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COMMERCIAL POLICY IN A PREDATORY WORLD

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ABSTRACT

Predation -- extortion or theft -- imposes significant, sometimes prohibitive, costs on trade. Mutual causation of predation and trade can explain trade volume responses to liberalization that are otherwise puzzlingly 'too big' or 'too small'. Efficient commercial policy in this setting should subsidize (tax) trade when enforcement is weak (strong). The Mercantilist predilection for trade monopoly and for subsidy has a rationale. Tolerance (intolerance) of smuggling is rational when enforcement is weak (strong). The switch from weak to strong enforcement explains the switch from tolerance to intolerance by British policy toward its North American colonies after 1763.

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Commercial policy has novel effects in a world where extortionists and thieves prey on trade.[1] Two way causation suggests that trade may respond to liberalization by more or less than models without predation would predict. Since security is an international public good, endogenous insecurity suggests a rich and complex role for commercial policy. These intimations are analyzed here with a formal model of commercial policy in a world of endogenous predation and trade.

The idea that security may improve as trade rises has a distinguished heritage: Adam Smith believed that commerce was civilizing.[2] More recent experience dilutes Smith's liberal optimism. Some regional agreements such as NAFTA create much more intra-regional trade than standard models predict (Anderson and van Wincoop, 2002), while others produce disappointingly little. Schiff and Winters (2003, p. 32) review 9 episodes of developing country regional agreements, of which 2 decreased trade and 2 others increased trade very modestly.[3] The formal mechanisms of predation and trade in this paper can explain trade responses both large and small.

What sort of commercial policy is efficient when the intensity of predation on trade is responsive to policy? With multiple markets, the externality is likely to run across markets and national borders. Private trade, if organized monopolistically, can internalize some at least of the public good externality, but not fully and not without inflicting a potential negative externality by stealing the market of trade rivals. Is it rational in this setting to tolerate smuggling, since it draws off predators even as it reduces tax revenue?

The model of trade and commercial policy in a predatory world developed

[1] Anecdotes of businessmen and journalists indicate that extortion is common. Anderson and Marcouiller (2002) provide systematic evidence, for example arguing that insecurity is as destructive of trade to Latin American countries as are their protectionist trade policies. The neglect of predation in standard trade policy analysis is based on convenience rather than reality.

[2] Here is Smith (1976) in Book III, Chapter IV: "...commerce and manufactures gradually introduced order and good government, and with them the liberty and security of individuals, among the inhabitants of the country, who had before lived in almost a continual state of war with their neighbours, and of servile dependency on their superiors. This, though it has been the least observed, is by far the most important of all their effects."

[3] Schiff and Winters report more sophisticated evaluation of the effect of regional agreements, with much the same conclusions. The Central American Common Market (CACM) has a particularly interesting history. In its first form it increased trade spectacularly between 1960 and 1970, trade fell in the 70's following on the outbreak of civil war and the agreement eventually died. The reestablishment of the CACM in 1991 led to a modest increase in intra-regional trade.

here to address these questions is based on Anderson and Bandiera (2006). The dramatis personae of the model are merchants, traders, cops and robbers. Like Tom Stoppard's *Rosenkrantz and Guildenstern Are Dead,* which moves the actions in Shakespeare's *Hamlet* offstage while the offstage action moves onstage, the action of standard trade theory moves offstage while the predators and enforcers move onstage.[4] Trade requires labor drawn from the same pool as robbers or extortionists.[5] Cops frustrate a portion of the encounters between traders and robbers. Merchants provide the capital required to carry on trade. They may form a guild to hire the cops and collect the revenue to pay for it. The guild may also control the volume of trade.[6] This setup is consistent with the observation that much property rights enforcement is private and that much trade is or has been carried on by actors with market power.

Section 1 sets out the analysis. Competitive merchants impose two externalities on each other. A positive externality, safety in numbers, arises because a marginal expansion of trade raises the success rate of shipment for all merchants. A negative externality arises because trade expansion raises the merchants' cost of hiring workers. The net effect of these externalities depends on the quality of enforcement. Then the setup expands to a second market connected to the first because both draw labor and predators from a common pool. This gives rise to international externalities.

Section 2 analyzes the comparative statics of commercial policy. Trade volume on the intensive margin responds to liberalization by more, the weaker

[4]I am in debt to Avinash Dixit for elaborating this analogy.

[5]British seaports in the age of Napoleon provide an example. In historical fiction of Patrick O'Brian, the port towns of the southwest coast of England provided labor markets for sailors who could choose to work on legitimate commercial ships, privateers (who sometimes preyed on British ships as well as their legitimate French prey), or smugglers. Internationally, such sailors could locate in pirate ports of the Caribbean from any original home port. Ship's crews in long distance trade were commonly quite heterogeneous in nationality. Legendarily meticulous in his research, O'Brian reportedly was consulted as an authority by professional historians of the period.

Modern ports similarly provide a venue for trade services workers who can also act as predators, stealing cargo or imposing delays on shippers unless bribes are paid to expedite the movement of goods.

[6]There is some evidence that monopoly power may be important in trade services. US agricultural trade is dominated by a monopolist while much trade in manufactures is carried on by distributers owned by or closely tied to monopolistically competitive firms. Anderson and van Wincoop (2004) note that apparent markups vary inversely with elasticities of substitution, consistent with monopoly power.

is enforcement. On the extensive margin, in contrast, liberalization is more likely to cause the inception of trade the better is enforcement quality.

Optimal commercial policy is analyzed in Section 3. Commercial policy encompasses trade taxes and trade subsidies in the form of infrastructure. A merchant interest government in an isolated market that internalizes the externalities of competitive trade should subsidize trade in a parameter range called weak enforcement and tax trade when enforcement is strong. A trading monopoly will in contrast internalize the externalities. The Mercantilist partiality to trading monopolies and to subsidy thus has a rationale. International externalities typically induce merchant interest governments to subsidize trade in Nash equilibrium. Cooperative trade policies should in contrast subsidize trade when enforcement is weak and tax trade when enforcement is strong, suggesting that Nash policies subsidize excessively.

Section 4 considers trade policy toward parallel legal and illegal markets. Smugglers evade taxes but draw off predators from legal trade. The analysis shows that official tolerance of illegal markets alongside legal markets is beneficial when enforcement is weak and detrimental when enforcement is strong. This implication provides an economic rationale for the dramatic and consequential shift in British policy from tolerance to suppression of smuggling in its American colonies after 1763.

The basic logic of commercial policy of Sections 2-4 is derived for simplicity in a partial equilibrium setting in which traders arbitrage between fixed buyer and seller prices. Section 5 shows that the qualitative logic holds up in a general equilibrium model trade model. Monopoly power in this setting expands to internalize the effect of volume expansion on the buyers' willingness to pay.

Section 6 concludes with a discussion of desirable extensions.

The model is related to a literature on institutions and insecurity (for example, Dixit, 2004, and references therein) and a smaller literature on trade and insecurity (for example, Skaperdas and Syropoulos, 2001, 2002). The novelty of the present line of research is that, very plausibly, predation occurs on the trade activity itself. Anderson and Marcouiller (2005) investigate the existence of insecure trading equilibrium in a two country two good Ricardian general equilibrium trade model with fixed trade costs. Much of the commercial policy analysis of the paper fits into the strategic trade policy literature pioneered by Brander and Spencer (1985). It differs from that literature in that the sources of market interdependence are due to insecurity and internationally linked labor markets.

1 Merchants, Traders, Cops and Robbers

Trade is carried on by traders who obtain goods from a low cost origin at fixed price c and sell them in a high value destination at fixed price b, $b > c$. Trade costs are modeled with a neoclassical cost function, the result of cost minimizing choices of capital and labor subject to a Cobb-Douglas technology. The performance problems between capital and labor are solved outside the model. It is easiest to think of the merchants as supplying their own labor to the trade activity. Thus the merchants in their role as traders hire additional traders who are paid a market wage w. Merchants in their role as capitalists may also act collectively to choose enforcement and possibly to limit trade. Trade capital is in fixed supply for the trade services market.[7]

The traders come from a labor pool in which their alternative activity is preying on the trade. In equilibrium the robbers must earn an expected return equal to w.

