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Abstract

A protectionist trade policy encourages foreign direct investment (FDI). If domestic producers prefer to compete with imports, they do not want unlimited protection. Instead, the desired level of protection is increasing in disincentives to direct investment. This may help explain why protection is higher (i) in industries where the country has a comparative disadvantage, (ii) in declining industries, (iii) in recessions. Fear of foreign direct investment can also explain the popularity of voluntary export restraints relative to other forms of protection. Finally, with endogenous protection, there is typically a negative relationship between the level of protection and the volume of FDI.

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1 Introduction

Many authors have argued that a country's trade policy is likely to reflect the preferences of strong interest groups. (For a survey of this literature, see Hillman (1989).) Since in most industries sellers are far better organized than buyers, who are often individuals, and domestic firms are normally in a better position to influence politicians than are their foreign competitors, we should expect the pattern of protection to reflect the interest of the domestic industry.

A first step toward testing this hypothesis is to identify the levels of protection desired by various industries. However, most authors have merely taken the answer for granted: Any industry wants as much protection as it can get. Thus the level of protection should be positively correlated with the political influence of the industry. Implicitly, this assumption underlies most of the empirical work in the area, including the contributions of McPherson (1972), Pincus (1975), Caves (1976), Salamon and Siegfried (1977), Ray (1981), Marvel and Ray (1983), and Baldwin (1985). These papers estimate the relationship between several industry variables and the level of import protection achieved by the industry. If there is a strong positive relationship between some industry characteristic and the protection level, this characteristic is said to enhance an industry's political influence.

But is it really true that high levels of protection is an objective of all domestic industries? There are at least two reasons for questioning this assumption. One is that stiff protection may encourage new entry by domestic firms as the foreign competition weakens. A second reason, which will be the main focus of this paper, is that a high level of protection may tempt foreign competitors to jump the trade barrier through local production. An example would be the decision of Japanese car manufacturers to establish U. S. production plants:

> In fact, United States quotas and orderly market arrangements simply accellerate the rate at which the Japanese become full-line competitors here. Within a few years of coming on shore, the Japanese become a stronger force than if they had remained mere exporters. *New York Times*[1]

[1]See Hout (1984). Thomas M. Hout, the author of the article, was then a vice president with the

The last sentence is essential. Foreign direct investment (henceforth FDI) is likely to be more competitive than imports are. Thus, from the vantage point of domestic firms, modest protection may be preferable to a trade policy that induces the foreign competitor to start local production. The question we pose in this paper is how much protection the domestic industry *does* want, and to what extent this is reflected in actual policy.

Clearly, the question can only be properly analyzed in the context of imperfectly competitive markets. Only then do domestic firms have rents to defend, and only then do they care about the behavior of a foreign rival. A general feature of oligopoly models with competing firms is that a firm's profit is increasing in its competitors' marginal cost.[2] Here is the key to our first set of results. Suppose the multinational prefers to export in the case where the tariff is zero. By increasing the tariff, the government can improve domestic firms' profit, as long as the multinational does not make a direct investment. So, if domestic firms know their foreign competitor's cost function, they will typically want the government to impose the "limit" level of protection, i. e. the highest level that does not induce direct investment.

One implication is immediate. Industries in which the country has a comparative disadvantage should be more protected. In these industries foreign producers will stay at home to take advantage of the lower production costs. This prediction is strongly supported by the evidence in Ray (1981) and Marvel and Ray (1983).

The theory also has dynamic implications. In any given industry, low levels of demand means that it is less tempting to invest in new production facilities, and so the tariff can be increased. This is consistent with the notion that there are higher levels of protection in declining industries as well as in recessions.

While tariffs affect the multinational's marginal cost, *quotas* restrict their output directly. Again, it is a general feature of oligopoly models that a firm's profit is decreasing in competitors' output. Note that in the absence of direct investments, there is always a quota which is as beneficial to domestic firms as any given tariff, and vice versa. When direct investment is an option, however, we show that domestic firms prefer voluntary export restraints (VERs) to other forms of protection. The intuition is as follows. With

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[2]If firms do not compete, i. e. products are complements, this relationship does not hold.

a VER, the multinational does not have to hand over money to the importing country. Therefore exporting is a more attractive option for any given level of output. As a result, it is possible to curtail imports more effectively using a quota than a tariff, without inducing direct investment.

It is an extreme assumption that domestic firms know precisely the level of protection that will induce FDI. Allowing for imperfect information, we show that there may be FDI in equilibrium. But, since protection is endogenous, there need no longer be a positive relationship between the level of protection and the probability of direct investment in equilibrium. Indeed, there is good reason to expect a negative correlation. This contrasts with the case where protection is exogenous, where the relationship must be positive (as demonstrated by Horst (1971) among others). Thus, our paper may shed new light on the empirical evidence presented by Orr (1975). Contrary to the received wisdom, he found no significant correlation between protection and FDI, and coefficients were negative.

