Mafia's side. The trade friction can be a discriminatory import tax on North's good coming from M (or symmetrically an export tax on region S goods going to M). This would be a rational response of S to the threat of loss of its independence via market forces.

The logic here suggests that North's intervention on behalf of M might well take the form of attempting to evade the 'internal' tax in region S. This policy resembles the actions of British East India Company agents in the period of Company rule prior to the Crown takeover in 1784. There were frequent accusations that such agents evaded internal taxes under the guise of their privilege of exemption from the external tax of the weak Mughal emperor.

8 Conclusion

A Ricardian model of trade subject to predation yields new qualifications to the gains from trade proposition. Poor countries (South) with weak institutions can lose from insecure trade, especially when predation (extortion and theft) is controlled by a Mafia. The mechanism dividing the gains from trade is the terms of trade effect as in the standard Ricardian model, but the terms of trade effect is amplified by an endogenous size effect as predators and enforcers move in or out of the labor force. Countries with strong institutions (North) that gain at the expense of South have incentives to resist South's efforts to improve its situation with enforcement or anti-Mafia action. Unlike standard trade agreements theory, the asymmetry of North and South may prevent sharing the gains from trade.

Contemporary trade relations theory implicitly assumes a world of capable states. Asymmetric capability suggests using the model of this paper as a starting point for thinking about alternative design for North-South relationships. The US Foreign Corrupt Practices Act and similar laws in other rich countries may limit tribute type problems for South caused by

trade with North. Perhaps limits to use of mercenary armies by North para-state actors are justified. Perhaps amendment to WTO obligations might limit potential harm to South.

Future application and development of the model looks promising in two directions. First, the comparative statics of the model suggest an approach to empirical work on the cross section variation of security of international trade and its relation to conflict and colonial-type international relations. Second, the nature of the South state is under-developed. Plausibly, South may raise its revenue from trade taxation and use it to combat the Mafia or to enforce against predation. Then the degree to which South can succeed may be neatly related to the deep economic parameters of the model rather than left as exogenous weakness of institutions.

9 References

Anderson, James E. and Douglas Marcouiller (2002), "Insecurity and the Pattern of Trade: An Empirical Investigation", *Review of Economics and Statistics*, 84(2), 345-52.

Anderson, James E. and Douglas Marcouiller (2005), "Anarchy and Autarky: Endogenous Predation as a Barrier to Trade" *International Economic Review*, 46, 189-214.

Andrade, Tonio (2004), "The Company's Chinese Pirates: How the Dutch East India Company Tried to Lead a Coalition of Pirates to War against China, 1621-1662", *Journal of World History*, 15 (4), 415-444.

Bagwell, Kyle and Robert Staiger (2004), *The Economics of the World Trading System*, Cambridge: MIT Press.

Frankel, Jeffrey A. (2010), "The Natural Resource Curse: A Survey", NBER WP No. 15836.

Garfinkel, Michelle and Stergios Skaperdas (2007), " Economics of Conflict: An Overview", Chapter 22 in *Handbook of Defense Economics*, vol. 2, pp 649-709, Elsevier.

Grossman, Herschel I. (2002), ""Make us a king": anarchy, predation, and the state," *European Journal of Political Economy*, Elsevier, vol. 18(1), pages 31-46, March.