The traders and the robbers interact in anonymous hide and seek. The objective probability of an encounter is assumed to be a logistic function of the ratio of predators to prey. Predators win all encounters if not prevented by the cops. It is easiest to think of the 'win' being theft of all the shipment, but the model also encompasses extortion by which a bargained share of the goods must be surrendered.

The basic elements of the model are the traders and robbers and their technologies for these two alternative activities. Their general equilibrium interaction combines equality of returns in the two activities, the rational expectations equilibrium shipment success rate, the labor market clearing condition and the zero arbitrage (or profit maximizing) condition in trading. For simplicity, but inessentially, other channels of general equilibrium are shut down until Section 5. Traders and robbers are not directly involved either in production or consumption; their sole interest is the highest expected return on their time.

The cops' enforcement effort, if any, frustrates a portion of the encounters between predators and prey. For simplicity in this paper, the merchant guild is assumed to be able to pay for a fixed enforcement capability. Endogenous enforcement is left to a future extension.

[7]For simplicity, heterogeneity of merchants is assumed away, so they will all earn the same return on their capital. Or, if they differ in ability, there is a rental market to ensure that capital goes to its most productive use.

1.1 Basic Elements

Traders

Trade costs induced by the trade activity are given by the Cobb-Douglas cost function $w^{\alpha}r^{1-\alpha}q$ where q is the trade volume, w is the wage rate, r is the service price of trade capital and α is the parametric cost share for labor.[8] The trade services unit cost, equal to the marginal cost of a price-taking competitive trading firm, is given by:[9]

$$t(q,w) = kwq^{\left(\frac{1}{\alpha}-1\right)},\ k>0. \tag{1}$$

The demand for labor in trade services is equal to[10]

$$q^{1/\alpha}k.$$

The buyers' willingness to pay is fixed at b while any quantity of the good can be purchased by traders at fixed price $c, 0<c<b$. The gross arbitrage margin $b-c$ gives an incentive for merchants to enter trade by buying goods at c, incurring trade costs t and hoping to sell at $b \geq c+t$.

Robbers

Predation is called robbery for simplicity, but the model also encompasses extortion, as demonstrated below. Predation is the alternative use of labor. Like traders, robbers are risk neutral.[11] A simple model of interaction between traders and robbers yields clear implications that should hold up more generally. Robbers attempt to steal goods while these are in transit between the two regions. Once the trader and buyer meet exchange is secure.[12] Rob-

[8] A number of the results hold for more general cost functions as will be noted below where applicable.

[9] The short run cost function with fixed capital K is given by $kwq^{1/\alpha}$, where $k = [(1-\alpha)/K]^{(1-\alpha)/\alpha} > 0$. This is formed by using $(1-\alpha)w^{\alpha}r^{-\alpha}q = K$ to solve for $r(w,K,q)$, then substituting to obtain $\overline{C}(w,K,q) = kwq^{1/\alpha}$.

[10] Here we use Shephard's Lemma.

[11] Risk aversion in the absence of insurance markets would tend to diminish predation relative to trading under the plausible hypothesis that informal insurance and self insurance are easier for traders.

[12] If both goods and money are subject to predation or if goods can be stolen from buyers after purchase, the setups are more cumbersome, but nothing essential changes. Moreover, it is quite plausible that goods in transit are less secure than goods at rest; our model focuses on a convenient limit case. Our simplifying assumption can be rationalized by enforcement at points of sale, by reputation of buyer and seller, or by the ability of massed concentrations of buyers and sellers to coordinate to deter opportunism which is against their collective interest.

bers sell their loot in a thieves market at a price normalized to one.[13]

Traders and robbers are specialized: traders never attack each other because such conflict is too expensive in the even match that results, and predators similarly do not attack each other even when one predator has goods to steal. Thus the only matches with economic significance are between traders and predators, and predators always win. There is at most one match per period. Traders cannot coordinate on a common defense strategy, though each trader can individually take defensive actions to avoid meeting the robbers while in transit. Robbers similarly do not coordinate offensive strategies.

The objective probability of successful shipment by traders is built as a compound of two elements, the avoidance probability and the enforcement probability. The probability that the prey avoids the predator is a decreasing function F of the ratio of predators to prey, B/q, where the volume of trade is q and the number of predators is B (for bandits or bad guys). The objective avoidance probability is given by the logistic function $F(B/q) = 1/[1+\theta B/q]$ where θ is a parameter capturing the effectiveness of the robbers' technology for seeking and chasing relative to the traders' ability to hide and run. It is sometimes convenient to refer to this below as the predation technology. The other element of shipment success is the enforcement probability M. Of those shipments which fail to avoid the predators, a fraction M will succeed anyway. Thus the objective success rate is given by $F + (1 - F)M = M + (1 - M)F$.

The cops that provide enforcement are drawn from outside the model, and the merchants guild is assumed to be able to pay for it, all action taking place offstage. Thus M is fixed, provided the merchants can overcome the free rider problem to provide the necessary payment.

Predation can also be taken to mean extortion, as is now readily seen. The M parameter can represent a bargained share left to the trader following an encounter. Behind the bargaining outcome lie outside options which might reflect spoliation of the goods in the event of a struggle, or the effects of an alarm to the cops.

Agents form beliefs π about the success rate of traders, and in equilibrium the beliefs converge on $M + (1 - M)F$.

Toward Equilibrium

The full equilibrium is solved for the values of B and q, the wage rate w

[13]That traders and robbers sell the goods at different prices reflects the intuition that consumers' willingness to pay for stolen goods is different. All results are qualitatively unchanged if we assume that both traders and robbers sell at the same price b.

and the equilibrium success rate π. It is useful to first characterize the rational expectations success rate conditional on trade volume. Potential predators allocate themselves between predation and trading to equalize payoffs given the wage rate and their beliefs about success rates in predation. In equilibrium the beliefs converge to objective success rates (which depend on B). Labor market equilibrium links the wage to a given volume of trade, hence links the equilibrium success rate to a given volume of trade. The full equilibrium is solved from the zero profit condition in trading, embedding equilibrium wages and success rates.

1.2 The Equilibrium Success Rate

The agents' beliefs about π determine the expected payoffs to trading and predation and hence the choice between the two activities. In rational expectations equilibrium, the subjective probability must equal the objective probability, the returns to labor on both types of activity must be equal and the labor market must clear.

The expected return to predation per predator is $(1-\pi)q/B$,[14] while employment in trade services pays w. Agents are indifferent between predation and trade services when

$$w = \frac{(1-\pi)q}{B} \Rightarrow \frac{B}{q} = \frac{1-\pi}{w}. \tag{2}$$

Substituting the labor allocation condition (2) into the objective probability function yields the success rate conditional on the wage. For the logistic function this simplifies to:[15]

$$\pi(w) = M + w/\theta. \tag{3}$$

[14]Predators sell their loot securely in a thieves market at constant price normalized to one, without loss of generality.

[15]In general, the fixed point problem has a trivial solution at $\pi = 1$, since $F(0) = 1$. Graphing $F[(1-\pi)/w]$ against π shows that if $\pi = 1$ is the only solution, it is stable under the plausible hypothesis that the subjective probability π adjusts toward the objective probability given the beliefs $F[(1-\pi)/w]$. If an interior solution exists and is unique, it must be stable because $-F'/w < 1$ in the neighborhood of the solution. In this case the secure equilibrium is unstable. There could be multiple interior equilibria, depending on the shape of the cumulative density function F. With multiple equilibria, unstable interior solutions are flanked by stable interior solutions.

The labor market clears when the total supply of labor N is equal to the sum of labor demanded in trade services and predation. Using (2), (4) and the demand for labor in the trade industry $q^{1/\alpha}k$ yields:

$$N = kq^{1/\alpha} + q[1 - \pi(w)]/w \tag{4}$$

Solving (4) for the unique[16] market clearing wage yields the equilibrium wage function:

$$W(q) \equiv \frac{q(1-M)}{N - kq^{1/\alpha} + q/\theta}. \tag{5}$$

Note that $W_q > 0$, the equilibrium wage is an increasing function of trade volume. Moreover, the wage function is inelastic at low (w, q) and elastic at high (w, q) with a unique critical value of q for which it is unit elastic. See Figures 1-3 for an illustration.