The paper is organized as follows. Section 2 contains the basic model and shows how the limit tariff depends on cost conditions. Comparative statics with respect to demand conditions are presented in section 3. Section 4 shows that domestic firms prefer a VER to any other policy instrument. In section 5, we relax the assumption that information is perfect, and show that asymmetric information about the multinational's cost is a reason why foreign direct investment may occur in equilibrium. We also prove that protection and the probability of direct investment are likely to be negatively correlated. Related literature is briefly surveyed in section 6. Final remarks are collected in section 7.

2 The Model

There are two countries, labeled A and B. We are interested in the market for a particular product, which is sold in country A only. There are n domestic producers (firms located in country A). In country B, there is a single firm, the *multinational*, which also possesses the relevant production technology.[3] The multinational can locate production in country B or make an investment and produce directly in country A. If it produces in country B

[3]Notice that parallel import is ruled out by the assumption that all goods are sold in market A. There is no entry or exit. These assumptions greatly simplify the analysis.

the sales are subjected to a tariff in country A. The government of country A sets the tariff, and is assumed to maximize some function that is strictly increasing in the profit of each domestic firm.

The time order of decisions is as follows. The government of country A sets the tariff. The multinational then decides where to produce. Finally, all firms play a quantity or price competition game, to be called the *market game*, in the A market.

We assume that the market game has a unique and stable (in the sense of Dixit (1986)) Nash equilibrium in which all firms produce and sell positive quantities. This guarantees that a firm's profit will be increasing in other firms' marginal cost regardless of whether the decision variables (prices or quantities) are strategic substitutes or complements (see Bulow, Geanakoplos, and Klemperer (1985)). We further assume that a firm's profit in the market game is decreasing in its own marginal cost.

Let $v_A^i(\theta)$ be the equilibrium profit of domestic firm i in a market game where the multinational has invested and produces in country A, where $\theta := (\theta_1, \theta_2, \ldots, \theta_m)$ is a vector of environmental parameters representing demand and cost conditions. The corresponding profit of the multinational is $v_B(\theta)$.

If the multinational produces at home in country B, it gets a profit of $u_B(\theta, t)$, where t is the tariff levied by the government of country A and $\partial u_B/\partial t < 0$. We think of t as directly affecting the marginal cost of production in country B. The wealth of consumers is finite, so for any θ there is some $\bar{t}(\theta)$ such that $u_B(\theta, \bar{t}(\theta)) = 0$. Under the same circumstances domestic firm i gets a profit of $u_A^i(\theta, t)$, where $\partial u_A^i/\partial t > 0$.

To make the model interesting, we further assume that in the case of no protection, the multinational would prefer exporting to direct investment, i. e. $v_B(\theta) < u_B(\theta, 0)$ and $u_A^i(\theta, 0) \geq v_A^i(\theta)$ for all θ and i.

A strategy for the country A government is, simply, a tariff t. A strategy for the multinational is a function that specifies a choice of production site for every possible value of t. It is now easily seen that there is a unique tariff level that makes the multinational indifferent as to where to locate production. That is, for all θ there exists a unique $t^*(\theta) \in (0, \bar{t}(\theta))$ such that

$$u_B(\theta, t^*(\theta)) = v_B(\theta). \tag{1}$$

We will refer to t^* as the limit tariff.[4] The optimal strategy of the multinational is then easily characterized.

Lemma 1 *An optimal strategy for the multinational prescribes production in country B if $t < t^*(\theta)$ and production in country A if $t > t^*(\theta)$.*

Behavior at $t = t^*(\theta)$ is dealt with in our key proposition.[5]

Proposition 1 *There is a unique subgame perfect Nash equilibrium such that $t = t^*(\theta)$ and the multinational produces in country B if $t \leq t^*(\theta)$ and in country A otherwise.*

PROOF. To see that this is an equilibrium, note that at $t^*(\theta)$ the multinational is indifferent between producing in country A and producing in country B, and might as well produce in country B. As for the domestic firms, if $t < t^*(\theta)$, the profit of each domestic firm can be increased by increasing t. If $t > t^*(\theta)$ the multinational will produce in country A, lowering the profit of each domestic firm. To see that the equilibrium is unique, consider a situation in which the multinational does something different. From Lemma 1 we know we need only consider different behavior at the limit tariff. Suppose the multinational produces in country A at $t = t^*(\theta)$ and otherwise optimally. Then the tariff-setter in fact fails to have a best reply. He must set $t < t^*(\theta)$, but for any such t there exists $\epsilon > 0$ such that $t + \epsilon$ yields a higher profit for every domestic firm. But given that in an equilibrium the multinational must behave as specified in the proposition, the tariff-setter has a unique best reply at $t = t^*(\theta)$. Subgame perfectness follows from the assumption that equilibria are played at the market game stage. □

We may now do comparative statics on the equilibrium tariff by totally differentiating (1). We find that

$$\frac{\partial t^*(\theta)}{\partial \theta_j} = \frac{\partial v_B(\theta)/\partial \theta_j - \partial u_B(\theta, t^*(\theta))/\partial \theta_j}{\partial u_B(\theta, t^*(\theta))/\partial t} \text{ for all } j = 1, \ldots, m. \tag{2}$$

which is positive (negative) as $\partial v_B(\theta)/\partial \theta_j$ is less than (greater than) $\partial u_B(\theta, t^*(\theta, k))/\partial \theta_j$. In words, the limit tariff increases in a given parameter if and only if the impact of that

[4] In the industrial organization literature a limit price refers to the highest price an incumbent firm can charge without encouraging entry.

