Size, Sunk Costs, and Judge Bowker's Objection to Free Trade

by

John McLaren, Columbia University

Discussion Paper No. 701

Size, Sunk Costs, and Judge Bowker's Objection to Free Trade

John McLaren
Columbia University
June, 1994

This research has benefitted to an unusual degree from comments and encouragement of diverse colleagues. The author is grateful to seminar participants at Columbia, the University of British Columbia, and the National Bureau of Economic Research's Universities Research Conference on International Trade Rules and Institutions. Special thanks go to Richard Clarida, Michael Connally, Ronald Findlay, Michael Gavin, and most especially to Dani Rodrik and my discussants Brian Copeland and Sang-Sueng Yi. Luis Tovar provided helpful research assistance. All remaining errors are mine.

Abstract.

This paper studies trade liberalization between a large country and a small one. We make two key assumptions, suggested by political debates on trade reform in small countries. First, future production requires an irreversible investment now. Second, there is the possibility of *future* trade negotiations. Strikingly, anticipated trade negotiations may make the small country strictly *worse* off than a fully anticipated trade war, and indeed worse off than autarchy. The reason is a negative strategic externality in the small country conferred by anyone investing in the export sector; such investment tends to lock the small country into trade with the large one, harming its bargaining power. This effect is dominated by the conventional gains from trade, so that anticipated bargaining benefits the small country on balance, only if (i) the two economies are sufficiently different, and (ii) there are sufficient substitution possibilities in consumption.

1. Introduction.

The difference in language between economists and non-economists on trade policy can be bewilderingly wide. For example, when a small country considers liberalizing trade between itself and a much larger one, protectionist rhetoric often stresses the danger to the "sovereignty" of the small country, threatened by its increased "dependence" on the large one[1]. By contrast, these misgivings are not even part of the *vocabulary* of most economists. The usual economist's view is that absent large-scale trade diversion problems (usually seen as empirically unlikely), two liberalizing countries will realize an increased gain from trade, and if one country is very much smaller than the other, it will tend to realize most of these gains itself[2].

Perhaps the vocabulary can be enlarged. This paper re-examines the question of the small country's gains from bilateral liberalization, with an emphasis on some strategic questions not heretofore emphasized in the theory. Specifically, we look at the effects of anticipated *future* trade relations in the context of *irreversible* investments. When these factors are present, current investment decisions can affect future trade policies, and conversely, anticipated policy affects current investment decisions. Recognizing this allows us to study the evolution of national bargaining strength as part of the general equilibrium of

---

[1]Examples abound. The "Dependency" view of Third-World underdevelopment offers a case in point; see Diaz-Alejandro (1978) for an economist's survey. Debate on the Canada-U.S. Free Trade Agreement offers another. For example, see Brodie (1989), especially p. 180. See Woodside (1989) for a survey of the views of many political scholars on the agreement which agrees with the generalization in the text; see especially p. 167.

[2]For a recent reaffirmation of this view, see the surge in CGE studies of the North American Free Trade Agreement. Brown (1992) provides a fine summary, and virtually all of the results she surveys fit the description just given.

the system. A key conclusion is that *expected future* bilateral negotiations can have *strategic* disadvantages for a small country not heretofore recognized in trade theory, and can be harmful on balance. The key is that the very anticipation of those negotiations hurts the small country's bargaining power in equilibrium. Thus, in some cases a small country can improve its welfare by committing never to negotiate on free trade with the large country. Further, if it cannot do so, it can be desirable to use protection in the meantime to become less dependent on trade with the large country.

Since the loss of bargaining power affects *all* aspects of relations between the two countries, the trade-off might be viewed as a price the small country must pay in "sovereignty" for the benefits of free trade. This analysis thus allows us to address this set of "non-economic" issues squarely, and make precise the conditions under which they do and do not outweigh the usual "economic" benefits of liberalization.

The basis for the canonical theory of bilateral trade relations was laid by Johnson (1953-4), Rodriguez (1974) and others who studied trade wars, or Nash equilibria of tariff and quota games. This has then been built into a theory of bilateral liberalization as a bargaining problem in which the Nash equilibrium is used as the threat point; see Mayer (1981), and the survey in Dixit (1986). More recent variations include Bagwell and Staiger (1990), in which the focus is the dynamic enforcement problem, and Grossman and Helpman (1992), where the focus is the effect of domestic interest groups. In all of these interpretations, both countries are weakly better off in the negotiated outcome than in the trade war, regardless of size, because if they did not benefit from the outcome they could simply refuse to participate[3].

However, some of the obsessions of real world skeptics are not addressed by this body of work. For example, some Canadian opponents of the Canada/U.S. Free Trade Agreement (CUFTA) in the key year 1988 dwelt on the agreement as a harbinger of *future* trade talks as well as a product of current talks. This is because the agreement shattered a long-standing taboo for Canadian politicians on comprehensive trade talks with the US, going back at least to Wilfred Laurier's crushing 1911 electoral defeat on a platform of reciprocity. Furthermore, the agreement virtually guaranteed ongoing renegotiation through its abrogation clause, permitting either side to cancel the agreement without cause on six months' notice. Therefore, if the traditional taboo on reciprocity could be thought of as a credible commitment never to negotiate with the US, the CUFTA brought that commitment to an abrupt end.

One skeptic who made much of these issues was a retired judge named Marjorie Bowker, who became a minor celebrity with a grass roots campaign against ratification and won many converts[4]. The abrogation clause, and the effect on future bargaining power, were key in her arguments. In her words, taken from a widely circulated pamphlet,

> Some Canadians have been heard to say, "Let's sign the Agreement anyway. We can terminate it with 6 months' notice if we don't like it".
>
> However it is not necessarily so simple. For one thing, the termination clause works both ways. The U.S. could, for example, use it as a threat against Canada in order to force agreement to certain concessions, in other words, the U.S. could enforce its future demands by threatening to pull out -- at a time

---

[3]Strictly speaking, in Grossman and Helpman (1992), it is for the two *politicians* running the two countries that bargaining is Pareto-improving.

[4]See Howse (1988) for a concise account.

> unsuitable to Canada. This could arise, for example, in the controversial subject of unfair subsidies and countervailing duties which must still be worked out during the coming years. The U.S. might threaten to terminate the Agreement unless the new definitions are to their liking.
>
> No matter which country were to terminate the Agreement, it could place Canada in a serious predicament for this reason: once the Agreement takes effect in January 1989, Canadian industries would begin 'gearing up' and restructuring in anticipation of greater exports to the U.S. This could include costly capital expenditures for upgrading factories, modernizing equipment, re-training workers (with some being laid off, temporarily at least). Once Canada had embarked on an industrial conversions process, cancellation would simply create another disruption to our national economy.
>
> For these reasons, termination cannot be looked upon as a "way out". (Bowker, 1988, pp. 45-6)

Similar qualms about the clause were also voiced by at least one member of the academic economics community in Canada, questioning the enthusiasm of the majority of the profession:

> ...[the agreement] has the potential to seriously weaken Canada's bargaining position with the U.S. with respect to any future dispute between the two countries...Recall that the only way in which Canada will get significant gains from the deal is if Canadian industry undergoes significant adjustment in order to serve the larger U.S. market... let us suppose for the sake of argument, that the investment *does* take place. Then because of the difference in relative importance of the FTA to the two countries, Canada becomes vulnerable to threats by the U.S. to abrogate the agreement -- the major investments made by firms to reap the benefits of free trade would significantly decline in value upon abrogation. Despite the good relationship between Canada and the U.S., occasional disagreements occur, such as the acid rain dispute, the pharmaceutical legislation, the shakes and shingles dispute, and so on. As Canada becomes more vulnerable to threats of abrogation, its bargaining position on all of these types of issues weakens. (Copeland, 1988, p. 21)[5].

Note the two crucial assumptions in these two passages. First, there is some degree of

---

[5]I should point out that the title of this paper does not mean to suggest any *claim* any particular writer has to this argument. I do not know how it originated, and by calling it "Judge Bowker's objection" I certainly do not mean to belittle the subtle and penetrating paper by Prof. Copeland. I merely mean that Judge Bowker *popularized* it in the fray of public debate.

irreversibility, or costly reversibility, of investment decisions. Thus, after reorienting production towards a particular trading partner, it would be very costly to return to the status quo. Second, the existence of an abrogation clause means that signing the current agreement also implies the likelihood of *future* negotiations. These two conditions together may have very strong implications for the distribution of the gains between the small country and the large one because of the way in which they affect the threat point in the future negotiations.

It is to incorporate these concerns, dragged in from the political front lines of trade policy, into the core of the theory that this paper is intended. We do this with the simplest possible modification of the standard model. Two countries with Ricardian technology trade with each other. There are two periods. In the first, worker/entrepreneurs must choose a sector and supply the labor to it that is needed for production. In the second period they are rewarded with the output, and trade and consumption take place. This is the simplest possible way to capture the irreversibility of investment decisions. We will consider two different policy regimes. In the first, there will be no cooperation between the two governments and this is understood by all, so it is understood as of period 1 that there will be a trade war in period 2. In the second, efficient (Nash) bargaining will occur between the two parties in period 2 and this is understood by all, so it is understood as of period 1 that there will be an *ex post* Pareto efficient liberal trade regime in period 2. This is the simplest way of incorporating the effect of *future* negotiations[6].

With this very slight modification of the standard model in hand, we find some fairly

---

[6]Of course, it would be more realistic to allow for a round of output and bargaining in period 1 as well, but it does not seem necessary to do so to make the point.

surprising results. First, in the case of trade war, if a country's exports are poor substitutes for its imports or the two economies are very similar, *the large country extracts all of the gains from trade.* Second, despite this finding, under the same conditions *the small country will be better off with an anticipated trade war than with anticipated cooperation.* This striking reversal of the standard outcome is a direct result of the forces conjectured by Bowker and Copeland: anticipated cooperation leads the small country to specialize; *ex post,* this makes it desperate for negotiations to succeed and kills its bargaining power. Third, again under the same conditions *the small country citizens would be better off under autarchy than under fully anticipated cooperation.* This result follows from the first two. Finally, if the small country government can subsidize its import-competing sector in period 1 or commit to protecting it in period 2 it should do so, because by doing so, *no matter how small it is, the small country can improve its terms of trade* in equilibrium should a trade war break out by manipulating the comparative statics of trade wars. These are all inimical to standard propositions of trade theory.

Indeed, if the elasticity of substitution between imports and exports is less than one, the results above appear with startling force: because of the workings of the strategic externality, anticipated cooperation transfers *all* of the small country's wealth to the large country. The equilibrium is effectively the worst nightmare of trade policy demagogues: anticipated free trade talks plunder and impoverish the small economy, bleeding its citizens dry.

Strictly speaking, what is needed for the argument of this paper is sunk costs in *trade partner specific* capital. The empirical importance of such costs is difficult to quantify but examples abound[7]. To quote Hirschman (1945, p. 108): "World trade is built ... in large proportion upon the reliance of the export products of one particular country upon the prosperity and tastes of one other individual country. New Zealand butter, Philippine sugar, and Bulgarian tobacco were not, in general, marketed in 'industrial countries,' but they were very specifically marketed in England, the United States, and Germany, respectively; possibilities of diversion from one of these countries to another hardly existed to any relevant extent."