Substituting (5) into (3) yields the equilibrium success rate as a function of the volume of trade q and of the exogenous parameters $(M, N, k, \theta, \alpha)$:

$$\Pi(q) = \pi[W(q)] = M + \frac{1-M}{\theta(N/q - kq^{1/\alpha - 1}) + 1}. \tag{6}$$

Notice that the success rate is increasing in the volume of trade, an effect called 'safety in numbers' by Anderson and Bandiera (2006). Safety in numbers arises because of increasing opportunity cost of predators. At constant opportunity cost w, (2) implies that the equilibrium B/q is constant, driven by free entry of predators.

1.3 The Full Equilibrium

The equilibrium volume of competitive trade is determined by the no arbitrage condition of profit-maximizing traders in a free entry equilibrium. Traders expect to break even when $\pi b - c - t = 0$. Their beliefs about π must be consistent with the equilibrium probability of success. The wage rate which helps determine the trade cost t and the success rate π must be consistent with labor market equilibrium for the volume of trade. The full

[16]The right hand side of (4) is decreasing in w and is unboundedly large at very low w, so a unique stable solution exists.

equilibrium of the model is determined by goods and labor market clearance simultaneously, embedding the equilibrium probability of success as a function of the wage.

The competitive equilibrium quantity for a given wage uniquely satisfies

$$Q(w) \equiv q : \left(M + \frac{w}{\theta}\right) b - c - wkq^{(\frac{1}{\alpha}-1)} = 0. \tag{7}$$

The equilibrium pair (w, q) is determined by equations (5) and (7). Figure 1 illustrates. Equilibrium with insecure trade is found where $w \leq \theta(1-M)$. The graphs of (5) and (7) are drawn in this region for the case where $Mb-c < 0$.[17]

For some parameter ranges, Q will lie everywhere below W and autarky is the only equilibrium while for other parameter ranges, secure trade is the only equilibrium. See Anderson and Bandiera (2006) for more discussion. This paper concentrates on the case of insecure equilibrium at point E in Figure 1.

The alternative form of the choice of trade volume is monopoly. This form becomes natural in the context of the merchant guilds required to solve the collective action problem of law enforcement. The earnings of capital in trade services are given by

$$S(q, w, M) = \int_0^q (\pi b - c - t)\, dq = \left[(M + w/\theta)b - c - \alpha wkq^{1/\alpha-1}\right] q. \tag{8}$$

Competitive trading implies $S_q = 0$ while monopoly trading implies

$$\begin{aligned} S_q + S_w W_q &= 0 && (9) \\ &= [\pi b - c - t] + [(\pi - M)b - \alpha t]\, W_q q/W && (10) \end{aligned}$$

under the plausible assumption that the monopoly understands the dependence of both trade costs and the shipment success rate on the underlying labor market equilibrium.[18] Equilibrium can lie in one of two regions. The strong enforcement case $M > [(1-\alpha)b + \alpha c]/b$ implies that

[17] If the condition is violated, some trade will always occur even if an encounter with a predator is certain. Thus this plausible condition opens the door to predation destroying all trade.

[18] The sophistication of the monopolist is not crucial to the qualitative results. In an early version of this model (Anderson and Bandiera, 2003) we modeled a naive monopolist who took the wage as given, understood that trade cost depended on q given w, and understood through the objective probability F that increases in q would raise π for given predation B. The qualitative results were the same as in the present case.

$S_q > 0, S_w < 0$ while the weak enforcement case $M < [(1-\alpha)b + \alpha c]/b$ implies that $S_q < 0, S_w > 0$. Figures 2 and 3 illustrate. Further analysis is in the Appendix. As with competitive trade, autarky or secure trade may be the only stable equilibria, depending on parameters.

The guild uses its knowledge of the externalities generated in the labor market in choosing the optimal trade volume. There is a negative pecuniary externality due to the cost push from more trade to higher demand for labor to higher trade costs t. Opposing this is a positive nonpecuniary externality, safety in numbers, due to the rise in wages pulling predators into trade and increasing security. The weak enforcement case means in equilibrium that $S_q = \pi b - c - t < 0$, associated with $S_w > 0$, where the safety in numbers externality dominates the cost push externality. The strong enforcement case implies, in contrast, that cost push dominates safety in numbers.

1.4 The Two Country Model

Two markets are connected through their trading activities. Formally, there is define a second market parallel to the first, with foreign variables denoted by *. A common labor pool supplies all predators and all labor in trade services. As in the one country model, a rise in the wage both raises trade costs and improves security, but the effect now has an inter-market or international externality. A useful alternative interpretation of the model sees the * market as a smuggling activity. Legal market commercial policy has effects on the smuggling activity that affect the optimal policy.

The total supply of labor is equal to N. Market clearance implies

$$N = kq^{1/\alpha} + +k^*(q^*)^{1/\alpha^*} + q[1-\pi(w)]/w + q^*[1-\pi^*(w)]/w. \tag{11}$$

This implies a market clearing wage

$$w = W(q, q^*) = \frac{q(1-M) + q^*(1-M^*)}{N - kq^{1/\alpha} - k^*(q^*)^{1/\alpha^*} + q/\theta + q^*/\theta^*}. \tag{12}$$

The graphical analysis of full equilibrium with one country's trade based on Figures 1-3 readily generalizes to the two country model. The parallels to Figures 1-3 depict, for example, the foreign market volume conditional on a given home market volume. The cross effects between markets run through the equilibrium wage function. A rise in home market volume raises the wage associated with any given foreign volume q^*.

2 Comparative Statics of Commercial Policy

Commercial policy is modeled here as a change in c. This is natural when the policy instrument is the price of access to infrastructure such as port facilities. Subsidized access is indeed very common. A trade tax also can be thought of as acting on c when predation is understood as extortion.[19] If predation is extortion by customs officials, then auditing may well compel corrupt officials to correctly collect taxes while extracting added bribes from shippers in order to let the goods through in a timely manner.

First consider the response of trade in a single market to a change in c, the policy-inclusive cost of the goods to traders. When trade is initially positive, the effect on marginal surplus is given by $S_{qc} = -1$. The result, not surprisingly, is a rise in trade volume q as c falls for given M, as illustrated in Figure 1 by the equilibrium point E moving northeast along $W(q)$. With monopoly too, equilibrium trade volume rises with a fall in c, illustrated in Figures 2 and 3.

An important implication of the model is that *trade is ordinarily more responsive to liberalization on the intensive margin the lower is enforcement capability.* Specifically dq/dc is smaller in absolute value the higher is M, all else held equal. The discussion is in the Appendix. Intuitively, the importance of the safety in numbers externality declines as enforcement capability rises.

In contrast, consider the effect of liberalization on the extensive margin.[20] Potential predation can prohibit trade initially (see Anderson and Bandiera, 2006, for details). In Figure 1, autarky is the only stable competitive equilibrium for initial parameter values such that the $W(q, M)$ function lies outside the $Q(w, M)$ function. In this case, a fall in c moves the market closer to a jump from autarky to an interior solution such as E on the diagram. All else equal, the larger is M, the more likely it is that a given reduction in c will cause the inception of trade. Thus *extensive margin competitive responses are larger the higher is enforcement quality.* Reductions in c can similarly

[19] The metaphor of theft, in contrast, suggests that liberalization should be modeled as a rise in b, with tariffs only being paid on the goods which escape predation. The technical analysis of this case is a bit more complex because b enters multiplicatively with π. This difference is inessential for the qualitative results.