[5] It is common in economics to specify tie-breaking behavior (players' action when they are indifferent) as a rule of the game. Here, we follow the advice of Simon and Zame (1990) and treat tie breaking as part of the *solution*.

parameter on v_B is greater (more positive or less negative) than on u_B. Suppose for the moment that marginal costs are constant. Then, comparative statics with respect to cost parameters are straightforward.

Proposition 2 *The equilibrium tariff is increasing (decreasing) in the multinational's cost of production in country A (B).*

PROOF. (i) Let θ_k be a fixed cost of setting up production in country A. Then $\partial v_B(\theta)/\partial\theta_k = -1$ and $\partial u_B(\theta, t^*(\theta))/\partial\theta_k = 0$, so by (2) we have that $\partial t^*(\theta)/\partial\theta_k = -1/(\partial u_B(\theta, t^*(\theta))/\partial t) > 0$. (ii) We have assumed that firms' profit is decreasing in own marginal cost. Thus, if θ_m is the marginal cost of the multinational's production in country A, we have $\partial v_B(\theta)/\partial\theta_m < 0$ and $\partial u_B(\theta, t^*(\theta))/\partial\theta_k = 0$, with the same conclusion as above. The comparative statics with respect to the cost of production in country A are analogous. □

The intuition is very simple. If the multinational's production costs increase in country A relative to country B, FDI becomes less attractive, and the limit tariff must go up. Hence, Proposition 2 presents a rationale for the common observation that industries which face high domestic factor prices (or low domestic factor quality) receive more protection (see in particular Ray (1981) and Marvel and Ray (1983)). Proposition 2 should be contrasted with the results of Dixit (1988). His model has imperfect competition, but no direct investment, and he assumes that the government maximizes the sum of domestic profit and consumers' surplus. For a given production subsidy, there is then a *negative* relationship between the domestic firm's marginal cost and the optimal level of the tariff (see Dixit's equation (26)). (Further contrasts between our work and that of others are highlighted in section 6.)

We note that the possible solutions of our model depend crucially on how the cost of producing in country A relates to that of producing in country B. One could think of set-ups different from the assumptions used above. Let $C_B^A(q)$ be the multinational's total cost of producing q units in country A, and $C_B^B(q)$ the total cost of producing in country B. To reduce the potentially very complex spectrum of possibilities, consider just the cases where the cost functions are affinely related. That is, let $C_B^A(q) = k + dC_B^B(q)$

for some constants k and d. We distinguish four cases as follows.

	$k \geq 0$	$k < 0$
$d < 1$	I	II
$d \geq 1$	III	IV

In case I, the marginal cost of producing in country A is lower than in country B, but there is a positive fixed cost differential. This case is the one discussed above and the main focus of our attention. In particular, we studied the case where, in the absence of protection, the multinational produces in its home country. This set of parameters also accords well with our general idea about cost conditions. Set-up costs are lower in the home country, because that is where the firm's top management is, so that coordination and planning is easier. Also, there may be synergies with other production. So, $k > 0$. On the other hand, transportation costs are reduced through FDI, and therefore $d < 1$. (A fuller discussion of typical cost parameters facing the multinational firm can be found in Caves (1982).)

For completeness, let us briefly examine the outcomes in cases II to IV. In case II, the multinational will always invest in country A. This is undesirable for domestic firms, since the multinational's marginal cost is then lower than it would be if it produced at home. In case III, the multinational will always produce at home and export. Finally, in case IV, one can show that in equilibrium there will be FDI, desired by domestic firms. Here, the multinational faces a low set-up cost but a high marginal cost in country A, and so it will be less aggressive after an FDI than under any tariff keeping production in country B. Arguably, this case is rare. In confronting our theory with individual cases, it is nevertheless important to check that cost parameters conform to case I, rather than any of the others.

3 Business Cycles and Protection

It is a widespread notion that it is easier for a declining industry to obtain protection than it is for a prospering one. The phenomenon has been given the label "senile industry protection." Conventional wisdom suggests that recessions work in the same direction.

Protection levels increase when times are bad. We substantiate this contention by considering the effect of demand shifts on the limit tariff.

Suppose now that the demand for the industry's product increases. Intuitively, this should increase the profit associated with locating in country A relative to exporting. The higher fixed cost means less relative to the lower marginal cost as the market grows larger. Consequently, as seen from (2), the limit tariff falls. We have been unable to prove this assertion at the level of generality of the previous section. Instead, we shall confirm the intuition in the special context of the linear duopoly model of Dixit (1979). While this model makes fairly strong assumptions about demand and cost conditions, it has the attractive feature that it permits analysis of both price and quantity competition. This allows us to show that the result is independent of the mode of market interaction.