For perspective, it is worth noting that the argument of this paper fits into a quite small literature which views trade policy as at least partly an instrument of national *power*. Hirschman (1945) focusses on the "influence effect" on international trade, through which a country seeking power can cause a second country to become more dependent on the first and thus to lose some of its bargaining power. Hirschman argues that Nazi Germany, for example, aggressively used this strategy before the war, deliberately dominating the trade of several small countries so that they would be unable to avoid making concessions to Germany when it may demand them. Perhaps the most serious weakness of the study is that Hirschman never acknowledges the importance of sunk costs in making such an argument complete. That is an underlying theme of the present paper. In an interesting variation on Hirschman's arguments, Gowa and Mansfield (1992) argue that trade policy, by strengthening

---

[7]A particularly recent and colorful case is the failed attempts of American apple growers to export to Japan, which have required enormous costs because of Japanese pest regulations (*New York Times*, August 17, 1993, p. A1). An account of marketing efforts, specialization, and other costly adjustments taken by Canadian firms in anticipation of the CUFTA is found in Jenish (1988). These adjustments are all specific to the US market. Morawetz (1981) lists many costs that must be incurred by Colombian clothing manufacturers to learn about and sell to the New York market. Yarbrough and Yarbrough (1986) list a variety of other examples.

allies and weakening enemies, can improve a country's odds in an actual shooting war, and that this is an empirically important determinant of trade flows. In a very different vein, an argument similar in some ways to the argument of this paper is found in Diwan (1990). He considers a country with foreign debts contemplating a future round of negotiations over debt service. He shows that under some conditions it should subsidize the import-competing sector to become less dependent on trade, and thus improve its bargaining power by making its default threat more credible. Although they ask different questions, all of these contributions have some family relationship with the argument of this paper.

Section 2 introduces the model, section 3 solves for period 2 equilibrium given inherited resource allocation decisions from period 1, and section 4 solves for period 1 equilibrium. The welfare comparisons between the two regimes are performed in section 5. This is the real heart of the paper. Section 6 discusses policy implications. Section 7 is a brief summary.

2. The model: Perfect mobility.

Imagine a world with two countries, Home and Foreign. Home has L workers with one unit of labor each, and Foreign has $L^*>L$ workers. (An asterisk will always indicate Foreign.) L is a strictly positive number, but throughout the paper we will usually be interested in what happens as $L/L^*\rightarrow 0$. There are two goods, x and y. One unit of labor in Home can produce $\alpha>1$ units of x or 1 unit of y. One unit of labor in Foreign can produce either 1 unit of x or one unit of y. Thus, the Ricardian ratio of comparative costs, which shows the degree of comparative advantage, is $\alpha>1$. The resulting quantities of output are denoted X, Y, X*, and Y* respectively, and we have:

(1) $$X/\alpha + Y = L$$
$$X^* + Y^* = L^*.$$

All consumers in the two countries are identical, with CES utility functions:

$$U(c_x, c_y) = (c_x^{(\sigma-1)/\sigma} + c_y^{(\sigma-1)/\sigma})^{\sigma/(\sigma-1)},$$

where c_x and c_y denote consumption of the two goods and $\sigma\geq 0$ is the elasticity of substitution. The two countries have available *ad valorem* tariffs denoted by τ and τ^* respectively. Foreign y is the numeraire; thus, we denote the prices of the two goods by P and $(1+\tau)$ in Home and by $(1+\tau^*)P$ and 1 in Foreign, where P denotes the terms of trade.

This all implies consumption as follows:

(2) $$c_x = I/[P^\sigma(1+\tau)^{1-\sigma} + P];\ c_y = I/[(1+\tau) + P^{1-\sigma}(1+\tau)^\sigma]$$
$$c_x^* = I^*/[(P(1+\tau^*))^\sigma + P(1+\tau^*)];\ c_y^* = I^*/[1 + (P(1+\tau^*))^{1-\sigma}],$$

where I and I* denote Home and Foreign income at their respective domestic prices. Both governments redistribute any tariff revenue in a lump-sum manner among their citizens. As a result, income may be calculated:

(3) $$I = PX + (1+\tau)Y + \tau(c_y - Y)$$
$$I^* = (1+\tau^*)PX^* + Y^* + \tau^* P(c_x^* - X^*),$$

which are readily solved for I and I* using (2). Finally, we have the common indirect utility function:

(4) $$V(p, q, I) = I/[p^{1-\sigma} + q^{1-\sigma}]^{1/(1-\sigma)} \text{ if } \sigma\neq 1,$$
$$= I/(pq)^{1/2} \text{ if } \sigma=1$$

for any (domestic) price p for x and q for y, and for any level of income I (or I*, as the case may be).

At this point it will be useful to sketch how the model works out for the standard case in which labor can relocate between sectors instantly and costlessly in response to trade policy. Since the general outlines of this case are familiar, the discussion will be terse.

Clearly, from the information on marginal products of labor and from (1), we have the labor market clearing condition:

(5) $P/(1+\tau) > 1/\alpha \Rightarrow X=\alpha L,\ Y=0;$
$P/(1+\tau) < 1/\alpha \Rightarrow X=0,\ Y=L$
$(1+\tau^*)P>1 \Rightarrow X^*=L^*;\ Y=0;$
$(1+\tau^*)P<1 \Rightarrow X^*=0;\ Y^*=L^*.$

Thus, we can solve for the market-clearing terms of trade P for any pair of tariffs; substituting this into (2), (3) and (4), we get expressions for equilibrium utility in the two countries which can be written $\tilde{V}(\tau, \tau^*)$ and $\tilde{V}^*(\tau, \tau^*)$. This can all be represented in terms of offer curves; Figure 1 shows Home offer curves for different elasticities, and Figure 2 shows the world equilibrium. As demonstrated in Figure 2, Home will demand positive imports of y if the terms of trade is above $(1+\tau)/\alpha$, and Foreign will demand positive imports of x if the terms of trade is less than $1/(1+\tau^*)$. Home's tariff shifts its offer curve up; Foreign's shifts its curve down. We can see that regardless of τ, for the case shown, in which $\sigma<1$, Foreign's optimal tariff satisfies $(1+\tau^*)=\alpha/(1+\tau)$, since for any smaller tariff an increase would move the equilibrium *down* Home's offer curve, increasing Foreign's consumption of both goods; but an increase beyond that point would shut down trade completely. Note that at this level of the tariff, relative prices in Home are the same as they would have been under autarchy and therefore Home does not gain from trade. On the other hand, regardless of τ^*, the small country's optimal tariff is zero, since its tariff does not affect its terms of trade and only causes a consumption distortion. (This is readily verified by calculating $\tilde{V}$ and taking its derivative with respect to τ.) Thus, the unique Nash equilibrium with trade is given by $(\tau, \tau^*) = (0, \alpha-1)$. There is another set of Nash equilibria with no trade, comprising all pairs such that both τ and τ^* are greater than $\alpha-1$. We will focus entirely on the equilibrium with trade[8].

Matters are somewhat more complicated in the case in which $\sigma>1$, because then the Home offer curve slopes upward throughout, and Foreign must choose between apples and oranges. It is straightforward to establish, by differentiating $\tilde{V}^*$ with respect to τ^*, that Foreign will still choose the corner solution $\tau^* = (\alpha-1)$ provided that $\sigma\leq\tilde{\sigma}$, where $\tilde{\sigma}$ is defined as the solution for σ of

(6) $$\alpha^{\sigma}[((\alpha-1)/\alpha)\sigma - 1] = 1.$$

Equation (6) defines $\tilde{\sigma}$ uniquely for any $\alpha>1$, yielding a function $\tilde{\sigma}(\alpha)$ that is strictly decreasing in α, with $\tilde{\sigma}(\alpha)\to\infty$ as $\alpha\to1$ and $\tilde{\sigma}(\alpha)\to1$ as $\alpha\to\infty$. The inverse is denoted $\tilde{\alpha}(\sigma)$ and is shown in Figure 3. Clearly, the requirement that $\sigma\leq\tilde{\sigma}(\alpha)$ is the same as $\alpha\leq\tilde{\alpha}(\sigma)$ and amounts to a requirement that either a country's exports are poor substitutes for its imports or the two economies are fairly similar. Again, if this condition holds, since the relative price in Home

[8]This is somewhat arbitrary. I find the Nash equilibria without trade implausible because they are built on weakly dominated strategies, which is not true of the equilibrium with trade. This multiplicity of equilibria is a well-known problem in these models; see Dixit (1987, p. 337) , who offers a contrary view to that offered here. I do not believe that the main argument of the paper really hangs on the choice of equilibrium; this will be discussed later in places where it makes a difference.

will be exactly what it would have been under autarchy, the small country will not gain from trade.

Regardless of the value of σ, there is a unique Nash equilibrium with trade, and in it we will have $\tau=0$ and $\tau^*>0$. Immediately, this proves in this case the well-known proposition that if the countries are sufficiently different in size, free trade is not in the core (Mayer, 1981; Kennan and Riezman, 1988). Foreign clearly prefers the tariff pair of zero and its optimal tariff to the tariff pair (0, 0).

Bargaining is now straightforward to analyze. Denote the utilities at the Nash equilibrium by V^N and V^{N*}. Then the Nash bargaining solution is the tariff pair that maximizes

$$W= (\tilde{V}(\tau, \tau^*)-V^N)(\tilde{V}^*(\tau, \tau^*)-V^{N*}).$$

There is no need to solve this explicitly here. All we need are the following conclusions from this version of the model. First, in the trade war if $\sigma<\tilde{\sigma}$, since $(\tau^*+1) = \alpha$, we have $P=1/\alpha$, so that the terms of trade equals Home's autarchic price ratio. Thus, in a trade war, Home does not gain from trade. Gains from trade are realized but they are all bled away by Foreign. Second, because the bargaining solution distributes some of the gain to both partners, Home does gain in the negotiated outcome -- both relative to autarchy and relative to the trade war.

Finally, the negotiated outcome must be in the core. This means, first, that it must be Pareto efficient, and so the prices must be the same in both countries, so $(1+\tau)(1+\tau^*)=1$. Second, both countries must prefer it to the trade war. These conditions require that either Home subsidize Foreign's exports ($\tau<0$), or, equivalently, the two countries agree on free trade with a side payment from Home to Foreign (say, a shipment of free x). This is one of the great insights of the existing literature: the large country must be, in a sense, *bribed* to accept the cooperative outcome and give up its optimal tariff. Dixit (1987, p. 337) points out that in practice a negative tariff is likely to be difficult to implement and is at any rate never seen. However, in practice for any two countries there are likely to be a broad spectrum of forms in which the equivalent of a side-payment may be made. In relations between Canada and the U.S., for example, there are always disputes on such matters as who will bear the costs of acid rain and regional military arrangements, the terms on which Canadian energy sales will be made to public sector buyers in the U.S., enforcement of intellectual property rights and cross-border royalty payments, support for an embargo on a country the U.S. deems an enemy, whether or not American weapons can be tested on Canadian soil, and the like. In relations between the U.S. and Mexico, there are questions of aid, debt relief, and again, energy sales and copyright royalties. A concession on any of these ongoing issues by either side is analytically equivalent to a side payment, since these are mostly zero-sum disputes. From here on in we will use the formulation in which bargaining leads to free trade plus side payments, and we will understand that in most cases the side payment will represent the equivalent monetary value to, say, a concession on the acid rain dispute.

This completes the model with perfect labor mobility.

3. Irreversible Investment, Period 2: the Exchange Economy.

3.A. Trade and Consumption.

Now we keep everything about the model up to this point except that we impose the irreversibility assumption. Now labor must be invested in a particular sector in period 1 to be productive and is thereafter immobile. The output arrives in period 2. We must first solve the model in period 2 for a given allocation of labor, and then back up and determine that allocation endogenously in period 1. Here we deal with period 2. Let the inherited allocation of labor be such that the sectoral output levels are respectively X, Y, X^*, and Y^*. These can be treated, *ex post*, as the endowments of an exchange economy. Define $\lambda \equiv X/Y$ and $\lambda^* \equiv X^*/Y^*$. Assume[9] for this section that $\lambda > 1 \geq \lambda^*$. We might call λ an index of Home's trade dependence and λ^* an index of Foreign's trade independence (and *vice versa* for the reciprocals), since the farther are λ and λ^* from each other the greater are the *ex post* gains from trade.