[20] Recent theoretical and empirical work emphasizes that extensive margin changes are a very important component of overall trade volume responses to liberalization and other exogenous shocks.

initiate monopoly trade starting from an initially weak enforcement regime. The inception of trade is sure to occur is with a fall in c large enough to flip the regime into a strong enforcement region. That is because interior monopoly equilibrium always exists with strong enforcement (see Anderson and Bandiera, 2006). The regime flip is more likely for a given sized fall in c the larger is M, hence this type of extensive margin rise in monopoly trade is, like competitive trade, more likely the larger is M.

Trade liberalization in one market also spills over to change the volume in unliberalized markets. Using signs for the spillovers derived in Sections 3 and 4, *liberalization reduces (increases) trade on the intensive margin in unliberalized monopoly markets when enforcement is strong (weak). It increases trade in unliberalized competitive markets when* $c - Mb > 0$. Spillovers acting on the extensive margin can initiate trade in competitive markets (the W function shifts to the right in Figure 1), and in monopoly markets with weak enforcement.

These and other comparative static effects of endogenous trade cost parameters on dq/dc implied by the model provide a framework to analyze the highly disparate responses of trade to liberalization episodes across countries. The model implies that dq/dc is smaller the smaller is k, which embodies the merchant capital, infrastructure or technology. The elasticity of import demand, the usual parameter that determines the response to liberalization, can be incorporated into the comparative statics of liberalization based on the general equilibrium extension of the model laid out in Section 5.

3 Optimal Commercial Policy

Suppose that the government sets policy to maximize the profits of merchants. This assumption is natural in the model since merchants are the only location specific agents.

Mercantilist policy often granted trade monopolies. Interpreted in light of the model, this policy overcame the free rider problem of private enforcement provision while also maximizing profits by bestowing on merchants the monopoly power over trade volume. It may have been efficient. Alternatively, government or a merchant guild provides private enforcement but leaves volume to be competitively determined. What is the efficient trade policy?

Trade expansion has two effects on trade costs: the pecuniary cost push

externality drives up the transport cost t while the nonpecuniary safety in numbers externality raises the success rate on trade π. The net effect of the externalities is negative (cost push dominates) in strong enforcement equilibrium and the net effect is positive (safety in numbers dominates) in weak enforcement equilibrium.

Competitive merchants fail to internalize the externality, but their merchant interest government can do so, subsidizing trade in weak enforcement equilibrium and taxing trade in strong enforcement equilibrium. A trading monopoly will in contrast internalize both externalities. In a multi-market setting, the trading monopoly fails to fully internalize, however, opening a role for government. When the markets are separated by borders, rival governments play Nash policies, or they may cooperate.

3.1 Optimal Policy in a Single Market

The net payoff for a government that acts in merchants' interest but also cares about revenue is given by

$$G(c) = S[q(c), W[q(c)], c] + \lambda q(c - c^0).$$

$\lambda \geq 1$ is the Marginal Cost of Funds (MCF) that must be raised from alternative revenue sources. For simplicity λ is assumed to be constant. $q(c - c^0)$ is the revenue raised by a tax $c - c^0$ when this is positive or the subsidy required when $c - c^0$ is negative.

The government influences the choice of q by altering c with a tax or subsidy. Competitive traders determine a trade volume such that $S_q = 0$ while a merchant guild sets aggregate volume such that $S_q + S_w W_q = 0$.

For the monopoly trade case, using the monopolist's first order condition, the government objective function rises with c according to

$$\begin{aligned} G_c &= (\lambda - 1)q + \lambda(c - c^0)dq/dc = -q\left[1 - \lambda/MCF^c\right] \\ MCF^c &\equiv \left[1 + \frac{c - c^0}{c}\frac{cdq}{qdc}\right]^{-1}. \end{aligned}$$

If lump sum taxation is available, $\lambda = 1$ and $G_c < 0$ except at $c = c^0$, free trade, where $MCF^c = 1$. Otherwise, $G_c = 0$ provides a revenue motive to require $c > c^0$, at least a small amount of trade taxation to substitute for

more expensive alternative revenue sources.[21]

In contrast, competitively determined trade implies an untreated externality at the free trade point.

$$G_c = (\lambda - 1)q + \lambda(c - c^0)dq/dc + S_w W_q dq/dc.$$

Proposition 1 *With no international externalities and no revenue motive ($\lambda = 1$), the optimal policy of the merchant interest government is: (a) laissez faire when the merchant guild has monopoly power in trade; (b) $c - c^0 = -S_w W_q$ in the absence of monopoly power; subsidize trade when enforcement is weak, $S_w > 0$, and tax trade when enforcement is strong, $S_w < 0$.*

Proposition 1 provides a rationale for the Mercantilist predilection for trading monopolies. Revenue motives combine with the domestic externality correction when $\lambda > 1$. This observation and Proposition 1 imply that when revenue is expensive and enforcement is weak, monopoly secures efficient trade while avoiding the subsidy needed for efficient competitive trade. State monopoly grants would have been more effective than merchant guilds that would have been vulnerable to defection and entry, with consequent loss of full internalization of the externality.[22]

3.2 International Externalities

In the two country model, a trade monopoly is assumed to operate exclusively in each market. International externalities travel through the common labor market. These international externalities operate independently of the standard terms-of-trade externalities that are shut down by assumption.

The two trade monopoly rivals lack the commitment power by which to exploit the effect of their decisions on their rival's choice of trade. Their governments can supply the lack with profit-shifting trade policies.

The Nash equilibrium trade policies will over most parameter ranges subsidize trade. The Nash policies are inefficient. Cooperative policies, in contrast, will subsidize trade in weak enforcement equilibrium and tax trade in

[21] The second order condition for this and succeeding problems is normally met, as may be checked in this case: $G_{cc} = (2\lambda - 1)dq/dc + \lambda(c - c^0)d^2q/dc^2$, which is negative by $dq/dc < 0$ unless the combination of large taxes and $d^2q/dc^2 > 0$ prevents it. In that case, a lower tax rate will satisfy both the first and second order conditions.

[22] The model abstracts from standard dead weight loss due to the monopolist's ability to benefit from the dependence of b and/or c on volume.

strong enforcement equilibrium. Note again that the model's subsidy implications are not unrealistic since subsidy to trade realistically comes via infrastructure provision that lowers c without full taxation to cover the provision.

Trade is determined by foreign and domestic guilds in a Nash equilibrium defined by

$$\begin{aligned} S_q + S_w W_q &= 0 \\ S^*_{q^*} + S^*_w W_{q^*} &= 0. \end{aligned}$$

This system of equations yields the Nash equilibrium volumes $q(c, c^*), q^*(c, c^*)$.

For simplicity in modeling government objectives, assume $\lambda = 1 = \lambda^*$, so there is no revenue motive, and assume that trade is monopolistically determined so there is no domestic externality correction motive. The objective functions of the two governments are given by $G = S\{q(c, c^*), W[q(c, c^*), q^*(c, c^*)], c\} + q(c - c^0)$ and $G^* = S^*\{q^*(c, c^*), W[q(c, c^*), q^*(c, c^*)], c^*\} + q^*(c^* - c^{*0})$.

3.2.1 Nash Trade Policies

Each government sets trade policy to maximize its objective function given the policy of the other government. The Nash equilibrium in noncooperative trade policies is determined by:

$$\begin{aligned} G_c &= 0 = (c - c^0)dq/dc + S_w W_{q^*} dq^*/dc \\ G^*_{c^*} &= 0 = (c^* - c^{*0})dq^*/dc^* + S^*_w W_q dq/dc^*. \end{aligned}$$

While the monopoly is able to internalize the effect of its own volume decision on the labor market, it is by assumption unable to do so for foreign volume. This leaves a role for government to respond at the margin to the international externality.