3.1 The Linear Duopoly Model

We briefly recapture a model originating with Dixit (1979) and further analyzed in Singh and Vives (1984).[6]

The inverse demand functions are

$$p_A = \alpha - \beta q_A - \gamma q_B \tag{3}$$

and

$$p_B = \alpha - \beta q_B - \gamma q_A, \tag{4}$$

where p denotes price, q denotes quantity and α, β, γ are parameters. Direct demand functions can then be written

$$q_A = a - bp_A + cp_B \tag{5}$$

and

$$q_B = a - bp_B + cp_A, \tag{6}$$

where $a = \alpha(\beta - \gamma)/\delta$, $b = \beta/\delta$, $c = \gamma/\delta$, and $\delta = \beta^2 - \gamma^2$. For the model to have interesting solutions, we assume that $\alpha > 0, \beta > 0, \gamma > 0, \beta - \gamma \geq 0$. The condition $\gamma > 0$ implies that the products are substitutes. The multinational's fixed costs, denoted k_B is

[6]Singh and Vives work with prices net of marginal cost, while marginal cost appears explicitly in our expressions. This accounts for the discrepancies between our formulas and theirs.

assumed to be higher if it invests in country A, i. e. $k := k_A^B - k_B^B > 0$. Marginal costs, denoted m_I, are assumed to be constant. To save notation, we include the tariff in the marginal cost whenever the multinational produces in country B, so that

$$m_B := \begin{cases} m_B^A & \text{if production in country } A \\ m_B^B + t & \text{if production in country } B. \end{cases}$$

We now compute the limit tariff for each kind of market interaction, and perform comparative statics with respect to α, the market demand parameter.

3.2 Quantity Competition

When quantity is the strategic variable, firm A chooses q_A to maximize its profit

$$\pi_A := (\alpha - \beta q_A + \gamma q_B - m_A) q_A,$$

and the multinational (firm B) solves the symmetric problem. The solution is

$$q_A^* = \frac{\alpha(2\beta - \gamma) - 2\beta m_A + \gamma m_B}{4\beta^2 - \gamma^2} \tag{7}$$

and

$$q_B^* = \frac{\alpha(2\beta - \gamma) - 2\beta m_B + \gamma m_A}{4\beta^2 - \gamma^2}. \tag{8}$$

Inserting back into the inverse demand functions, we find that the equilibrium prices can be expressed as

$$p_I^* := \beta q_I^* + m_I, \text{ for } I \in \{A, B\}. \tag{9}$$

The maximized profit is

$$\pi_I^* := (p_I^* - m_I) q_I^* - k_I = (q_I^*)^2 - k_I.$$

It can easily be checked that the equilibrium is unique and stable, and that π_I is decreasing in m_I. Then Proposition 1 applies, and there is a limit tariff t^*. The equilibrium quantity depends on where the multinational produces, and we are particularly interested in the equilibrium quantities at the limit tariff. Thus, it is convenient to define

$$q_B^A := q_B^*(m_B^A)$$

and

$$q_B^B := q_B^*(m_B^B + t^*).$$

The limit tariff is implied by the equation

$$(q_B^B)^2 = (q_B^A)^2 - k. \tag{10}$$

Total differentiation yields

$$\frac{dt^*}{d\alpha} = \frac{q_B^A(\partial q_B^A/\partial\alpha) - q_B^B(\partial q_B^B/\partial\alpha)}{q_B^B(\partial q_B^B/\partial t)}. \tag{11}$$

Signing this expression is straightforward.

Proposition 3 *Under quantity competition, the limit tariff is decreasing in the demand parameter α.*

PROOF. The denominator of (11) is negative, since firm B's equilibrium output is positive and decreasing in m_B, as seen from equation (8). Consider the numerator of (11). Notice from (8) that $\partial q_B^*/\partial\alpha$ does not depend on m_B. Hence, $\partial q_B^A/\partial\alpha = \partial q_B^B/\partial\alpha > 0$. Thus, the numerator has the sign of $q_B^A - q_B^B$. Since $m_B^B + t^* > m_B^A$, the numerator is positive. □

3.3 Price Competition

Price competition is studied analogously. Now, firm A sets p_A to maximize

$$\pi_A := (p_A - m_A)(a - bp_A + cp_B)$$

and firm B solves the symmetric problem. The equilibrium prices are

$$p_A^* := \frac{a(2b + c) + 2b^2m_A + bcm_B}{4b^2 - c^2} \tag{12}$$

and

$$p_B^* := \frac{a(2b + c) + 2b^2m_B + bcm_A}{4b^2 - c^2}. \tag{13}$$

Inserting back into the demand equations, the equilibrium quantities can be expressed as

$$q_I^* = b(p_I^* - m_I). \tag{14}$$

The maximized profit for firm I is then

$$\pi_I^* = b(p_I^* - m_I)^2 - k_I. \tag{15}$$

Again, the equilibrium is unique and stable and a limit tariff exists. Define r as the price net of effective marginal cost, evaluated at the limit tariff. We say that

$$r_B^A := p_B^*(m_B^A) - m_B^A$$

and

$$r_B^B := p_B^*(m_B^B + t^*) - m_B^B - t^*.$$

Hence the equilibrium tariff t^* solves

$$b(r_B^B)^2 = b(r_B^A)^2 - k. \tag{16}$$

To study how t^* reacts to a shift in α, we differentiate this equation to get

$$\frac{dt^*}{d\alpha} = \frac{r_B^A(\partial r_B^A/\partial\alpha) - r_B^B(\partial r_B^B/\partial\alpha)}{r_B^B(\partial r_B^B/\partial t)}. \tag{17}$$

The sign of this expression is our next result.