Since in period 2 the world is an exchange economy, we can define the *ex post* autarchic price ratio for each country as the price ratio at which its consumers would choose to consume its endowment, hence $\lambda^{-1/\sigma}$ for Home and $(\lambda^*)^{-1/\sigma}$ for Foreign. Of course these have nothing to do with production costs, which are sunk and irrelevant. We will concentrate on values for the terms of trade in between these two values, since that is where it must settle in equilibrium.

---

[9]The other cases can be worked out in the same way, but we will not need them.

If $P \geq \lambda^{-1/\sigma}$, then Home's export supply is given by:

$$\text{(7)} \qquad XX(P) = X - c_x = \frac{X - YP^{-\sigma}(1+\tau)^{\sigma}}{[1 + P^{1-\sigma}(1+\tau)^{\sigma}]},$$

where we have used (2). The shape of offer curve that this implies is shown in Figure 4. Analogously, Foreign's import demand if $P \leq (\lambda^*)^{-1/\sigma}$ is given by:

$$\text{(8)} \qquad MX^*(P) = c_x^* - X^* = \frac{Y^* - X^*(P(1+\tau^*))^{\sigma}}{[(P(1+\tau^*))^{\sigma} + P]}.$$

The equilibrium is depicted in Figure 5, for the case $\sigma<1$.

3.B. Trade Wars.

We could in principle equate (7) with (8) to find the equilibrium price for any τ and τ^* and calculate Nash equilibrium tariffs in that way, but since there is no closed form expression for the equilibrium terms of trade, and since here any tariff equilibrium with trade will be an interior solution (see Figure 5), that would be quite onerous. Instead we will use a shortcut. Instead of calculating equilibrium tariffs for arbitrary L and $L^*>L$, we will calculate the *limits* of the equilibrium tariffs as $L/L^*\rightarrow 0$. This is tractable because of two facts. First, for either country, the optimal tariff is equal to the reciprocal of the export elasticity of the other country. This is a well-known result derived, for example, in Dixit and Norman (1980, pp. 150-2). Second, as $L/L^*\rightarrow 0$, the smallest elasticity of export supply for any point on the Foreign offer curve that can be reached by the Home offer curve goes to infinity (see Figure 5); thus, the optimal choice for τ goes to zero. This means that to find the limiting value of the equilibrium τ^*, all we need to do is to use the inverse elasticity formula with Home's free-trade offer curve. Define $z \equiv \lim_{L/L^* \to 0}(1+\tau^*)$, where τ^* is Foreign's optimal tariff; then the optimal tariff formula is:

$$z - 1 = \lim_{L/L^* \to 0}\left(\frac{P}{XX(P)}\frac{dXX}{dP}\right)^{-1}.$$

Using (7) and rearranging, this gives:

$$\text{(9)} \qquad \lambda^* z^\sigma - \lambda(\lambda^*)^{(1-\sigma)/\sigma} z^{-\sigma} + \sigma(\lambda^*)^{1/\sigma} z - \sigma\lambda z^{-1} - (1-\sigma)[\lambda - (\lambda^*)^{1/\sigma}] = 0.$$

This gives an explicit expression for z only in special cases. In the Cobb-Douglas case (σ=1), the solution is simply:

$$\text{(10)} \qquad z = \sqrt{\frac{\lambda}{\lambda^*}}$$

This expression contains a lot of information. First, z is strictly greater than unity whenever $\lambda > \lambda^*$. Thus, as long as the two countries' endowment proportions are different, as the small country becomes vanishingly small, the optimal tariff of the large country against it does *not* become vanishingly small. Of course, as $L/L^* \to 0$, the effect of the small country on large country welfare becomes vanishingly small, as does the difference between equilibrium domestic prices in Foreign and the autarchic prices in Foreign. But although the ***benefit*** from protectionism becomes vanishingly small as Home becomes small, ***the tariff that maximizes*** *this benefit does not.* This is a powerful insight of the orthodox literature[10]: large countries do have an incentive to pick on tiny countries. It is only as λ falls toward λ^*that z approaches unity; as the *ex post* opportunities for trade become small, so does the largest tariff that does not kill off all trade, and hence so does the optimal tariff.

The second observation is that z is strictly increasing in λ and decreasing in λ^*, with $z \to \infty$ as $\lambda \to \infty$ and as $\lambda^* \to 0$. Thus, as Home becomes more dependent on trade, the barriers that are raised against its trade become more severe, and as Foreign becomes more dependant on trade, it also becomes more aggressive in manipulating the terms of trade in its favor. There is an ironic quality to this, rather like the belief of some people that remembering to bring their umbrella causes pleasant weather and forgetting it causes thunderstorms. If Home workers were very worried in period 2 about Foreign protectionism and many of them invested in the import good as a result, then in fact *as a result* protectionism will be mild. But if they were optimistic about protectionism and all specialized in x, the result will be $\lambda=\infty$ and extremely severe protectionism[11]. This dependence of z on λ represents a major strategic externality in the Home country which will be very important in what follows.

Similar features are exhibited by the special case with $\sigma=1/2$ and $\lambda^*=1$, in which the solution is simply $z=\lambda$. In addition, comparing these two shows that the diminished substitutability between exports and imports yields an equilibrium tariff that is higher and

---

[10]For example, see Mayer (1981). Kennan and Riezman (1988) calculate the exact Nash equilibrium tariffs for the Cobb-Douglas case, so it is easy to see just *how* the tariffs converge to the limit as $L/L^* \to 0$.

[11]Of course, the tariff will not in fact be infinite -- it will be a large finite number. For $\lambda=\infty$, there is strictly speaking no optimal tariff; the supremum of Foreign utility can be arbitrarily closely approached by a sufficiently high finite tariff.

more responsive to Home's trade dependence. This is because higher elasticities erode monopoly power here as anywhere. The basic features of these two special cases are shown in Proposition 1 to be general: The importance of substitutability, in parts (i) and (iv), and the "umbrella theorem" in (ii) and (iii).

Proposition 1. *(i) Assume $\lambda^*=1$. Then Foreign's optimal tariff is decreasing in σ. It falls to a limit of zero (i.e., $z=1$) as σ becomes large, and becomes arbitrarily large as σ falls toward zero.*

(ii) z is everywhere increasing in λ for $\lambda \geq 1$.

(iii) If $\lambda^*=1$, we have two cases.

Case I: $\sigma \leq 1$. Then $z \to \infty$ as $\lambda \to \infty$.

Case II: $\sigma > 1$. Then $z \to z^\infty(\sigma) < \infty$ as $\lambda \to \infty$, where $z^\infty(\cdot)$ is a strictly decreasing function with $\lim_{\sigma \to 1+}(z^\infty) = \infty$ and $\lim_{\sigma \to \infty}(z^\infty) = 1$.

(iv) Recall $\tilde{\sigma}(\alpha)$ as defined by (6). Then $z^\infty < \alpha$ if and only if $\sigma > \tilde{\sigma}(\alpha)$.

The proof involves tedious manipulation of (9), and is left to an Appendix.

Now, armed with the equilibrium tariffs, we can calculate utilities in the two countries. First note that for L/L^* sufficiently small the terms of trade P is equal to $(\lambda^*)^{-1/\sigma}z^{-1}$ (see Figure 5). Now, denoting by $V(\lambda, \lambda^*, \sigma)$ and $V^*(\lambda, \lambda^*, \sigma)$ the utility of a worker in each country absent side payments, we have:

$$\text{(11)} \qquad V(\lambda,\lambda^*,z) = \frac{I/L}{[P^{1-\sigma} + (1+\tau)^{1-\sigma}]^{1/(1-\sigma)}} = \frac{z^{-1}\lambda + (\lambda^*)^{1/\sigma}}{[z^{-(1-\sigma)} + (\lambda^*)^{(1-\sigma)/\sigma}]^{1/(1-\sigma)}} \frac{1}{[\lambda/\alpha + 1]},$$

if $\sigma \neq 1$, and

$$\text{(12)} \qquad V(\lambda,\lambda^*,z) = \frac{I/L}{[P\ (1+\tau)]^{1/2}} = \frac{z^{-1}\lambda + \lambda^*}{[\lambda^* z^{-1}]^{1/2}[\lambda/\alpha + 1]},$$

if $\sigma=1$. We have used (1), (3) and (4), as well as $\tau=0$. Since increases in z and in λ^* worsen Home's terms of trade, V is decreasing in z and in λ^* provided that Home exports x[12]. V is also increasing in λ for a given z and λ^* provided that the terms of trade are above Home's autarchic price ratio[13]. V^* can be written out similarly:

$$\text{(13)} \qquad V^*(\lambda,\lambda^*,z) = \frac{I^*/L^*}{[(P(1+\tau^*))^{(1-\sigma)} + 1]^{1/(1-\sigma)}}$$

if $\sigma \neq 1$, with a similar expression if $\sigma=1$, where I^* is given by (3).

3.C. Bargaining.

[12]The precise condition is $\lambda^{-1/\sigma} < (\lambda^*)^{-1/\sigma} z^{-1}$, which says that Home's *ex post* autarchic price is less than the terms of trade.

[13]The precise condition is $1/\alpha < (\lambda^*)^{-1/\sigma} z^{-1}$.

We will use the formulation in which the "bribe" to Foreign alluded to in the perfect mobility case is paid in the form of a side-payment rather than in the form of an import subsidy. As noted above, these are mathematically equivalent but the side payment is more realistic. Thus, under the negotiated outcome, we will have z=1 and a payment of S per Home worker to Foreign. The threat point will be a trade war. We denote respectively the threat point utility in the two countries by V_T and V_T^*, and the free trade utility by V_F and V_F^*. (In what follows $\sigma \neq 1$; the Cobb-Douglas case is analogous.) Under these conditions, Nash bargaining maximizes the following function:

$$W(S) = \left(V_F - \frac{S}{[P^{(1-\sigma)} + 1]^{1/(1-\sigma)}} - V_T\right) \cdot \left(V_F^* + \frac{SL/L^*}{[P^{(1-\sigma)} + 1]^{1/(1-\sigma)}} - V_T^*\right)$$

Maximizing this and subtracting the equilibrium payment from Home income, we can find final utility for the Home worker under the bargaining outcome, denoted V_B:

$$V_B = V_T + \frac{1}{2}\left[(V_F - V_T) - \frac{L^*}{L}(V_T^* - V_F^*)\right] \tag{14}$$

The quantity in the square brackets is the international surplus generated by free trade relative to the trade war, calculated per Home citizen. The first term is the Home surplus, and the second is the aggregate Foreign benefit from a trade war (per Home citizen), which is minus one times the Foreign surplus from free trade. Subtracting Foreign's preference for a trade war from Home's preference for free trade delivers the total surplus from free trade. If the trade war is internationally inefficient, this value will be positive, even though $V_T^* > V_F^*$.

4. Irreversible Investment, Period 1: Resource Allocation.

Now we know what happens in period 2 for any given allocations λ and λ^* in the event of a trade war and in the event of cooperation. Assuming that worker/entrepreneurs understand this, this allows us to work out what those allocations will be by analyzing equilibrium choices in period 1. The key is the market-clearing relationship (5), with P interpreted as the price *expected* as of period 1 to prevail in period 2, and the tariffs as the expected tariffs. The worker/entrepreneurs understand what the equilibrium tariffs will be for any λ and λ^*, and that

(15) $$\lim_{L/L^* \to 0} P = (\lambda^*)^{-1/\sigma}/z.$$

(Again, consult Figure 5.) Under these conditions, the first observation to make is that if L/L^* is very small, Foreign will be incompletely specialized. (By (15), if it specialized in either good, since then $\lambda^*=0$ or ∞, the domestic relative price of the other would exceed unity if L/L^* is small, and thus contradict (5).) Thus, for reasons quite analogous to the case of perfect mobility, we have a domestic price in the large country equal to its ratio of marginal products of labor. Thus, we must have $zP = 1$. By (15), this means that in the limit, $\lambda^*=1$.