The tax or subsidy implied is

$$c - c^0 = -S_w W_{q^*} R^*_q$$

where R^*_q is the slope of the foreign best response function, the values of q^* which satisfy $S^*_{q^*} + S^*_w W_{q^*} = 0$ for any given value of q. A similar optimal tax characterizes the foreign government's policy. Since $W_{q^*} > 0$, the sign of the tax is the sign of $-S_w R^*_q$; *trade is taxed (subsidized) when S_w and R^*_q differ in (have the same) sign.*

The slope of the best response functions is determined by differentiating the first order conditions of monopoly trade guilds. Assuming the stability condition is met, the sign of R_q^* is given by the sign of

$$S_{q^*w}^* W_q + S_w^* W_{q^*q} = S_{q^*}^* W_q / W + S_w^* W_{q^*q} q^* / W.$$

Making use of the first order condition for the foreign guild, the preceding expression reduces to $S_w^* W_{q^*}/W$.[23]

Lemma*(a) Trade volumes are strategic substitutes if and only if enforcement is strong, (b) Trade volumes are strategic complements if and only if enforcement is weak.*

The implications for non-cooperative trade policy are as follows.

Proposition 2 *(i)Trade is subsidized in Nash policy equilibrium if and only if both markets have the same enforcement regime (weak or strong), (ii) trade is taxed in Nash policy equilibrium if and only if the two markets differ in their enforcement regimes.*

One case of subsidy has a familiar cause, though in a new setting. When $S_w < 0$ and $S_w^* < 0$,, strong enforcement equilibrium, trade volumes are strategic substitutes, $R_q^* < 0$ and $R_{q^*} < 0$. The rationale for subsidy is essentially the Brander-Spencer profit-shifting mechanism: subsidizing the home trader monopoly under strategic substitutability permits it to take more of the world's trade and hence profits from trade.

In contrast, weak enforcement equilibrium induces optimal subsidies through a different mechanism. In this case there is strategic complementarity. Due to 'demand complementarity',[24] the home trader benefits from the foreign trader's expansion. Due to strategic complementarity, the home government achieves internalization of this benefit through subsidy.

Taxation arises when S_w and S_w^* differ in sign. The intuitive rationale for this case as compared to the cases under (i) is similar to the switch in the Brander-Spencer logic made by Eaton and Grossman: with 'demand substitutes' in the home market ($S_w < 0$) but strategic complementarity ($S_w^* > 0$), taxation is the optimal rent-shifting policy. Taxation also arises in this model with 'demand complements' in the home market but strategic substitutability for the foreign response, a more novel possibility relative to the Brander-Spencer model literature. Brander (1995) surveys all the possibilities in an

[23]Substituting from the first order condition reduces the expression to $S_w^* W_{q^*}[-W_q/W + W_{q^*q}]$. Then differentiation of (12) and some tedious algebra yields the result.

[24]Demand complementarity is used here to describe a positive response of the markets' willingness to pay for trade services, $\pi b - c - t$, to a rise in q^*.

abstract setup that explores the four possible combinations of strategic substitutability/complementarity and demand substitutes/complements, an abstraction clothed here with the details of a model in which each possibility can easily be realized with appropriate combinations of the strength of enforcement in the two markets.

Proposition 2(i) implies that governments should normally subsidize trade in order to internalize the international externalities arising through the labor market and the inability of the monopoly guilds to commit in order to realize the gains. Here 'normal' means that enforcement conditions are not too different. Proposition 2(ii) shows, however, that the international externality is not always positive. Differences in enforcement regimes can make taxation optimal.

3.2.2 Cooperative Trade Policies

Now consider international cooperation in trade policy. The response of joint surplus to c and c^* is defined by

$$G_c + G_c^*$$
$$G_{c^*} + G_{c^*}^*.$$

Here the new cross effects G_c^*, G_{c^*} incorporate the effect of domestic policy on the other government's objective function. The implications for jointly desirable policy change are seen by evaluating the cross effect at the Nash equilibrium values of policy. Considering the home policy for example, at the Nash equilibrium policies, $G_c + G_c^* = S_w^* W_q dq/dc$. This has the sign of $-S_w^*$.

In weak enforcement equilibrium in the foreign market, $S_w^* > 0$, joint surplus is decreasing in c. If the home market is also in weak enforcement equilibrium, the Nash subsidy is not large enough, an increase in subsidy is indicated. If the home market is in a strong enforcement equilibrium, the Nash tax is too large, indicating a reduction in taxes. In strong enforcement equilibrium in the foreign market, $S_w^* < 0$, the joint surplus is increasing in c. If the home market is also in strong enforcement equilibrium then the Nash subsidy is too large, a cut in subsidy is indicated. If the home market is in weak enforcement equilibrium, the Nash tax is too small, a rise in the tax is indicated.

A common enforcement regime equilibrium implies trade subsidy in the noncooperative policy equilibrium, by Proposition 2. The Nash subsidies

are too big in a common strong enforcement equilibrium and too small in a common weak enforcement equilibrium. Coordinated policy should reduce the subsidy competition with strong enforcement and increase subsidies with weak enforcement.

Differing enforcement regimes have more novel consequences. Both partners tax trade in Nash equilibrium. Coordinated policy change should raise the tax of the weak enforcement country whose partner has strong enforcement while reducing the tax of the strong enforcement country whose partner has weak enforcement. The asymmetric implication is dramatic and realistic in the context of city or central government policies across neighborhoods or regions — improve infrastructure of high rent city cores or regions and let the high crime neighborhoods and regions go.

To understand this at first sight puzzling result, consider weak enforcement Home's marginal policy change. A rise in c is indicated, lowering q. Profits fall at home and rise abroad at the initial q^*. Strong enforcement Foreign's trade is a strategic substitute for Home's trade, however, so q^* rises. Because Home has weak enforcement, the rise in q^* is beneficial; safety in numbers dominates cost push in this case. This indirect effect tends to offset the loss to Home caused by raising its tax above the Nash equilibrium level at the initial Foreign trade level. The jointly optimal direction requires raising weak enforcement Home's tax, which implies that the gain to Foreign dominates the loss to Home from this move. Similarly, the reduction in Foreign's tax implies that the gain to Home dominates the loss to Foreign.

The difference between the present analysis and the standard analysis of Nash vs. cooperative tariffs is wide. The present analysis centers on an international externality which operates through endogenous trade costs rather than endogenous terms of trade.

The full jointly optimal trade policies are defined by

$$-(c - c^0) = S_w W_{q^*} R_q^* + S_w^* W_q + (c^* - c^{*0}) R_q^*$$

and the analogous expression for the foreign policy. In the symmetric case this simplifies to $-(c - c^0) = S_w W_q$. In the general case the solution is

$$c - c^0 = \frac{-S_w^* W_q + S_w^* W_q R_q^* R_{q^*}}{1 - R_q^* R_{q^*}} \tag{13}$$

$$c^* - c^{*0} = \frac{R_q^* R_{q^*} S_w W_{q^*} - S_w W_{q^*}}{1 - R_q^* R_{q^*}} \tag{14}$$

Proposition 3 *(a) When policies are set cooperatively, trade should be subsidized (taxed) in weak (strong) enforcement symmetric equilibrium. (b) With enforcement asymmetry, the weak market should be taxed and the strong market should be subsidized.*

The result of Proposition 3 (a) continue to hold for mild amounts of asymmetry between countries. But Proposition 3 (b) deals with the case where one country has weak enforcement and the other has strong enforcement. This yields strongly asymmetric policies — the weak are punished and the strong are strengthened.

The need for intervention arises even with cooperative policies, because in contrast to the one country case, the two national guilds do not internalize the effect of their actions on each other. This discussion and the preceding discussion of the sign of optimal Nash policy suggests that the case for international coordination of trade policy is even stronger than the standard tariff case because the sign of the trade policy can switch in moving from non-cooperative to cooperative equilibrium.

4 Commercial Policy with Smuggling

What does commercial policy look like in a predatory world that includes an illegal market such as a smuggled version of legal goods or another illegal good? The two market setup can be reinterpreted to reflect this common situation of parallel legal and illegal markets. The * variables now refer to those of the illegal market. Policy includes taxes or subsidies in the legal market and tolerance or intolerance of the illegal activity.

Collective action being more difficult in illegal activity, trade volume in the illegal market is likely to be set competitively and 'enforcement' in the illegal market is exogenous with $0 \leq M^* < M$. M^* can be greater than zero, reflecting extortion by predators from smugglers. (An alternative setup is explored in Anderson and Bandiera, 2006, in which a mafia provides enforcement in the illegal market and its monopoly pricing is a key element in the analysis of anti-drugs policies.)