Proposition 4 *Under price competition, the equilibrium tariff is a decreasing function of demand.*

PROOF. From (13) we can compute the size of the denominator:

$$\partial r_B^B/\partial t = \partial p_B^*(m_B^B + t^*)/\partial m_B - 1 = (c^2 - 2b^2)/(4b^2 - c^2).$$

Since $b > c$ (by the assumption that $\beta > \gamma$), this expression is negative.

Consider now the numerator. From (13) we see that

$$\frac{\partial p_B^*}{\partial\alpha} = \frac{(2b + c)(\beta - \gamma)}{\delta(4b^2 - c^2)},$$

which is positive and independent of m_B. Hence $\partial r_B^A/\partial\alpha = \partial r_B^B/\partial\alpha > 0$.

We have just established that $\partial r_B^B/\partial m_B < 1$. We know that $m_B^B + t > m_B^A$, and hence $r_B^A > r_B^B$. It follows that the numerator is positive. □

This completes the demonstration that t^* varies countercyclically regardless of the mode of market interaction.

4 Tariff versus Non-Tariff Protection

So far, tariffs have been the only means of protection considered. However, the model suggests a reason why tariffs and quotas are not equivalent from the point of view of the domestic industry. The idea is that a quota can limit the imports while extracting less rent from the foreign firm. Consequently, the quota can be set at a lower level than the imports implied by the limit tariff, without attracting foreign direct investment.

Again, the argument is quite general and can be substantiated in a variety of oligopoly models. For simplicity, we consider only the duopoly case.

Suppose the government in country A can set a quota, $\bar{q}_B$, together with a quota license fee, $l \geq 0$. The license fee, as well as any tariff proceeds, will remain with the government.[7]

While the quantity competition case is actually easier to analyze with quotas instead of tariffs, price competition becomes slightly more complex. The reason is that for some pairs of prices there is an excess demand for the multinational's product. We therefore need to specify how sales are distributed in the case of shortage, i. e. a rationing assumption. Here, we follow Krishna (1989) and adopt the assumption that rationing is efficient: The foreign good is allocated to those with the highest willingness to pay. (This allocation would automatically come about if arbitrage were costless.) With this assumption, rationed buyers are effectively faced with the market clearing price for product B rather than the price quoted. Hence, the effective demand for the *domestic* product (for any given price) is larger the smaller is the quota. [8]

Define a "limit quota" $\bar{q}_B^*(t,l)$ as a quota for which the multinational is indifferent between exporting and making a direct investment:

$$\tilde{u}_B(\bar{q}_B^*(t,l),t) - l = v_B, \tag{18}$$

where $\tilde{u}_B$ is the maximized profit, gross of the (output idependent) license fee, for the

[7] If proceeds from a quota license fee and/or the tariff were allocated to the domestic industry, the results below would no longer hold.

[8] While the assumption of efficient rationing greatly simplifies our analysis, we believe that it is not crucial to the result. As is shown below, we only need that the domestic firm's profit is decreasing in the size of the quota.

multinational if it chooses to export.[9] Here we have suppressed θ to save notation. In the following, it should be remembered that *all* equilibrium values depend on this vector of environmental parameters.

We will be interested in the relationship between the limit quota and the other two variables. Differentiation of (18) yields

$$\frac{d\overline{q}^*}{dt} = -\frac{\partial \tilde{u}_B(\overline{q}^*_B(t,l),t)/\partial t}{\partial \tilde{u}_B(\overline{q}^*_B(t,l),t)/\partial \overline{q}}, \tag{19}$$

and

$$\frac{d\overline{q}^*}{dl} = \frac{-1}{\partial \tilde{u}_B(\overline{q}^*_B(t,l),t)/\partial \overline{q}}. \tag{20}$$

We now determine the sign of these expressions. Clearly, $\partial \tilde{u}_B/\partial t < 0$. When the quota does not bind, this follows directly from our assumption that profits decrease in own marginal cost (see section 2). Under a binding quota it is trivial, since the tariff does not affect the quantity of imports, but does extract rent.