Next, we analyze the determination of λ. This is more complicated, and we must distinguish between the two policy regimes which concern us. First, consider the case of an anticipated trade war. In that case, substituting $\lambda^*=1$ into (15) and using Proposition 1 gives us an arbitrarily close approximation for P as a function of λ. This gives the terms-of-trade implications of any given labor market allocation, and is summarized by the light curve in Figure 6. At the same time, (5) with $\tau=0$, $\lambda^*=1$ and $(1+\tau^*)=z$, gives a correspondence for λ in terms of P. This gives the labor market equilibrium for any given expected terms of trade, and is summarized by the heavy curve in Figure 6. The intersection of the two curves then gives the equilibrium λ and P. By Proposition 1, there are three important cases: If $\sigma\leq 1$, the light curve falls toward zero as λ becomes large, but if $\sigma>1$, it falls only to a lower bound of $1/z^{\infty}>0$, and if $\sigma>\tilde{\sigma}(\alpha)$, the lower bound is $1/z^{\infty}>1/\alpha$.

It is immediate, and somewhat surprising, that if $\sigma\leq\tilde{\sigma}(\alpha)$, there is exactly one equilibrium: $P=1/\alpha$. Thus, the allocation of labor in Home adjusts so that the *ex post* tariff that Foreign will choose is equal to $(\alpha-1)$, making Home investors *ex ante* indifferent between the two sectors. It is clear why this happens: If any higher price was expected, Home workers would all rush to x, with the result that $\lambda=\infty$, and Foreign would choose a giant tariff, pushing P down close to zero. Thus, we have a contradiction. Similarly, if any lower price was expected, Home workers would rush to y, yielding $\lambda=0$ and no tariff on x; thus we would have $P=1$ (or greater, if a tariff was imposed on y), and all workers would regret their decision. Thus, $1/\alpha$ is the unique rational expectations terms of trade, and consequently Home does not gain from trade.

For higher levels of σ we find that in equilibrium $\lambda=\infty$ and $P=1/z^{\infty}>1/\alpha$. Thus, the small country gains from trade under *exactly* the same conditions as was the case with perfect labor mobility.

It is important to note that in the cases in which Home does not gain from trade, a positive fraction of its labor force is devoted to y production and is hence misallocated.

Denote the equilibrium value of λ by λ^e and let $\theta \equiv \alpha/[\lambda^e+\alpha]$ be the fraction of the labor force so misallocated. In the Cobb-Douglas case, (10) implies that $\lambda^e=\alpha^2$ and thus half of the labor force is misallocated if the two economies are very similar ($\theta \cong 1/2$ if $\alpha \cong 1$) but a negligible fraction if they are very different ($\theta \to 0$ as $\alpha \to \infty$). Similarly, when $\sigma=1/2$ we find that $\lambda^e=\alpha$; thus half of the labor force is misallocated for all α. Note how different this is from the case of a trade war with perfectly mobile labor: in that case Home specialized completely in x, so there was no misallocation of labor. Further, the tariff and domestic prices in Foreign are the same in both cases, but here there is strictly less trade, hence less tariff revenue; therefore, Foreign is worse off. The reason for these anomalies is roughly the same as in the classic opportunism problem of industrial organization[14]: it could be advantageous to both if Home were to invest more in x, but if it did, it would be vulnerable to Foreign, and is therefore reluctant. Foreign would be better off if it could somehow *commit* not to use a tariff greater than α no matter what.

For the case of general elasticity, we can solve (9) for λ with $z=\alpha$ to get λ^e and then use this in the definition of θ to get:

$$\theta = \frac{[1 + (1-\sigma)\alpha^{\sigma} + \sigma\alpha^{\sigma-1}]}{[1 + \alpha^{\sigma} + \alpha^{\sigma-1} + \alpha^{2\sigma-1}]} \quad \text{if } \sigma < \tilde{\sigma}(\alpha).$$

This takes a value of 1/2 for $\alpha=1$, and for large α this takes a value of $(1-\sigma)$ when $\sigma \leq 1$. When $\sigma>1$, for high enough α we will have $\lambda^e=\infty$ and so $\theta=0$. Thus, if the two economies are very similar, half of the labor force will be misallocated; if they are very different, the

---

[14]See section 6 for a brief discussion of the relationship between that class of problems and this one.

misallocation will be large if substitutability is low and small or nil if substitutability is high. Indeed, if the two goods are perfect complements and the two economies are very different, virtually *all* of Home's labor will be in the wrong sector. This is, of course, because a lower substitutability between the two goods gives Foreign an incentive to use a much higher tariff for any given allocation of labor. Once again, the opportunistic nature of the tariff results in a less efficient allocation of labor under irreversible investment than would have obtained under perfectly mobile labor. Again, although this efficiency loss occurs in Home, its cost is borne entirely by Foreign.

This completes the equilibrium for the case of an anticipated trade war. In the case of anticipated negotiations, we will still have $\lambda^*=1$ for the same reasons as before. Now recalling that $z=1$ in the negotiated settlement, (15) tells us that $P=1$; therefore, from (5), we must have $\lambda=\infty$. Thus, we see that Home's dependence on trade is maximized when cooperation is anticipated.

5. Welfare.

We have now seen all the elements of equilibrium under both policy regimes. Now we may examine the bottom line. Is anticipated cooperation better or worse than anticipated war?

If $\sigma\geq\tilde{\sigma}(\alpha)$, anticipated cooperation must be preferable to the anticipated trade war because in both cases $\lambda=\infty$, so the anticipated trade war outcome is the same as the threat point of the bargaining problem. Henceforth, we will focus on the case with $\sigma<\tilde{\sigma}(\alpha)$. In that case, substituting $z=\alpha$ and $\lambda^*=1$ into (11) and (12) yields expressions for Home utility under the anticipated trade war:

(16) $V_W = [\alpha^{-(1-\sigma)} + 1]^{-1/(1-\sigma)}$ if $\sigma \neq 1$, $\sigma \leq \tilde{\sigma}(\alpha)$;

$= \alpha^{1/2}$ if $\sigma=1$.

Note that this is simply Home's *ex ante* autarchic utility.

We compare this with utility under anticipated cooperation. Recalling (14), to evaluate Home welfare under the bargaining regime we must evaluate the surplus the two countries receive under free trade relative to the threat point. We will evaluate the Home surplus first. Using (11) and (12) with (15), setting $\lambda^*=1$ and taking the limit as $\lambda \to \infty$, we find that Home utility as a function of Foreign's gross tariff z is, before correcting for the side payment, given by:

$$V(z) = \begin{cases} \dfrac{\alpha}{\left[1 + z^{1-\sigma}\right]^{1/(1-\sigma)}} & \text{if } \sigma \neq 1; \\[2ex] \alpha z^{-\frac{1}{2}} & \text{if } \sigma = 1. \end{cases}$$

Under free trade, we have $z=1$, so to use the notation of (14), we have

$V_F = \alpha 2^{-1/(1-\sigma)}$ if $\sigma \neq 1$;

$= \alpha$ if $\sigma=1$.

To find the threat point utility V_T, we must distinguish two cases. If $\sigma>1$, we simply set $V_T=V(z^{\infty}(\sigma))>0$. On the other hand, if $\sigma \leq 1$, we must take the limit of V(z) as $z \to \infty$. This gives a utility level of *zero*. This is essentially the insight of Judge Bowker and Professor Copeland. If the Home workers expect cooperation and hence liberal trade, they will all invest in x, and we will have $\lambda=\infty$. But this high level of dependence on trade also dramatically worsens their threat point (making it worse for them for a given Foreign tariff, and also raising the threatened tariff), thus harming their bargaining power[15].

Next, to evaluate the Foreign surplus, we use (13) with (3), (15), (1), and the requirement that $\lambda^*=1$ in equilibrium to find:

$$\left(V_T^* - V_F^*\right)\frac{L^*}{L} = \begin{cases} \dfrac{(\tau^*P)MX^*}{2^{1/(1-\sigma)}}\dfrac{1}{L} & \text{if } \sigma\neq 1; \\[2ex] \dfrac{(\tau^*P)MX^*}{L} & \text{if } \sigma = 1. \end{cases}$$

where MX^* denotes Foreign's imports of x under the trade war. The meaning of this equation is immediate: in order to accept free trade, Foreign would need to be compensated for the lost revenue from the trade war. The amount of this tariff revenue, deflated by the free-trade price deflator and evaluated per Home resident, is exactly the right hand side of the equation. Now, using balanced trade and (7), again with (15) and letting $\lambda\rightarrow\infty$, this becomes:

$$\left(V_T^* - V_F^*\right)\frac{L^*}{L} = \begin{cases} \alpha\dfrac{(z-1)}{(z+z^{\sigma})}\dfrac{1}{2^{1/(1-\sigma)}} & \text{if } \sigma\neq 1; \\[2ex] \dfrac{\alpha}{2}\left(\dfrac{z-1}{z}\right) & \text{if } \sigma = 1. \end{cases}$$

If $\sigma>1$, we simply replace z in this expression with z^{∞} to find the value of this surplus in

---

[15]This conclusion actually does not hang on selection of the Nash equilibrium with trade as the threat point. A similar conclusion would emerge with the autarchic equilibrium as the threat point. Home's autarchy utility is also decreasing in λ in the relevant range, since in any trade equilibrium in this model λ will be above the optimal autarchy ratio of x and y output. Chan (1988) studies this point in some detail.

equilibrium. On the other hand, if $\sigma<1$, we must let $z\to\infty$; it is easy to see that in the limit the expression is *equal* to the expression just derived for V_F: the compensation required by Foreign to accept free trade is equal to the *whole* of Home's surplus from free trade. Similarly, letting $z\to\infty$ for $\sigma=1$ gives Foreign surplus of $\alpha/2$, or half of the Home free trade surplus.

Putting these elements together, we have the following evaluation of welfare under anticipated bargaining:

$$(17)\qquad V_B = \begin{cases} \dfrac{\alpha}{2}\left[[1+(z^{\infty})^{1-\sigma}]^{-1/(1-\sigma)} + \left(\dfrac{(z^{\infty})^{\sigma}+1}{(z^{\infty})^{\sigma}+(z^{\infty})}\right)\dfrac{1}{2^{1/(1-\sigma)}}\right] \text{ if } \sigma>1; \\ \dfrac{\alpha}{4} \text{ if } \sigma=1; \\ 0 \text{ if } \sigma<1. \end{cases}$$

There is a rather deep difference between the cases $\sigma<1$ and $\sigma\geq1$, as highlighted by this equation. The Foreign tariff can be thought of as doing two things: it transfers wealth from Home to Foreign, and it introduces a deadweight loss through the consumption distortion, which is generated by the difference in prices faced by consumers in the two countries. Thus, it is an imperfect transfer in which the gain to Foreign is smaller than the loss to Home, resulting in a positive value for the surplus from free trade in (14) and mutual gains from negotiation. For $\sigma\geq1$, this surplus is increasing in the tariff. However, if $\sigma<1$, then as the tariff becomes sufficiently large, the wealth transfer becomes so complete that Home consumption becomes vanishingly small and the consumption distortion vanishes in importance. Thus, the surplus from free trade in (14) also vanishes, and so does the mutual benefit from negotiation. This is why the Home country receives zero utility in the bargaining outcome for the case of low substitutability.

This phenomenon is a consequence of the backward bending offer curve that obtains with $\lambda=\infty$ and $\sigma<1$. It is thus related to a well-known insight of theoretical public finance: that the marginal cost of funds from an income tax is less than unity if the supply curve for labor bends backward[16]. The income effect of a worsening terms of trade dominates the substitution effect if $\sigma<1$, so an increase in Foreign's tariff *increases* Home's exports, thus *expanding* the base on which the tariff is raised. For an arbitrarily large tariff, Home's exports are arbitrarily close to its whole supply. The result is that Foreign chooses a very high tariff, and virtually all of the wealth of the Home country is transferred to Foreign without cost.