The 'best response' function of the smugglers reflects competitive reactions, $N^*_{q^*} = S^*_{q^*}[q^*, W(q, q^*)] = 0$. $R^*_q = -N^*_{q^*q}/N^*_{q^*q^*}$ is signed by $S^*_{q^*w}w = [(\pi^* - M^*)b^* - t^*] = c^* - M^*b^* > 0$ ordinarily.[25] Thus *illegal trade is ordi-*

[25]This is a plausible condition. If it is violated, even when a trader is certain to encounter a predator, at least some trade will always occur. The condition implies weak enforcement.

narily a strategic complement of legal trade.

Now consider the effect of smuggling on the response of legal trade to trade liberalization. The Nash equilibrium trade volumes are determined by $N_q = S_q + S_w W_q = 0$ and $N^*_{q^*} = S^*_{q^*}[q^*, W(q, q^*)] = 0$. Differentiating the system with respect to c and solving yields $dq/dc = 1/[N_{qq} + N_{qq^*} R^*_q]$. Thus

Proposition 4 *smuggling lowers (raises)* $|dq/dc|$ *as* $N_{qq^*} < (>)0$*; i.e., as enforcement is strong (weak).*

Turning to the implication for optimal trade policy, the first order condition for the government yields:

$$G_c = [(c - c_0) + S_w W_{q^*} R^*_q] dq/dc = 0.$$

The first order condition implies that:

Proposition 5 *Absent revenue motives, trade in the presence of smuggling should be taxed in strong enforcement equilibrium and subsidized in weak enforcement equilibrium.*

Proposition 5 suggests that high tax/high smuggling equilibria are not efficient. Thus revenue needs that require trade taxes in weak enforcement environments lay a heavy burden on the economy.

Anti- or pro-smuggling policy is another important policy instrument. Suppose the state can change c^* by some costless action, such as permitting or denying smugglers access to port facilities. A fall in q^* raises or lowers legal merchants' profits as enforcement is strong or weak. Formalizing this insight,

$$G_{c^*} = [(c - c_0) R_{q^*} + S_w W_{q^*}] dq^*/dc^* = 0.$$

When $c = c_0$, the optimal policy on c^* drives $S_w = 0$, assuming this is feasible with interior equilibrium. In the case of weak enforcement with no intervention, the c^* policy is a subsidy to smuggling, raising w and hence security. In the case of strong enforcement with no intervention, the c^* policy is to attack smuggling and raise its costs.

For any given $c - c_0 \neq 0$, the optimal c^* policy solves $S_w = -(c - c_0) R_{q^*}/W_{q^*}$. At the optimal c policy, changes in c^* are effective in raising surplus further since the standard stability condition implies that $R^*_{q^*} > R_{q^*}$. The implication is that c^* policy is more powerful than c policy. The global analysis makes this point clear, as given in Figure 4 for the case where enforcement is weak and Figure 5 for the case of strong enforcement.

The government's policy in the merchants' interests in effect confers on the trade monopoly a first mover advantage that it lacks in setting its trade

strategy. When the government is able to affect the smugglers' cost directly, it can shift the smugglers' best response function along the legal market monopoly's best response function. Assume for the moment that such shifts are feasible while the interior insecure equilibrium still obtains. Then the optimal policy shifts the smugglers' reaction function to the optimal point where a legal market iso-profit contour is tangent to the legal market best response function, point L^* on Figure 4. This yields higher profits than those associated with the optimal c given by point L on Figure 4. The analogous analysis for the case of strong enforcement is given in Figure 5.

Summarizing the implications:

Proposition 6 *(a) The optimal smuggling policy encourages it when enforcement is weak and suppresses it when enforcement is strong. (b) Pro- or anti-smuggling policy should be followed to the extent possible, supplemented if need be with legal market tax/subsidy policy.*

The analysis illuminates a crucial regime change in British policy toward its American colonies around 1763, the end of the Seven Years War (called the French and Indian War in its North American aspect). Official toleration of smuggling prevailed for a century prior to 1763 as smugglers almost openly used the major American ports. Afterwards, British intolerance of smuggling fueled resentment leading to the American Revolution.

Applying the model, weak enforcement prevailed prior to 1763 as British naval forces contended with their European rivals, especially the French in the 18th century. In terms of the model, $S_w > 0$, hence rational tolerance was the optimal British policy. After 1763, the released British naval forces suppressed piracy from its Caribbean bases. By implication the equilibrium shifted to a strong enforcement regime where $S_w < 0$ and intolerance of smuggling became rational for a government in the *legal* merchants' interest.[26]

In contrast, the usual economic explanation for the regime change of 1763 is the increased demand for revenue by the British government following its expensive war with the French.[27] In terms of the model, however, an

[26]The model offers a novel economic interest explanation of the bitter divisions within the colonies during the Revolution: the switch to intolerance benefitted legal merchants while harming the merchant capital tied up in the illegal market, along with harming the common sailors. Loyalists have been estimated to comprise as much as 1/3 of the population during the Revolution. In contrast, prior to 1763 the British policy of 'benign and salutary neglect' aided all three groups.

[27]The increased revenue demand story is somewhat problematic because the revenue motive operated during and prior to the war years too, when Americans under threat from

increased appetite for revenue cannot cause a rational regime change from tolerance to intolerance of smuggling. Formally, a rise in λ, the marginal cost of funds from alternative sources, normally leads to a rise in the tax on legal trade c. The effect of the rise in λ and c on smuggling policy is implied by

$$G_{c^*} = [\lambda(c - c_0)R_{q^*} + S_w W_{q^*}]dq^*/dc^*.$$

When enforcement is weak, the incentive to subsidize smuggling is increased, G_c^* falls, while when enforcement is strong the incentive to attack smuggling is increased, G_c^* rises.

A limitation of the model is that the exogeneity of b shuts down a possible motive for anti-smuggling policy which could raise the willingness to pay for legal goods. However, this motive would also have operated before 1763, so it cannot explain the regime shift.

5 General Equilibrium

The preceding partial equilibrium model can be embedded in a simple general equilibrium model. All qualitative implications about commercial policy continue to hold. The general equilibrium model is tailored to make the partial equilibrium results hold up, and resembles others in the trade literature built with the same purpose in mind. Terms of trade effects are shut down for simplicity because they present familiar elements for commercial policy analysis.[28]

Each country produces a numeraire good and an export good consumed only by foreigners. Numeraire production is given by an endowment in each country. The export good of the home country has unit labor requirement equal to a, so the cost of goods supplied by the home country to the foreign

the French and their native allies had a strong incentive to cooperate with the British in raising revenue for their defense, as indeed they did with funding colonial militias. Another problem with the revenue demand story is the relatively small revenues involved in actual British tax plans. The economic motive of this paper complements a plausible non-economic story offered by historians. After 1763 there was a shift to centralized and rational bureaucratic administration throughout the British Empire.

[28] Allowing for terms of trade effects can sometimes enable trade in a world that otherwise would be autarkic. Anderson and Marcouiller (2005) provide a model where terms of trade improvement raises the real wage of the poorer country, that supplies all the predators, by enough to reduce the lure of predation sufficiently to enable trade. The result suggests subsidizing trade to improve security, an argument that resembles those above.

country is given by $c^* = aw$. Similarly the cost of goods supplied by the foreign country to the home country is given by $c = a^*w$. Unlike most trade models, labor is internationally mobile, so the wage rate is internationally equalized. Merchant capital, in contrast, is country-specific just as it was in the preceding sections. This leads to diminishing returns in the trade activity carried on by each set of merchants. The numeraire good is costlessly tradable[29] but the non-numeraire goods require trade services. The direction of trade in the numeraire good is an inessential detail residually dependent on the details of the general equilibrium model that determine the volume of trade in the non-numeraire goods.