Now, what about $\partial \tilde{u}_B(\overline{q}^*_B(t,l),t)/\partial \overline{q}$? In the quantity competition case it is positive as long as quantities are strategic substitutes. (This is well known. See Tirole (1988), p. 326 for a proof). The positive effect on the equilibrium price never suffices to outweigh the loss from a lower quantity. With price competition, the expression may be negative for some interval.[10] Consequently, the solution to (18) may not be unique. However, since $\tilde{u}_B(0,t,l) = 0 < v$, we know that $\partial \tilde{u}_B/\partial \overline{q} > 0$ at the solution with the smallest quota. As it turns out, this is the one that we are interested in.

As indicated, the country's trade policy is now a triple $\langle t, l, \overline{q}_B \rangle$, and our objective is to characterize the policy desired by the domestic firm. Notice that a voluntary export restraint (VER) is just the special case where the tariff and the license fee are both zero.

We are now ready to present the main result of this section. Let there be competition in either prices or quantities, and let them be strategic complements and substitutes respectively.

Proposition 5 *A VER is preferred to any other means of protection. That is, the optimal policy from the domestic industry's point of view is* $\langle 0, 0, \overline{q}^*_B(0,0) \rangle$.

[9]There may be more than one solution to equation (18). Firm A will typically prefer the one with the lowest quota. We return to this problem below.

[10]Krishna (1989) shows that a modest quota restriction may benefit the foreign firm.

PROOF. The proof proceeds in two steps. Step 1: For given t and l, the government will impose the (lowest) limit quota. (i) Quantity competition: If the quota binds, the residual demand facing the domestic firm is greater the smaller is the quota, and so it can sell more at any price. The equilibrium profit, $\tilde{v}_A$, is therefore decreasing in the size of the quota. (ii) Price competition: (For a fuller exposition, see Krishna (1989).) Consider the multinational's best response function without a quota. Then impose the quota. For prices p_A such that the quota does not bind, the multinational's best response remains the same. But when the quota does bind, p_B is irrelevant to the quantity sold. In this case, the multinational should increase its price up to the level where the quota just does not bind. This means that the multinational becomes less aggressive: For any given p_A its best response price is (weakly) higher the smaller is the quota. Since the domestic firm's profit is increasing in p_B, it follows that it prefers the (lowest) limit quota to any other.

Step 2: Now we show that $t = l = 0$. From (19) and (20) we have that $d\bar{q}^*/dt$ and $d\bar{q}^*/dl$ are both positive (at least at the lowest limit quota). Thus, the limit quota is at its smallest when both t and l are zero. □

Notice that the choice of instrument does not affect the equilibrium profit of the multinational. Regardless of the means of protection it earns v, the profit associated with direct investment. This contrasts with the popular opinion that VER's necessarily leave a larger rent with foreign producers than other means of protection. While it is true that foreigners obtain the full rent on each unit sold, the VER allows a smaller volume of imports than any alternative trade policy.

Although the VER is the best trade policy for domestic sellers, other domestic interests suffer from the lack of government revenue. Consequently, these interests should oppose VER's more vigorously than a tariff. A tariff protects the industry *and* generates revenue, as does a traded quota. A VER only protects the industry. A reasonable hypothesis is therefore that VER's should be more strongly correlated with industry subsidies and measures of political influence than other means of protection.

5 Equilibrium Foreign Direct Investment

A problem with the current model specification is that it seems to accord badly with some famous case histories.

As argued in the introduction, Japanese car manufacturers made heavy U. S. investments only after the protectionist policies initiated by the American car industry. Also, Japanese producers of color TV's built U. S. manufacturing plants as a response to a VER initiated by the American electronics industry (see Gordon and Lees (1986) and Graham and Krugman (1991) for more details about these and other cases). But the way the model is specified above, the U. S. industry would only ask for such a high level of protection if it actually desired foreign investment. According to several commentators this was not so, however. As the New York Times quote in the introduction shows, observers early realized that the Japanese would be more competitive once they built their transplants. We must conclude either that the U. S. industry was plainly stupid in asking for increased protection (they now face more aggressive competition than they would have done in the absence of Japanese direct investment), or that they did not have accurate information. Below, we explore the latter possibility.

It is clearly unrealistic that the domestic industry knows the costs of the foreign producer with certainty. We shall now show that asymmetric information about cost may generate direct investment along the equilibrium path with positive probability. In other words, the domestic industry may be willing to trade off a higher profit in the case of no FDI against a positive probability of FDI.

To make the analysis as simple as possible, we assume that only the multinational's *fixed* costs are unknown to the domestic industry. Let k, the difference in fixed cost between production in countries A and B, be a random variable with the continuous and differentiable distribution $F(k,s)$ on the interval $[\underline{k}(s), \bar{k}(s)]$, where s is a shift parameter. The corresponding density function is denoted $f(k,s)$. As a convention, let F be decreasing in s. In other words, an increase in s means that the distribution over k moves to the right.

It is convenient to work with profits net of the common fixed cost element. Hence, a multinational of type k has payoff $v_B - k$ if it produces in country A, and $u_B(t)$ otherwise.