Finally, using (16) and (17), we may compare Home's welfare under the two policy regimes. First, clearly if $\sigma<1$, the anticipated trade war is far superior to anticipated cooperation. The trade war leaves Home residents as well off as they would be under autarchy, but anticipated cooperation bleeds away all of their wealth. If $\sigma=1$, an anticipated war is superior to anticipated cooperation if and only if $\alpha < 16$. If $\sigma \in (1, \tilde{\sigma}(\alpha))$ the solution must be obtained numerically and is plotted in Figure 7. For any σ in this range, a threshold level for α can be calculated, denoted $\bar{\alpha}(\sigma)$[17], for which anticipated cooperation is superior if

[16]See Stiglitz and Dasgupta (1971) and Atkinson and Stern (1974) for early explorations of this point, and Ballard and Fullerton (1992) for an overview.

[17]The graph of $\tilde{\alpha}(\sigma)$, shown in Figure 3, lies everywhere above and to the right of $\bar{\alpha}(\sigma)$, but is not shown in Figure 7. Further, numerical calculations show that $\bar{\alpha}(\sigma)$ becomes very close to 16 as $\sigma\rightarrow1^{+}$.

$\alpha>\bar{\alpha}(\sigma)$ but an anticipated trade war is superior if $\alpha<\bar{\alpha}(\sigma)$[18]. Since the classical gains from trade are increasing in α, we can read this as saying that for cooperation to be beneficial, the classical gains from free trade must be great enough to exceed the *strategic disadvantages* that come with negotiating it.

A final point to make about the welfare comparisons is that in each case in which a trade war is preferred to cooperation, autarchy is also preferred to cooperation, since in those cases Home's autarchic utility is identical to its utility in the anticipated trade war (provided that the autarchy was also anticipated). We conclude that in these cases in this model autarchy is preferred to free trade (for the small economy!) *if* the *only* way of securing free trade is by deferred negotiations. This is an indication of the strength of the negative strategic externality associated with investment in the export sector.

6. Partial Remedies.

In a slightly expanded model, there are a number of measures the small country may be able to take to improve on the two poor options we have just examined.

First, since the tariff Home finally faces if there is a tariff war depends positively on λ, investments in x generate a negative externality. One might suspect, then, that if the Home government can tax x investment or subsidize y investment in period 1, it will be able to improve matters. This is indeed correct. In the case of an anticipated trade war, a period 1

---

[18]Note that the elasticity of V_B with respect to α equals one everywhere, but the elasticity of V_W with respect to α equals $(1+\alpha^{1-\sigma})^{-1}<1$, so that it must always be the region below $\bar{\alpha}$ for which the trade war is superior.

subsidy of s to y investment in Home modifies (5) slightly, with s taking the place of τ. Tracing through the effects of this on Figure 6, we see immediately that a rise in s would shift the heavy curve up, thus lowering λ. Thus, we can write $\lambda(s)$, with $\lambda'<0$.

If the subsidy is financed by a lump-sum tax, utility under the subsidy is given by:

$$V^s = \frac{I/L}{(P^{1-\sigma}+1)^{1/(1-\sigma)}} = \frac{((1+s)\lambda+\alpha)}{((1+s)^{1-\sigma}+\alpha^{1-\sigma})^{1/(1-\sigma)}}\frac{1}{[\lambda/\alpha+1]}$$

from (4), (1), and $\alpha P = (1+s)$, which comes from the modified Figure 6. Taking the derivative of this with respect to s and setting s=0, we find an improvement provided that $\lambda>[\alpha/(1+s)]^\sigma$, which is the condition that Home exports y[19]. A similar principle would work in the case of anticipated cooperation, but the subsidy would need to be at least $(\alpha-1)$ to have any effect. In addition, under either anticipated cooperation or trade war, a subsidy just large enough to induce the same allocation of Home resources as would obtain under autarchy would also be welfare-improving, because then *ex post* Home utility would be no lower than under Autarchy[20].

Thus, we have -- unusually -- a simple proof of a beneficial small subsidy *and* of a beneficial large one.

A natural extension of this idea would be to consider two rounds of production and trade following the irreversible investment, and look at the possibility of a period 1 tariff on y. By the usual sort of second best reasoning (Bhagwati, 1971), we would expect to find that

---

[19]Recall that $(1+s)/\alpha$ is the equilibrium relative price.

[20]I am grateful to Dani Rodrik for pointing this out.

a small period 1 tariff, despite the additional consumption distortion it would impose, would improve Home welfare.

A second possibility, if there happen to be other countries in the world besides Home and Foreign, is to try to include some of those in any liberalization[21]. It is tempting to speculate that if Home is dependent on trade with several other countries rather than simply one, then should a trade war break out, each country will have less of an incentive to hit Home with a very high tariff than Foreign does in this model, and for a given level of tariffs, the damage to Home's welfare will be less than in a model with only one trading partner. The former is likely to hold with special force if countries are bound by Most Favored Nation rules. However, all of this is mere speculation, well beyond the scope of this paper. A multilateral extension of this inquiry would be a very promising avenue to explore.

A measure that is *not* likely to help is the negotiation of an agreement in period 0, before labor allocations have been determined. The reason is that in the regime of anticipated cooperation, if there is no prior agreement, the two countries' payoffs, as derived in section 5, will be Pareto efficient, since they will correspond to (correctly anticipated) free trade plus a side payment. These payoffs will constitute the threat point payoffs for period 0 bargaining; and since the threat point is Pareto efficient, the only possible negotiated outcome is the threat point itself. This is a major difference between this game of liberalization and the usual hold-up problem of industrial organization. In the latter, a firm contemplating a relationship-

[21]This sort of argument has a long history. During the debate on the repeal of the Corn Laws, Macaulay argued for free trade thus: "Next to independence, and indeed, amounting to practically the same thing, is a very wide dependence, a dependence on the whole world, on every state and climate." Quoted by Hirschman (1945, p. 7), who notes related arguments by Smith on Britain's dependence on trade with the American colonies.

specific investment always has the option of walking away at period 0 if it anticipates a hold-up; thus it can not possibly do worse than it would have done if it had never met the transactions partner[22]. In many models, prior negotiation can remove the problem entirely[23]. However, in the problem of national bargaining studied in this paper, the rational actions taken by *decentralized* agents in *anticipation* of future bargaining can rob the small country of its flexibility, and make it worse off than it would have been if its trade partner did not exist.

7. Conclusion.

We have made two very minor extensions to the canonical model of trade negotiations between a small country and a large country. First, the inputs to production must be committed, irreversibly, some time in advance of the actual output. Second, negotiations, if they occur, occur after this investment. These modifications were motivated by the vigourous public debate in Canada on the Canada-U.S. Free Trade Agreement, and particularly by fears some Canadians had about its abrogation clause. They have been shown to have remarkably large effects.

The driving force behind the model is the fact that in either policy regime studied, investments in the small country's export sector generate a negative strategic externality, for two reasons. First, if there should be a trade war in the future, a higher dependence by the

---

[22]See, for example, the classic treatments by Klein, Crawford, and Alchian (1978) and Grossman and Hart (1986).

[23]See MacLeod and Malcomson (1993).

small country on its export good will give the large country an incentive to charge a higher tariff (the "umbrella theorem" of Proposition 1). Thus, because of its ability to shift its trade partner's future incentives to protect, the small country can greatly influence its future terms of trade -- even if it is infinitesimal compared to the large country. Second, if negotiations are expected in the future, greater dependence on the export good will worsen the threat point, hampering the small country's bargaining power. In both cases, individual investors ignore their own small contributions to this aggregate harm.

This externality results in a variety of perverse outcomes. Most notably, fully anticipated negotiations are worse for the small country than is a fully anticipated trade war whenever exports are sufficiently poor substitutes for imports or the two economies are sufficiently similar. In these cases, negotiated free trade is also worse than autarchy. In the most extreme case, anticipated trade talks transfer all of the small country's wealth to the large country. To restore the superiority of cooperation that is the usual presumption of trade theory, exports must be sufficiently substitutable for imports *and* the two countries must be sufficiently different. Another result is that temporary protectionism in the small country can be welfare-improving, and thus, if the small country anticipates an opportunity to negotiate free trade with the large country in the future, the small country has an incentive to use some protection in the meantime.

This argument is not intended to condemn bilateral trade agreements, which must, as anything, be judged in their full unruly complexity, one case at a time. It is simply intended to highlight one strategic issue which is likely to be relevant in many cases but has not been part of the formal theory. The model can also be read as an argument on the relative merits of multilateralism versus bilateralism. Finally, it may be useful in some elements of the political economy of free trade agreements. Is it possible that part of the reason worries about the "price" of the agreement in terms of sovereignty and future political repercussions caused so much more consternation in Canada in 1988 than they seem to now in Mexico is that the Canadian and American economies are so similar while the Mexican and American economies are so different -- is $\alpha<\bar{\alpha}$ in the first case but $\alpha>\bar{\alpha}$ in the second?

APPENDIX

Proof of Proposition 1.

(i) Call the expression on the left hand side of (9) G(z, σ). It is mechanical to verify that if $\lambda^*=1$, $G_\sigma>0$ and $G_z>0$. Thus, the optimal z is certainly decreasing in σ. The easiest way to see that $z\to\infty$ as $\sigma\to 0$ is to note that in the limit, Home's offer curve is downward sloping throughout the quadrant, so that the farther Foreign moves down the offer curve, the more of both goods its consumers receive (see Figures 4 and 5). Similarly, as $\sigma\to\infty$ Home's offer curve becomes a ray through the origin, thus infinitely elastic, and so $z\to 1$.

(ii) The first order condition for the large country's optimal tariff, equation (9), can be written:

(A.1) $$A(z;\lambda^*,\sigma) = \lambda B(z;\lambda^*,\sigma),$$

where

$$A(z;\lambda^*,\sigma) = [1 + (z-1)\sigma](\lambda^*)^{(1-\sigma)/\sigma}z^{1-\sigma} + z$$

and

$$B(z;\lambda^*,\sigma) = \left[z^{-\sigma}(\lambda^*)^{(1-\sigma)/\sigma} + \frac{\sigma}{z} + (1-\sigma)\right]\frac{z^{1-\sigma}}{\lambda^*}$$

For any λ, λ^* and σ with $\lambda>\lambda^*$ and $\lambda\geq 1$, $\lambda B(1;\lambda^*,\sigma) \geq A(1;\lambda^*,\sigma)$. At the same time, $\lambda B(z;\lambda^*,\sigma)/A(z;\lambda^*,\sigma) \to 0$ as $z\to\infty$. Thus, there is an interior solution of the first order condition at which the λB schedule cuts the A schedule from above. Since neither A nor B is affected by λ, this means that an increase in λ raises the value of z that solves (A.1).

(iii) Suppose that $\lambda^*=1$. If $\sigma<1$, B is positive for all z; thus as $\lambda\rightarrow\infty$, λB shifts upward everywhere without bound; since A increases in z globally and without bound, the solution to $A=\lambda B$ satisfies $z\rightarrow\infty$ as $\lambda\rightarrow\infty$. However, if $\sigma>1$, there exists a least upper bound, which we will denote z^∞, to the set $\{z: B(z, \lambda^*, \sigma)\geq 0\}$. This must also be an upper bound for the z which solves the first order condition, and indeed, the optimal z must take a limit of z^∞ as $\lambda\rightarrow\infty$; see Figure 8. That z^∞ depends on σ in the manner claimed in the Proposition can be seen from Figure 9 and the realization that z^∞ solves $B(z, 1, \sigma)=0$ for z..

(iv) Finally, $z^\infty<\alpha$ if and only if $B(\alpha, \lambda^*, \sigma)<0$. For $\lambda^*=1$ and for given α, the greatest lower bound for values of σ that satisfy this condition, denoted σ^*, is given by $B(\alpha, 1, \sigma^*)=0$. But this is just equation (6).

Bibliography

Atkinson, Anthony B. and Nicholas H. Stern (1974). "Pigou, Taxation, and Public Goods," *Review of Economics Studies* 41 (January), pp. 119-28.