Ricardo, David (1817), *On the Principles of Political Economy and Taxation.*

Smith, Adam (1776), *The Wealth of Nations.*

10 Appendix: Predation on South Exports Case

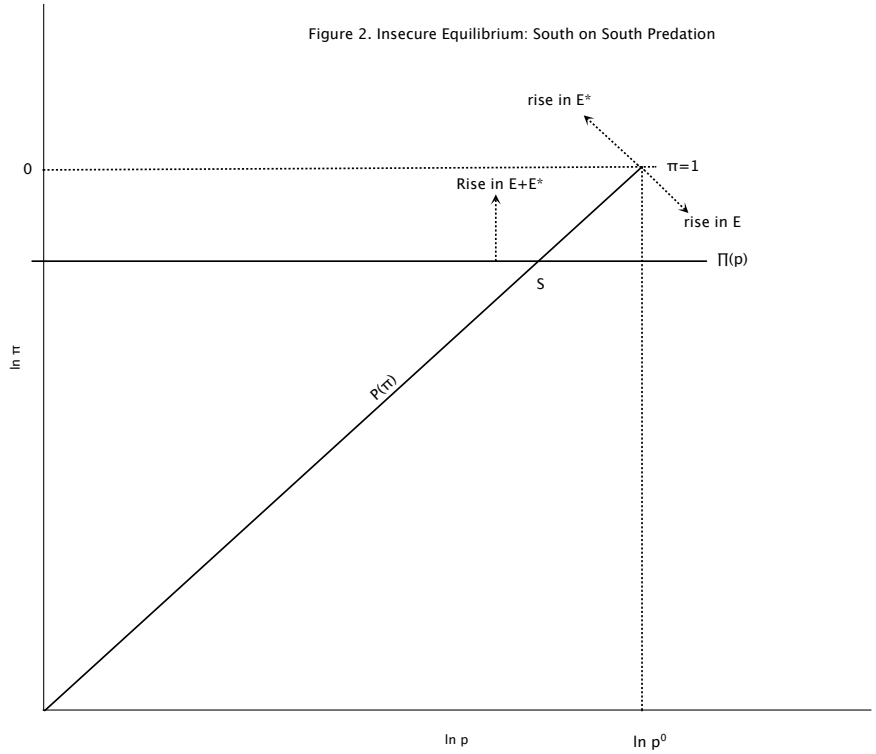
If the predation by South raiders is on South goods coming into the market, the equilibrium terms of trade for North are determined by

$$(1-\gamma)pL/a_1 = \gamma\pi L^*/a_2^* \Rightarrow \frac{p}{\pi} = \frac{\gamma}{1-\gamma}\frac{L^*/a_2^*}{L/a_1}. \tag{18}$$

The South labor market indifference condition in terms of South's product is market wage equal to per predator return to predation $\Rightarrow 1/a_2^* = (1-\pi)(1-\gamma)L^*/R^*$. This implies that predation on South goods, if it exists, is inelastic to the terms of trade. $1-\pi = (1-\mathcal{E})(N-E+N^*-E^*-R^*)/(N-E+N^*-E^*+\theta R^*)$, and substituting this expression into the indifference condition yields a quadratic equation in R^* as a function of the exogenous N, N^*, E, E^* and the parameters ϵ and θ. Thus $\Pi(p)$ is invariant to p.[7] The resulting insecure equilibrium, if it exists, is shown in Figure 2. $P(\pi)$ is given by $p = \pi(\gamma L^* a_1)/[(1-\gamma)La_2^*]$ by (18), yielding a ray from the origin in log space, with slope equal to the inverse of North's terms of trade p/π. The price p^0 associated with certainty ($\ln\pi = 0$) is given by

$$p^0 = \frac{\gamma}{1-\gamma}\frac{N^*/a_2^*}{N/a_1}.$$

[7] It is convenient to solve for $r^* = R^*/N^*$, the proportion of population engaged in predation. Define $n = N/N^*$ and evaluate at zero enforcement. The roots of the quadratic are complex, with real parts that both may lie in the unit interval. If so, use the smaller root.



The implications are simpler than in the case of predation on North's export. E and E^* act directly on North's terms of trade by rotating the $P(\pi)$ schedule. Shifts in the $\Pi(p)$ schedule have no effect on North's terms of trade p/π. In contrast, South's terms of trade move inversely to security. The implications for enforcement policy are that each opposes the other's enforcement, as follows. For North enforcement E increases, the rightward rotation in $P(\pi)$ guarantees a rise in North's terms of trade p/π. The upward shift in $\Pi(p)$ induces a further rise in p, a further deterioration in South's terms of trade. South enforcement E^* raises p and harms North by lowering p/π. South's gain in terms of trade is offset by the upward shift in $\Pi(p)$ but South may still gain on net.

10.1 Mafia Predation by South on South Goods

As with predation on North goods, the indifference condition of predator free entry is replaced by a monopoly Mafia selection of the profit maximizing number of predators based on understanding the predator prey relationship taking prices and the productive labor supply as given. The analysis remains qualitatively identical to the free entry case and the logic of

Figure 2 continues to hold. The difference is that predation is lower and the Mafia makes a profit $\mathcal{M}$.