Recall that the equilibrium of the market game is independent of k. Like in the previous section, we suppress θ (which should now be interpreted as all parameters except fixed cost) in order to save notation. (All results are valid for an arbitrary vector of parameters, as long as the market game satisfies the general conditions imposed in section 2.) Then, for each k there is $t^*(k)$ such that

$$u_B(t^*(k)) = v_B - k.$$

As before, if $t < t^*(k)$, the multinational produces in B. If $t > t^*(k)$, it produces in A. Define

$$\kappa(t) := v_B - u_B(t).$$

The probability that the multinational produces in A when the tariff is equal to t can then be written

$$G(t,s) := F(\kappa(t), s). \tag{21}$$

The associated density function is denoted $g(t,s)$. For simplicity we assume that there is only one domestic firm. Its expected profit is

$$e_A(t,s) := G(t,s)v_A + (1 - G(t,s))u_A(t). \tag{22}$$

It is easily seen that $e_A(t,s)$ is continuous and right-differentiable at $t^*(\underline{k}(s))$. Let $t^{**}(s)$ denote the tariff that maximizes expected profit. If $t^{**}(s) \in [t^*(\underline{k}(s)), t^*(\overline{k}(s))]$, there will be a positive probability that the multinational chooses to produce in country A in equilibrium. Clearly, a sufficient condition for this to be the case is that $\partial e_A(t^*(k(s)))/\partial t > 0$. Differentiating (22), this condition can be written

$$\frac{\partial u_A(t^*(\underline{k}))}{\partial t} > (u_A(t^*(\underline{k}(s))) - v_A)g(t^*(\underline{k}(s))). \tag{23}$$

This inequality has a natural interpretation. Foreign direct investment may occur in equilibrium if, when the tariff is set at $t^*(\underline{k}(s))$, (i) the domestic firm has much to gain from an increase in the multinational's marginal cost ($\partial u_A(t^*(\underline{k}(s)))/\partial t$ is large), (ii) the domestic firm has little to lose from direct investment by the multinational ($u_A(t^*(\underline{k}(s))) - v_A$ is small), and (iii) an increase in the tariff above $t^*(\underline{k}(s))$ only leads to a small probability of direct investment ($g(t^*(\underline{k}(s)))$ is small). The last factor can alternatively be written

$$g(t^*(\underline{k}(s))) = -f(\underline{k}(s))\frac{\partial u_B(t^*(\underline{k}(s)))}{\partial t}.$$

In words, the probability of direct investment increases slowly with the tariff in this region if k is considered unlikely to assume values close to $\underline{k}(s)$ or if a change in protection has a small impact on the multinational's profit.

A simple example where FDI occurs with positive probability is when the multinational's marginal cost is independent of location ($m_B^A = m_B^B$), and $\underline{k}(s) = 0$. Here, any positive tariff induces FDI with positive probability, so $t^*(\underline{k}(s)) = 0$. Consequently, $u_A(t^*(\underline{k}(s))) - v_A = 0$, and the right hand side of (23) is zero. Since the left hand side is strictly positive by assumption, the condition is satisfied.

Do our comparative statics survive the introduction of uncertainty? To answer this question, we need to consider a shift in F, the distribution of the multinational's fixed cost. If a positive shift results in a higher level of protection, we have an analog to Proposition 2. Obviously, the relationship always holds for parameter values such that $t^{**}(s) = t^*(\underline{k}(s))$, for which the probability of FDI is zero. To study the case in which $G(t^{**}(s), s) > 0$, maximize (22). The first order condition is

$$g(t^{**}(s), s)(v_A - u_A(t^{**}(s))) + \frac{\partial u_A(t^{**}(s))}{\partial t}(1 - G(t^{**}(s), s)) = 0. \tag{24}$$

The first term is the expected cost of increasing the tariff, viz. the increase in probability of FDI multiplied by the difference in profit. The second term denotes the corresponding gain, which is the probability that the multinational will continue to export multiplied by the increase in firm A's profit. The second order condition can be written

$$h(t^{**}(s), s) < 0, \tag{25}$$

where

$$\begin{aligned} h(t^{**}(s), s) \;:=\; & \frac{\partial g(t^{**}(s), s)}{\partial t}(v_A - u_A(t^{**}(s))) - 2\frac{\partial u_A(t^{**}(s))}{\partial t} g(t^{**}(s), s) \\ & + \frac{\partial^2 u_A(t^{**}(s))}{\partial t^2}(1 - G(t^{**}(s), s)). \end{aligned}$$

Differentiating in (24), we can characterize the tariff's dependence on s as follows;

$$\frac{dt^{**}(s)}{ds} = \frac{\overbrace{\frac{\partial g(t^{**}(s), s)}{\partial s}}^{?} \overbrace{(v_A - u_A(t^{**}(s)))}^{-} - \overbrace{\frac{\partial G(t^{**}(s), s)}{\partial s}}^{-} \overbrace{\frac{\partial u_A(t^{**}(s))}{\partial t}}^{+}}{\underbrace{h(t^{**}(s), s)}_{-}}. \tag{26}$$

Thus the only term which may have an ambiguous sign is $\partial g(t^{**}(s), s)/\partial s$. From (21) we know that

$$sgn\left(\frac{\partial g(t,s)}{\partial s}\right) = sgn\left(\frac{\partial f(k,s)}{\partial s}\right).$$

Hence, a *sufficient* condition for $t^{**}(s)$ to be increasing in s is that

$$\frac{\partial f(\kappa(t^{**}(s)), s)}{\partial s} \leq 0.$$

For a uniform distribution, this condition holds with equality. For any single-peaked density function f, with a peak at $\hat{k}(s)$, it holds if and only if $\kappa(t^{**}(s)) \leq \hat{k}(s)$. (If the distribution is symmetric, this means that the probability of FDI, $G(t^{**}(s), s)$, must be less than $1/2$.)