The predators prey on the non-numeraire good trade of each country, earning an expected return equal to the wage they could earn in productive activity, production of the export goods or in trade services. The stolen (or extorted) goods in expected amounts $q(1-\pi)$ and $q^*(1-\pi^*)$ are resold in the retail markets with the legitimate goods, but incur a fixed iceberg trade cost in doing so. Thus $bq(1-\pi)$ worth of non-numeraire goods nets the predators on home imports $(b/T)q(1-\pi)$ where $T \geq 1$. In the partial equilibrium model, the trade costs were set equal to b so that the thieves' market price was equal to one. Here in contrast the thieves' market is integrated with the legitimate market as a simple way to close the general equilibrium model. For simplicity, $T = 1 = T^*$.[30]

The predators come from the common labor pool and are all identical in their productivity in the various types of production and predation. They have tastes that differ, however, depending on their origin, so some of them spend their income in the home country, buying the home numeraire good and the foreign export good while the remainder of the predators spend their income in the foreign country buying the foreign numeraire good and the home export good. This setup closes the general equilibrium model in the simplest way that is consistent with the underlying deep cause of trade: taste differences.

Tastes are modeled with quasi-linear utility, linear in the numeraire good and a strictly concave function $f(z) = z^\omega, 0 < \omega < 1$ of the non-numeraire good in the home country and $f^*(z^*) = (z^*)^{\omega^*}$ in the foreign country. Under these assumptions, denoting the price of the numeraire good as p, the home

[29]This simplification is inessential so long as trade costs are exogenous.

[30]It may be useful in future work to consider the use of T as a policy instrument by the government, but for present purposes this is a distraction.

buyer's willingness to pay for the non-numeraire good b is given by $b = p\omega z^{\omega-1}$. The foreign buyer's willingness to pay for the non-numeraire good (exported from the home country) is given by $z^* = p\omega^*(q^*)^{\omega^*-1}$. It is useful for future purposes below to note that expenditure on the non-numeraire good in terms of the numeraire is given by $bz/p = \omega f(z)$ and similarly for the foreign country. The individual demand z is scaled up by the number of agents with home tastes, N, to form the aggregate home demand for the non-numeraire good $q = Nz$. Similarly, $q^* = N^*z^*$. (Thus each merchant owns one unit of labor, with the merchant group forming a fraction of N, N^*.) Demand for the numeraire good is given by $I/p - bq/p$ where I is aggregate income, equal to $Nw + S$ for the home country and $N^*w + S^*$ for the foreign country. This income aggregate includes the income received by all agents with national (home and foreign respectively) tastes, whether merchants or workers in the trade services, export production or predatory activities.

The merchants' exercise of monopoly power now includes their ability to exploit variation in the willingness to pay of consumers of the non-numeraire good. Marginal revenue is given by $N\pi pf'(1 + zf''/f') = N\pi\omega pf'(q/N)$ in the home country. Integrating to form the merchants' (producers') surplus yields

$$S(q, w; p) = N\omega p(q/N)^{\omega}(M + w/\theta) - wa^*q - \alpha wkq^{1/\alpha}. \tag{15}$$

A similar expression describes the foreign surplus S^*. The merchant guild understands the dependence of w on its choice of trade q as previously, but it takes the numeraire price p as given.

The labor market clears with global supply equal to global demand. The demand for labor includes that in trade services, $kq^{1/\alpha}$, exports aq^*, and similarly for the foreign country. This implies

$$N + N^* = a^*q + aq^* + kq^{1/\alpha} + k^*(q^*)^{1/\alpha^*} + (1 - \pi)bq/w + (1 - \pi^*)b^*q^*/w.$$

The labor market clearance condition can be solved for the wage as a function of (q, q^*, p):

$$W(q, q^*, p) = p\frac{(1 - M)D + (1 - M^*)D^*}{N + N^* + pD/\theta + pD^*/\theta^* - aq^* - a^*q - kq^{1/\alpha} - k^*(q^*)^{1/\alpha^*}},$$

where $D = N\omega(q/N)^{\omega}$ and $D^* = N^*\omega^*(q^*/N^*)^{\omega^*}$.

The numeraire goods market clears with the world endowment equal to world demand. Using the expressions for merchants' surplus, the numeraire market clearance condition can be solved for the price as a function

of (q, q^*, w):

$$P(q, q^*, w) = w\frac{N + N^* - aq^* - a^*q - \alpha k q^{1/\alpha} - \alpha^* k^* (q^*)^{1/\alpha^*}}{y + y^* + D(1 - M - w/\theta) + D^*(1 - M^* - w/\theta^*)}.$$

The simultaneous solution of $w = W(q, q^*, p)$ and $p = P(q, q^*, w)$ yields the reduced form solution $w = \tilde{W}(q, q^*)$ and $p = \tilde{P}(q, q^*)$. Assuming the stability condition $W_p P_w < 1$ is met, both w and p are increasing in both q and q^*.

With this general equilibrium machinery working in the background, the choice of q, q^* by the merchant guilds proceeds as in the partial equilibrium setting. The conditions for the weak or strong enforcement regimes change, as explained in the Appendix, but the qualitative implications remain the same. There is a slight tension because the general equilibrium derivative $\tilde{W}_q$ incorporates the endogenous determination of p while the merchant guild is assumed to take p as given. The merchant guild may instead use W_q in setting its quantity policy. This difference is, however, an inessential detail.

When equilibrium is secure, the labor market clearance condition above implies that the wage is no longer a function of q, q^* directly. The model solves for the relative prices $p/w, b/w, b^*/w$ and the quantities q, q^*. The monopolists' power reduces to the standard power over the buyers' willingness to pay, taking the numeraire good's relative price in terms of labor as given. Demands for the non-numeraire good being independent across markets, strategic independence characterizes the interaction of merchant guilds and there is no role for strategic trade policy.

6 Conclusion

This paper provides a formal model of trade policy in a predatory world. Efficient trade policy in this world may often require subsidy to trade, realistically provided through subsidy to transport infrastructure. International externalities due to both cost push and nonpecuniary spillovers on the security of trade indicate the desirability of cooperation in setting trade policies. The model provides insights into why illegal markets operating alongside legal ones are sometimes tolerated and sometimes attacked.

A richer model of government would allow a deeper exploration of the interaction of trade liberalization with policies designed to affect the other costs of trade, especially those associated with enforcement costs. The merchant

interest model has at least opened the door. Optimal commercial policy in this setup reveals key elements that will be at work in richer models.

A major challenge is to embed the government in political economy. One use of such a model would view the predators as corrupt customs officials with the costly enforcement being lobbying by merchants to reduce extortion by officials. The current model assumes a fixed cost of enforcement. It is simple to endogenize enforcement effort by allowing for a variable component, though it is not clear that it can stand as a good metaphor for lobbying costs to persuade a top politician to crack down on his corrupt bureaucracy.[31]

Another political economy challenge is the state's objective function. Usually the merchants' interest will be well represented in the state's objective function, but not fully, as here. States care about the interests of their legitimate citizens and even their illegitimate ones. Pointing the way forward, while in the current setup labor supplies both markets, the general equilibrium setup of Section 5 gives labor a locational identity in consumption.

The organization of the provision of enforcement is the another important topic for deeper exploration. Private enforcement is provided here by a trading monopoly or by a guild which permits competitive trading. It could alternatively be provided by a monopoly enforcer such as a mafia (see Anderson and Bandiera, 2006). Details of the economic environment are likely to determine which organizational form can be successful, and therefore which state policies may be able to reap the benefits of private enforcement without the costs of monopoly. Some types of enforcement activity are less purely public than the setup of this paper. Such forms are less subject to underprovision due to free riding, but may present negative externality problems (car alarms deflect predators onto unprotected cars). If the state takes over the provision of enforcement, it must of course collect revenues to pay for it. These may include revenue raised from the taxation of trade, leading to the interaction of trade taxes with the insecurity of trade.

Another useful extension of the present setup is to explore the effect of capital mobility on the merchants' interests, and hence the desirability of integration in the form of international capital mobility.

[31] I am in debt to Avinash Dixit for pointing this out.