Bagwell, Kyle and Robert W. Staiger (1990). "A Theory of Managed Trade," *American Economic Review* 80:4, pp. 779-795.

Ballard, Charles L. and Don Fullerton (1992). "Distortionary Taxes and the Provision of Public Goods," *Journal of Economic Perspectives* 6:3 (Summer), pp. 117-132.

Bhagwati, Jagdish (1971). "The Generalized Theory of Distortions and Welfare," in Bhagwati, J. N., Ronald W. Jones, Robert A. Mundell and Jaroslav Vanek (eds.), *Trade, Balance of Payments, and Growth: Papers in International Economics in Honor of Charles P. Kindleberger*, North Holland. Reprinted in Bhagwati (ed.), *International Trade: Selected Readings* (2nd edition). 1987, Cambridge: MIT Press.

Bowker, Marjorie M. (1988). "What Will the Free Trade Agreement Mean to You and to Canada? An independent analysis based on the Actual Text of the CANADA/U.S. FREE TRADE AGREEMENT," mimeo, Ottawa: PRINT 2000.

Brodie, Janine (1989). "The 'Free-Trade' Election," *Studies in Political Economy* 28 (Spring), pp. 175-82.

Brown, Drusilla K. (1992). "The Impact of a North American Free Trade Area: Applied General Equilibrium Models," in Lustig, Nora, Barry P. Bosworth, and Robert Z. Lawrence (ed.), *North American Free Trade: Assessing the Impact.* Washington, D.C.: The Brookings Institution.

Chan, Kenneth (1988). "Trade Negotiations in a Nash Bargaining Model." *Journal of International Economics* 25 (November), pp. 353-63.

Copeland, Brian R. (1988). "Of Mice and Elephants: The Canada-U.S. Free Trade Agreement." University of British Columbia Department of Economics Discussion Paper No. 88-16.

Díaz-Alejandro, Carlos F. (1978). "Delinking North and South: Unshackled or Unhinged?" In Albert Fishlow, Carlos F. Díaz-Alejandro, Richard R. Fagen, and Roger D. Hansen, *Rich and Poor Nations in the World Economy*, New York: McGraw-Hill.

Diwan, Ishac (1990). "Linking Trade and External Debt Strategies." *Journal of International Economics* 29 (November), pp. 293-310.

Dixit, Avinash K. (1987). "Strategic Aspects of Trade Policy," in Truman Bewley (ed.), *Advances in Economic Theory: Papers Presented at the Fifth World Congress of the*

Econometric Society. Cambridge: Cambridge University Press.

____________ and Victor Norman (1980). *Theory of International Trade*. Cambridge: Cambridge University Press.

Gowa, Joanne, and Edward Mansfield (1992). "Power Politics and International Trade," *American Political Science Review* 87:2 (June), pp. 408-420.

Grossman, Gene and Elhanan Helpman (1992). "Trade Wars and Trade Talks." Woodrow Wilson School Discussion Papers in Economics, #163, Princeton University.

Grossman, Sanford J. and Oliver D. Hart (1986). "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration." *Journal of Political Economy* 94:4, pp. 692-719.

Jenish, D'Arcy (1988). "Winning the Trade Battle," *Maclean's* September 19, 1988, pp. 32-4.

Kennan, John and Raymond Riezman (1988). "Do Big Countries Win Tariff Wars?" *International Economic Review* 29:1 (February), pp. 81-5.

Klein, Benjamin, Robert G. Crawford, and Armen A. Alchian (1978). "Vertical Integration, Appropriable Rents, and the Competitive Contracting Process," *The Journal of Law and Economics* XXI, October, 1978, pp. 297-326.

Howse, John (1988). "Verdict on free trade," *Macleans*, October 31, 1988, pp. N1-2.

Hirschman, Albert O. (1945). *National Power and the Structure of Foreign Trade*. Berkeley: University of California Press.

Johnson, Harry. G. (1953-1954). "Optimum Tariffs and Retaliation," *Review of Economic Studies* 21, pp. 142-53.

Mayer, Wolfgang (1981). "Theoretical Considerations on Negotiated Tariff Adjustments." *Oxford Economic Papers* 33:1 (March), pp. 135-53.

MacLeod, W. Bentley and James Malcomson (1993). "Investments, Holdup, and the Form of Market Contracts," *American Economic Review* 83:4 (September), pp. 811-37.

Morawetz, David (1981). *Why the Emperor's New Clothes are not Made in Colombia: A Case Study in Latin America and East Asian Manufactured Exports*. New York: Oxford University Press for the World Bank.

Rodriguez, Carlos Alfredo (1974). "The Non-Equivalence of Tariffs and Quotas under Retaliation." *Journal of International Economics* 4, pp. 295-8.

Stiglitz, Joseph E. and Partha S. Dasgupta (1971). "Differential Taxation, Public Goods, and Economic Efficiency," *Review of Economic Studies*, 38 (April), pp. 151-74.

Woodside, Kenneth (1989). "The Canada-United States Free Trade Agreement," *Canadian Journal of Political Science* 22 (March), pp. 155-70.

Yarbrough, Beth V., and Robert M. Yarbrough (1986). "Reciprocity, bilateralism, and economic 'hostages': self-enforcing agreements in international trade." *International Studies Quarterly* 30 (March), pp. 7-21.

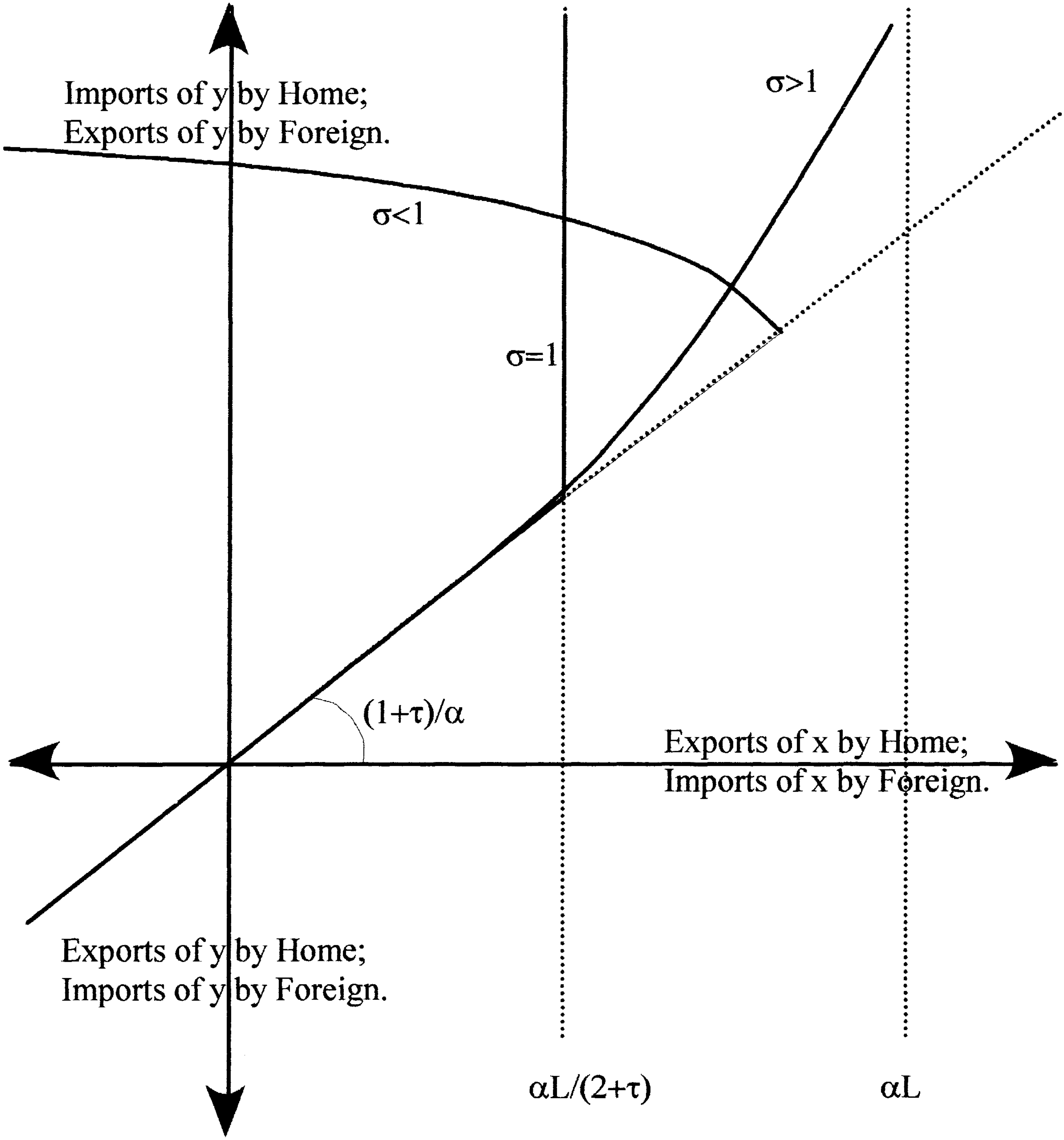


Figure 1: Home's offer curve.