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8 Appendix: Comparative Statics of Equilibrium

8.1 Competitive Trade

Competitive trade volume is determined by $S_q = 0$. Then since $S_{qc} = -1$, $dq/dc = 1/S_{qq}$. Differentiating with respect to M yields $d^2q/dcdM = -S_{qq}^{-2}[S_{qqM} + S_{qqq}dq/dM]$. Evaluating S_{qq} shows that its dependence on M comes through its dependence on w. Noting that $W_M = -W/(1-M)$ and hence $W_{qM} = -W_q/(1-M)$, $S_{qqM} < 0$. Moreover, $dq/dM > 0$ and $S_{qqq} < 0$ ordinarily and necessarily so if $S_w W_{qq} < 0$. Then dq/dc is ordinarily increasing algebraically, becoming less responsive in absolute value, the greater is M.

8.2 Monopoly Trade

A guild which controls trade volume chooses an interior volume where:

$$-S_q/S_w = W_q.$$

Figures 2 and 3 illustrate. Characterizing the equilibrium depends on the shape of the iso-surplus contours. This is determined by two limiting values of the derivatives of the surplus function. $S_w = 0 \Rightarrow q^w = (b/\theta k\alpha)^{\alpha/(1-\alpha)}$. All iso-surplus contours asymptotically approach q^w. Evaluating $S_q = 0$ at the secure equilibrium wage $w = \theta(1-M)$,

$$S_q[q, \theta(1-M), M] = 0 \Rightarrow q^0 = \left(\frac{b-c}{\theta k(1-M)}\right)^{\alpha/(1-\alpha)}.$$

The case $q^0 > q^w$ implies that the interior equilibrium is associated with $S_q > 0$. Manipulating the expressions for q^w and q^0, $S_q > 0$ if and only if $M > 1 - \alpha + \alpha c/b$ while $S_q < 0$ if and only if $M < 1 - \alpha + \alpha c/b$. These are the strong enforcement and weak enforcement cases respectively.

It is straightforward to show that the curvature of the surplus function in the two cases is as depicted in Figures 2 and 3.

Interior equilibrium requires that the second order condition is met, and that positive profits are earned. It is possible that autarky is the only stable equilibrium or that secure trade is the only stable equilibrium. See Anderson and Bandiera for more discussion of existence in a closely related model in

which all qualitative issues are the same. (In that model, a monopoly enforcer provides M and maximizes profits by pricing enforcement sold to competitive traders.)

The effect of a change in c is shown graphically in the two figures. For the monopoly case, the comparative static derivative is given by $dq/dc = 1/[S_{qq} + S_{wq}W_q + S_wW_{qq}]$.

As with the competitive case, the effect of M on the marginal response arises through its effect on the wage along with the effect of M on q. It can be shown that the denominator is decreasing in M provided that $S_wW_{qq} > 0$ and additionally if $S_wW_{qqq} < 0$. These are oversufficient conditions. Thus trade is ordinarily less responsive to reductions in c the larger is M.

8.3 Monopoly in General Equilibrium

The surplus contours of the monopolist in (w, q) space are shaped qualitatively like those of the partial equilibrium case. Evaluating the limiting values of the general equilibrium surplus function (15) at $S_w = 0$ and $S_q(q, \theta(1 - M)) = 0$ yields

$$q^w = (\frac{\omega b - a^*}{\alpha k})^{\alpha/(1-\alpha)}$$

and

$$q^0 = (\frac{\omega b - \theta(1 - M)a^*}{\theta(1 - M)k})^{\alpha/(1-\alpha)}.$$

This implies that the critical condition is

$$M > (<)1 - \alpha + \alpha\frac{a^*}{\omega b/(1 - \alpha)\theta - a^*}.$$

Compared to the partial equilibrium condition characterizing weak and strong enforcement regimes, c/b is replaced by $c/[\gamma b - c]$ where $\gamma = \omega(\pi - M)b/(1 - \alpha), c = a^*w, \pi - M = w/\theta$. Unlike the partial equilibrium condition, the variable b on the right hand side is a (decreasing) function of q, so the condition holds under unspecified deeper relationships among the parameters that determine equilibrium. Otherwise it has qualitatively similar implications.

Figure 1. Competitive Trade

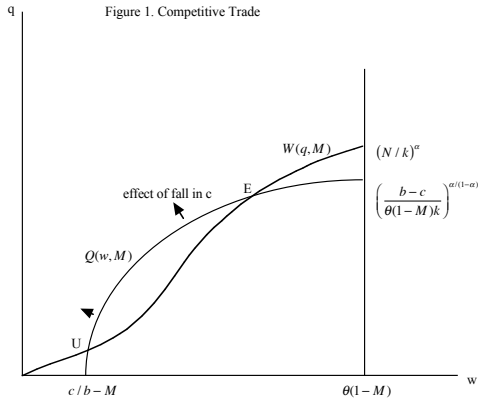

Figure 2. Strong Enforcement Equilibrium, $S_q > 0,\ S_w < 0$

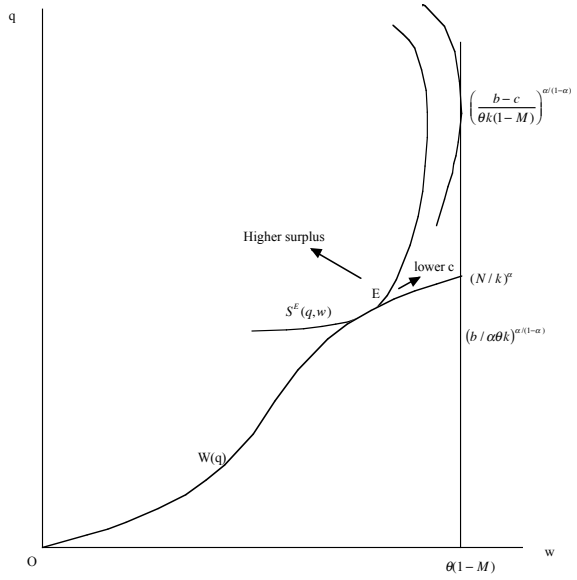

Figure 3. Weak Enforcement Equilibrium, $S_q < 0,\ S_w > 0$

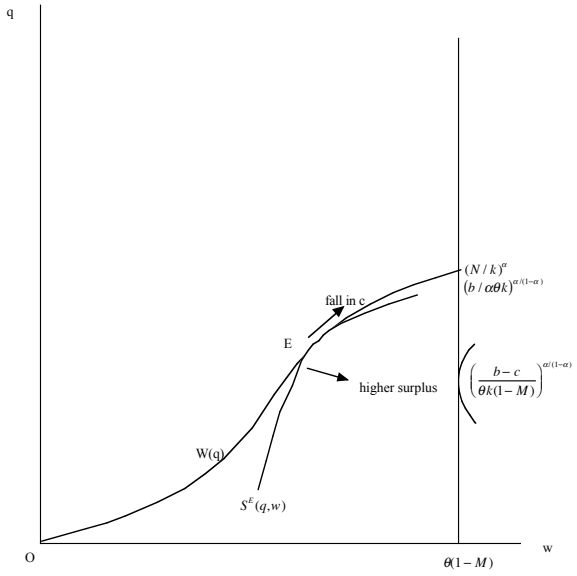

Figure 4. Weak Enforcement Case

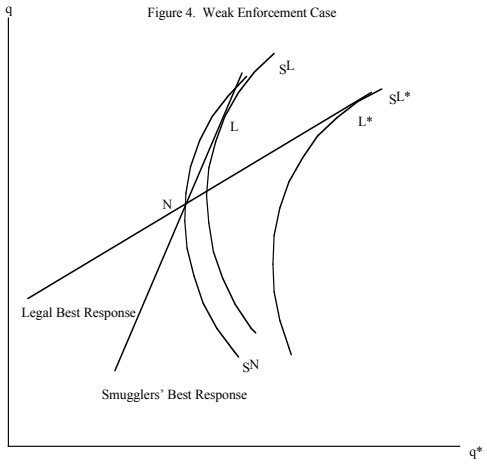

Figure 5. Strong Enforcement Case