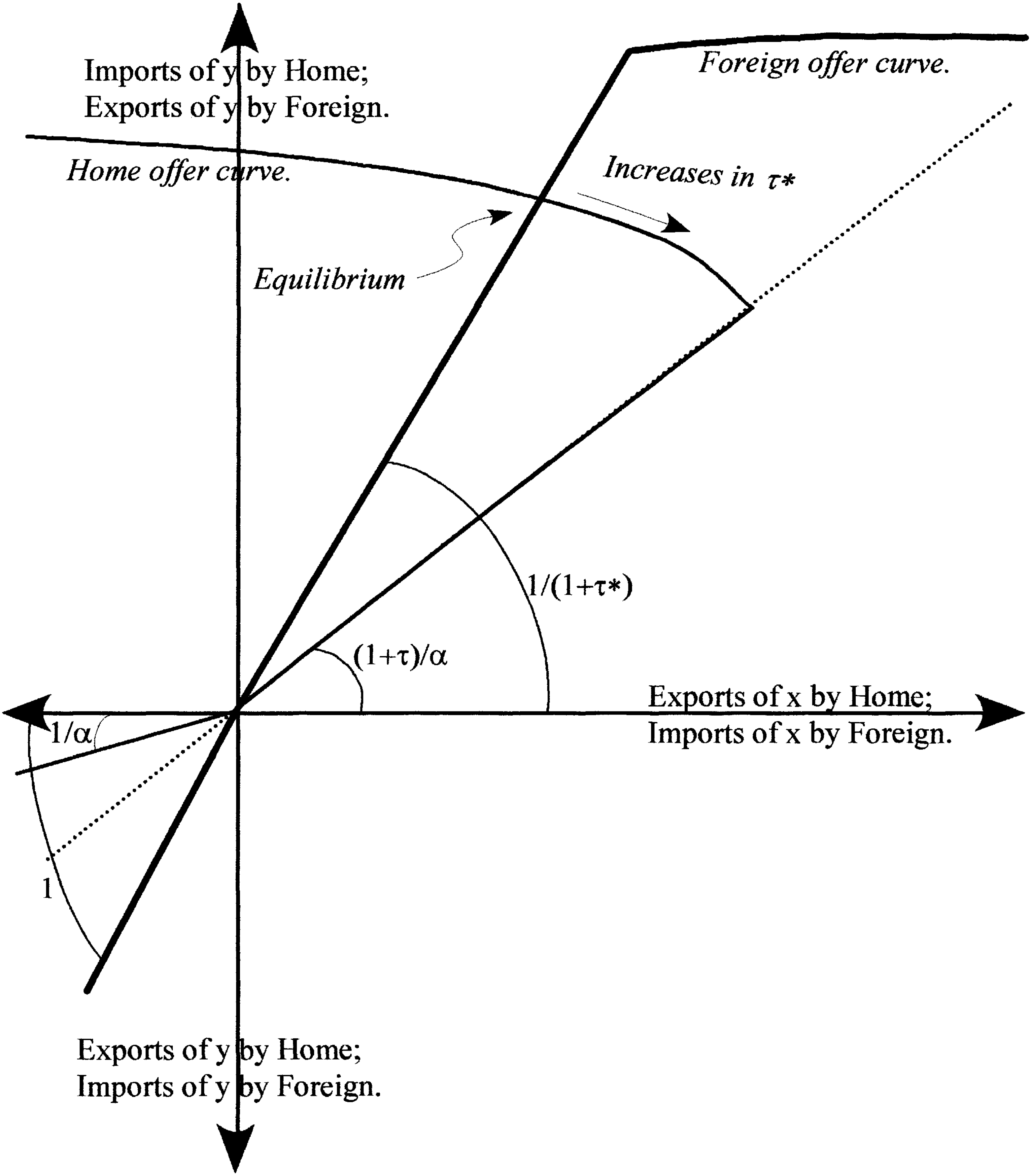
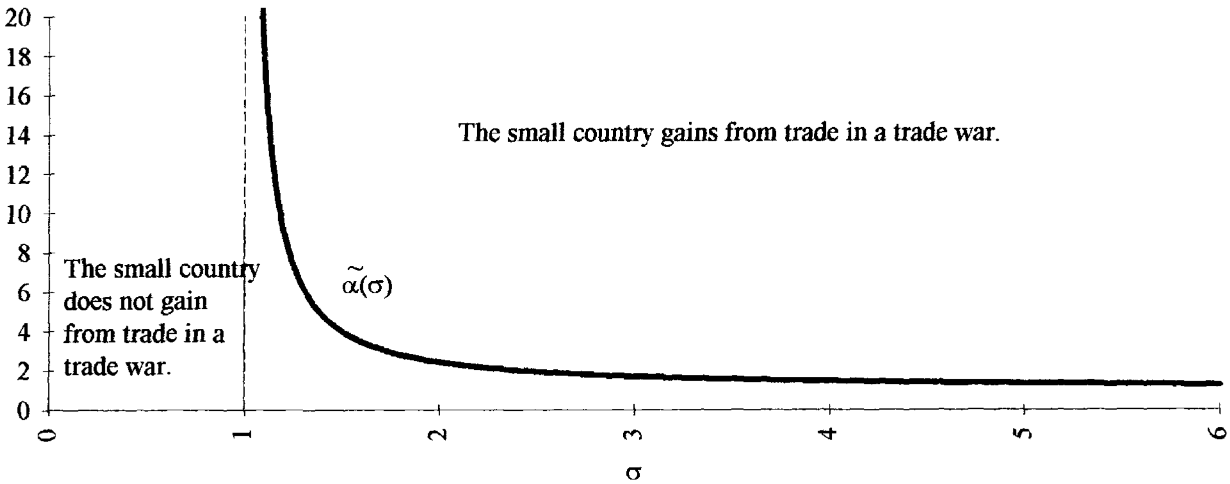


Figure 2: World Equilibrium with $\sigma<1$.

Figure 3.



20
18
16
14
12
10
8
6
4
2
0
The small country gains from trade in a trade war.
The small country does not gain from trade in a trade war.
$\tilde{\alpha}(\sigma)$
0
1
2
3
4
5
6
σ

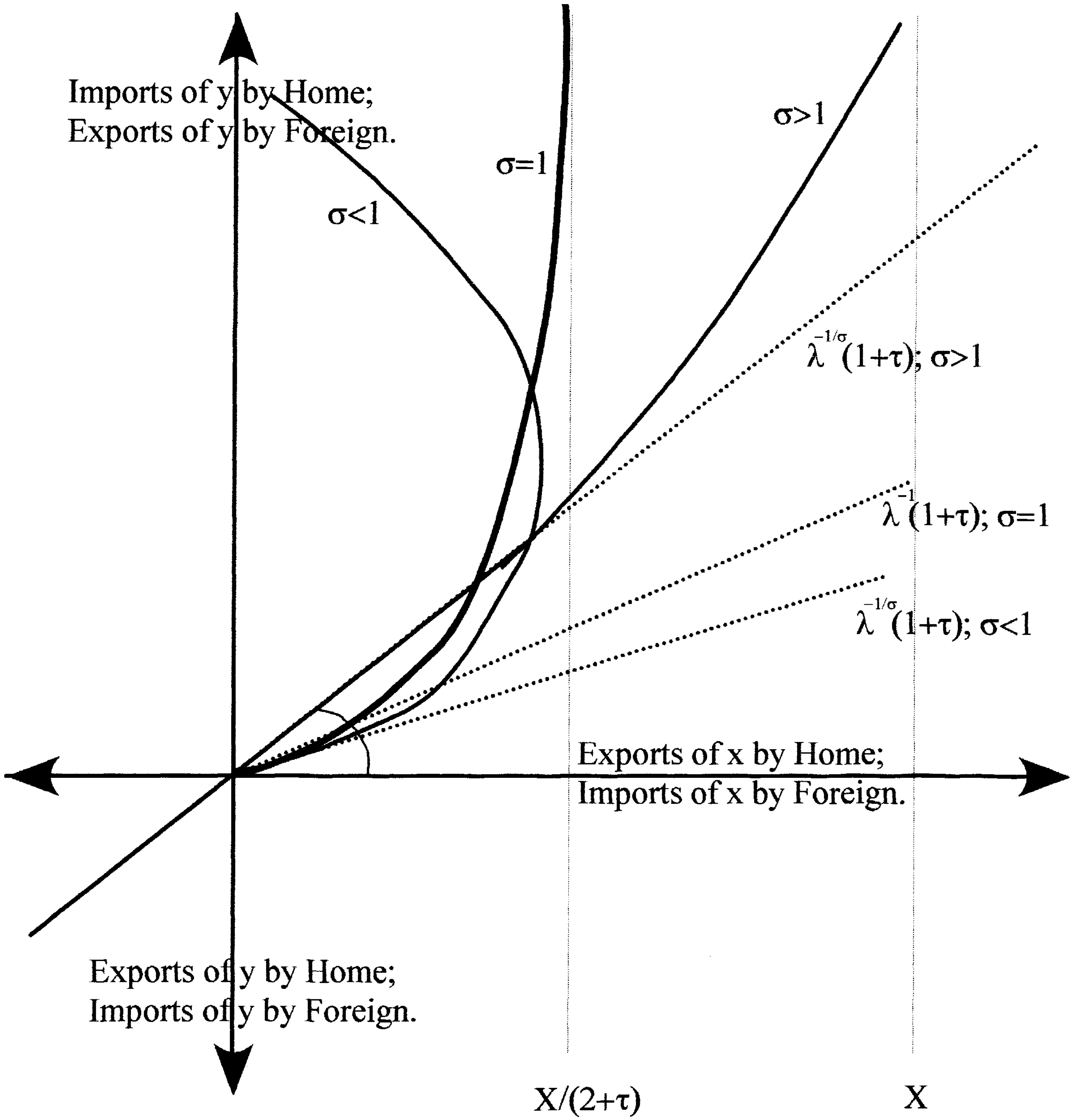


Figure 4: Home's offer curve (irreversible investment).

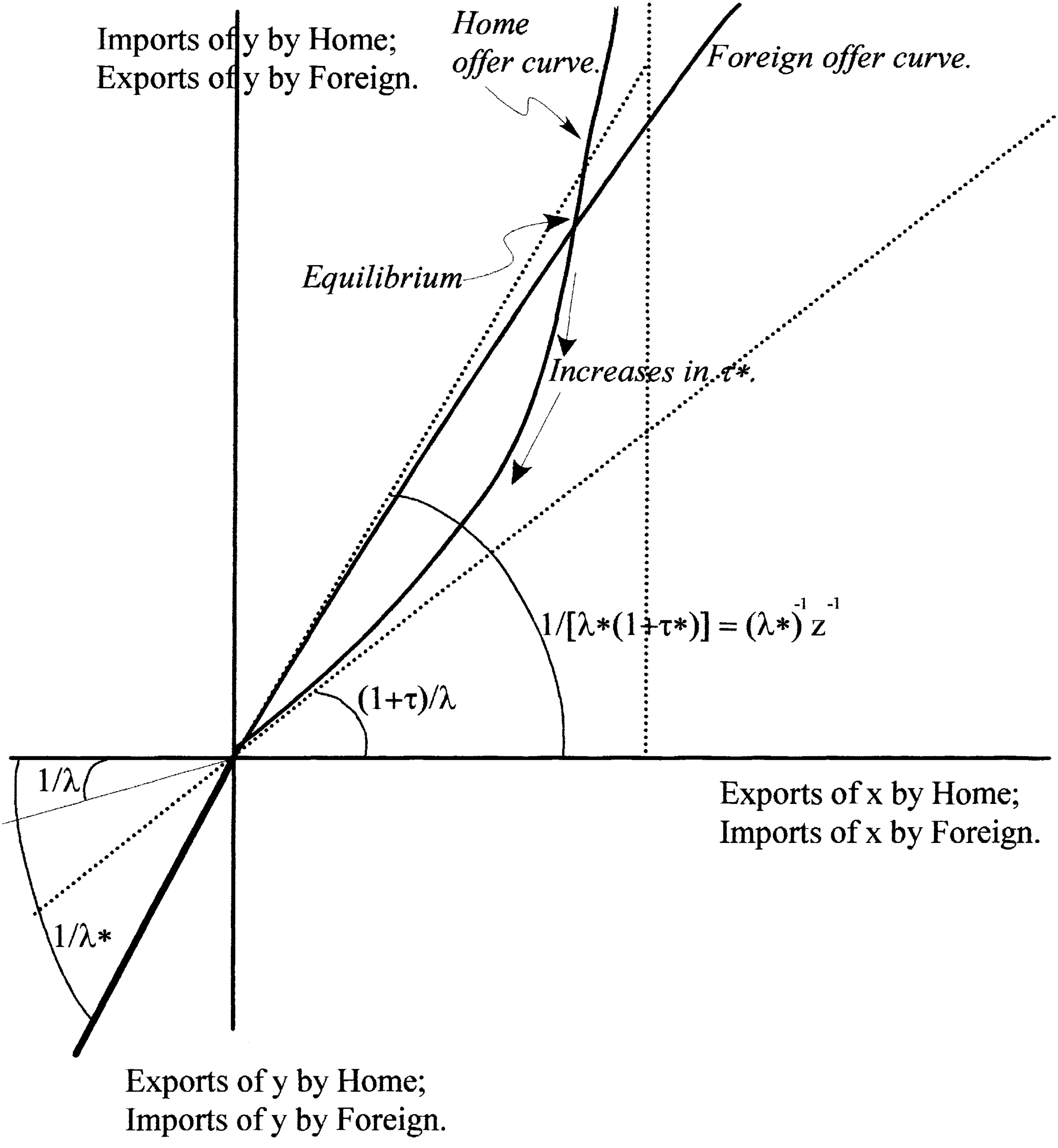


Figure 5: World Equilibrium with σ=1.

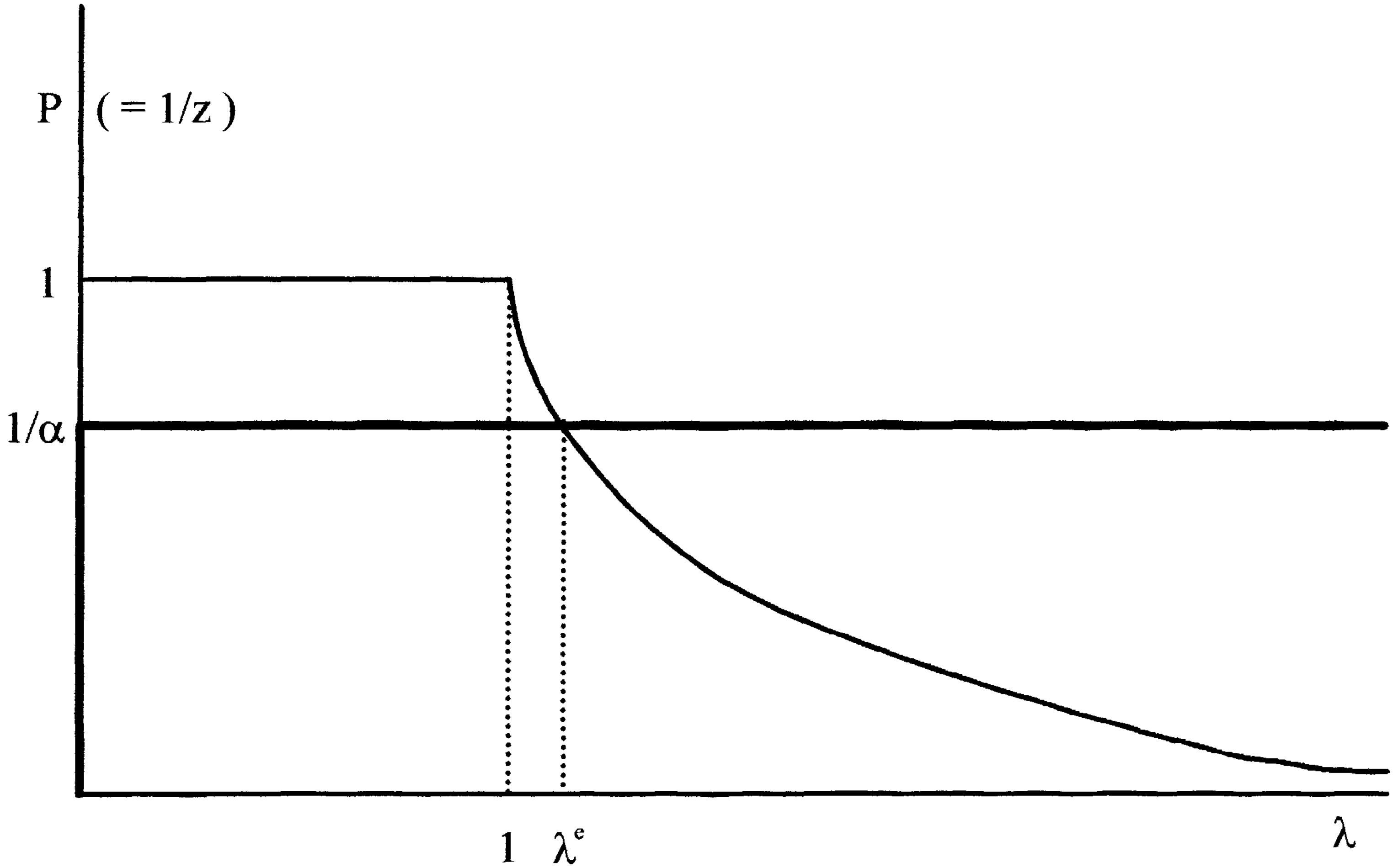
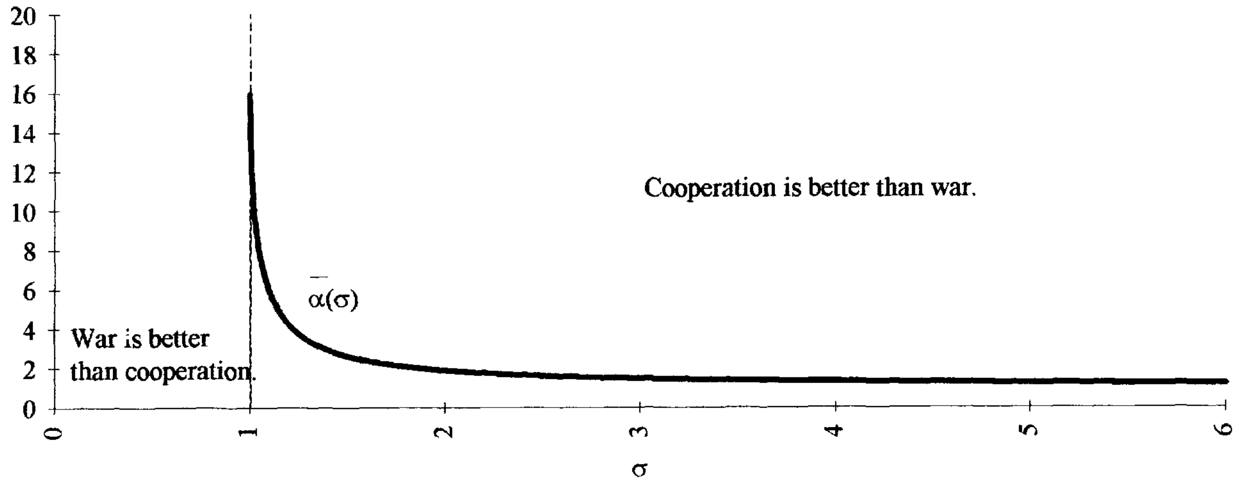


Figure 6.

Figure 7.



20
18
16
14
12
10
8
6
4
2
0
Cooperation is better than war.
$\bar{\alpha}(\sigma)$
War is better
than cooperation.
0
1
2
3
4
5
6
σ

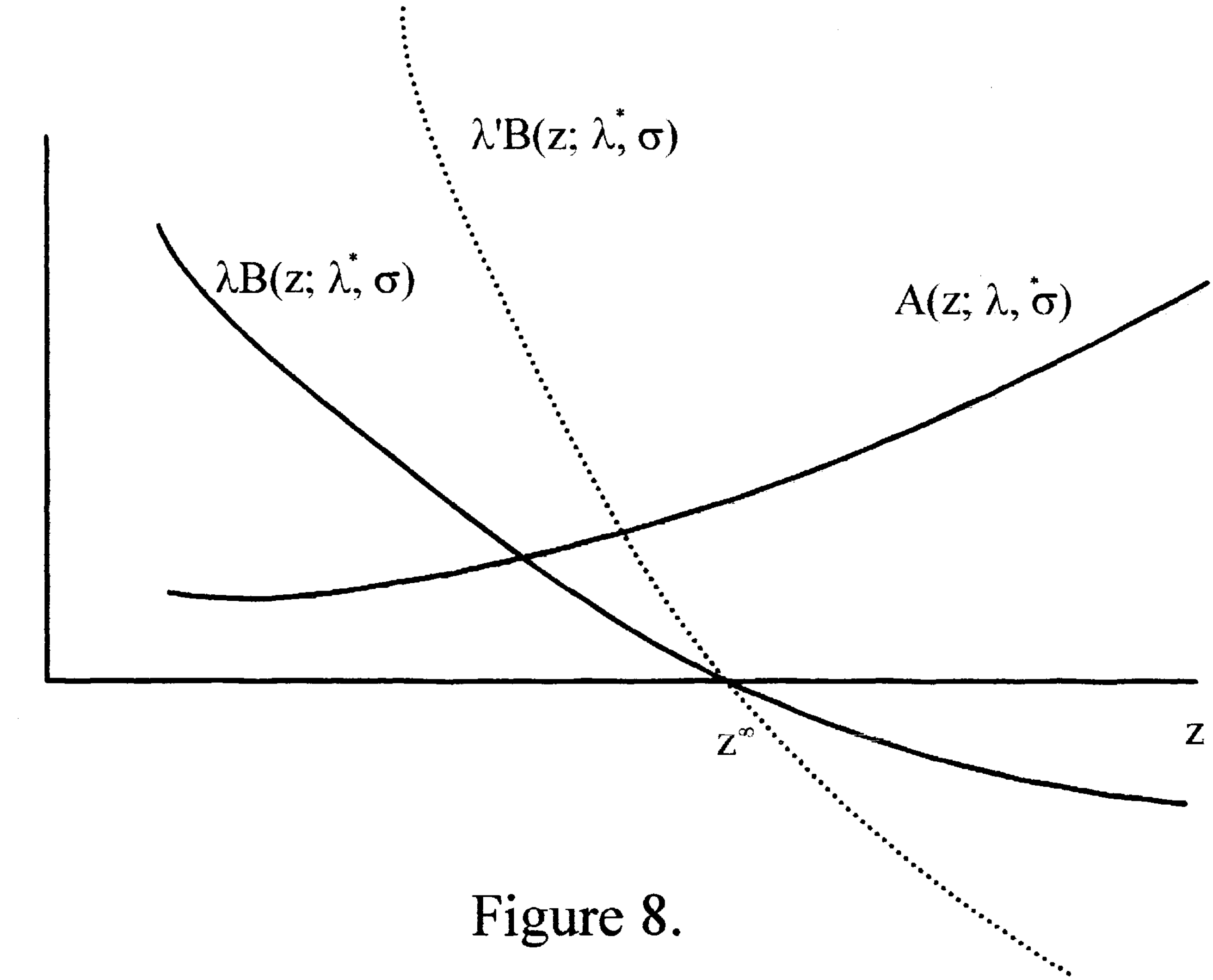


Figure 8.

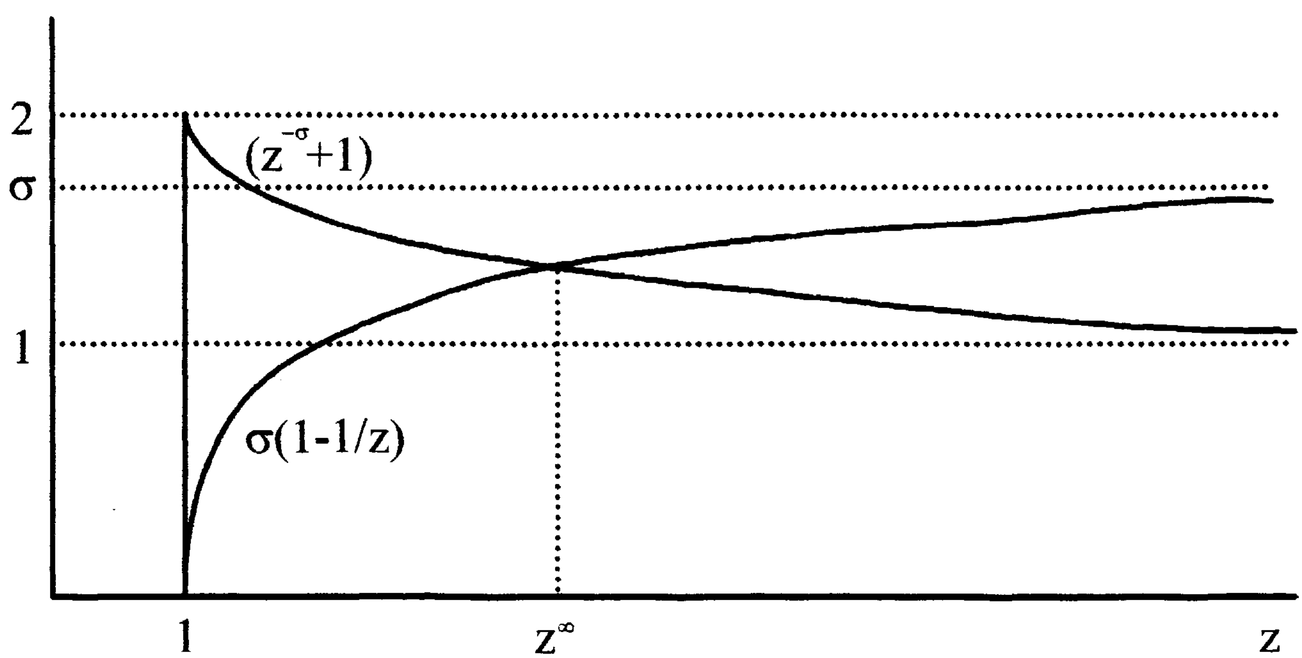


Figure 9.