Necessary conditions are harder to interpret. We cannot completely discard the possibility that there are distributions such that dt^{**}/ds is negative over an interval.[11] We conclude that a perfect analog to Proposition 2 may not exist for all possible distribution functions F and parameters θ. Whether a counterexample can be found remains to be seen, however.

Above, the probability of FDI and the level of protection are jointly determined. So, whereas a given firm is more likely to invest the higher is the level of protection, we cannot draw the conclusion that investment and protection should be positively correlated as long as both variables are affected by the distribution of k. Indeed, there is a case to be made that there should be a negative relationship instead. The intuition is simple: As the cost difference k increases, firm A can exploit the situation in two ways. It can keep the tariff and benefit from the probability of direct investment going down, or it can increase the tariff. But the higher the tariff, the more the domestic firm has to lose from FDI, and hence it should be more cautious (wish for a lower G) as k is higher. Formally, we can show the following result.

Proposition 6 *In equilibrium, the probability of foreign direct investment is decreasing in s.*

[11] The intuition is the following. Consider a solution in which $\kappa(t^{**}(s)) > \hat{k}(s)$. If s goes up, the decrease in probability of FDI from a marginal reduction in t is greater than before, and it may therefore be profitable to lower t.

PROOF: The result is obtained by total differentiation of the first order condition (equation (24)). Rearranging terms, substituting in from the first order condition and dividing by $\partial u_A(t^{**}(s))/\partial t$, we find

$$\frac{dG(t^{**}(s),s)}{ds} = \frac{dt^{**}}{ds}h(t^{**}(s),s) + \frac{\partial g(t^{**}(s),s)}{\partial s}(v_A - u_A(t^{**}(s))).$$

This can be further simplified using equation (26), to obtain

$$\frac{dG(t^{**}(s),s)}{ds} = \frac{\partial G(t^{**}(s),s)}{\partial s}\frac{\partial u_A(t^{**}(s))}{\partial t},$$

which is negative. □

The corollary is immediate.

Corollary 1 *If there is a positive relationship between t^{**} and s, then there is a negative relationship between G and t^{**}.*

In other words, if industries differ only in their cost of direct investment (the distribution of k), and if trade policy is in the hands of the domestic industry, there would typically be a negative correlation between protection and direct investment. This result may shed light on a challenging empirical finding by Orr (1975). In a cross-section sample, he found no significant relationship between Canadian tariffs and the ratio of direct investment over imports. The coefficient, however, was negative —quite contrary to the received theory. That theory, developed by Horst (1971,1972) among others, was one in which protection was exogenous and consequently predicted a positive correlation between protection and FDI.

To summarize the section, the introduction of asymmetric information allows foreign direct investment in equilibrium even when firms have rational expectations. Thus, the notion that the VER's lobbied for by the American electronics and car industries triggered direct investment by Japanese firms, is not evidence that the lobbying was irrational or that the American industry stood to gain from the presence of transplants. The more compelling story is that they behaved rationally given their beliefs, but underestimated the adaptability of the Japanese technology.

Moreover, the relationship between protection and direct investment changes sign if protection levels are endogenously rather than exogenously determined.

6 Related Literature

The paper brings together two previously separate strands of literature. The theory of endogenous trade policy is extended to allow for direct investment as a substitute for trade, and the theory of multinational firms is extended to take account of endogenous trade policy. Below, we relate our work to earlier contributions.

Mundell (1957) is an early article discussing the relationship between trade in commodities and factor movements. In particular, he showed formally that "an increase in trade impediments stimulates factor movements and an increase in factor movements stimulates trade." He also demonstrated the possibility of using high tariffs to attract capital.

While Mundell's analysis is carried out in a a world of perfect competition, the present paper relies heavily on the assumptions that markets are imperfect, and that a multinational firm has a technological advantage which is transferable across countries. This theory of the multinational corporation originated with Hymer (1960) and is now broadly accepted. In this tradition, an early formalization is Horst (1971) who analyzes the connection between tariffs and the behavior of a multinational monopoly. He did however not try to explain the level of tariffs.

In the normative trade theory, there has been a number of attempts to assess the welfare consequences of import tariffs in a framework with imperfect competition. The seminal article is Brander and Spencer (1984). Dixit (1988) generalizes their analysis and derives a number of comparative static results. As Dixit (p.68) himself concludes, the results are not consistent with the practices we observe, and he argues that "political necessity" must be the main explanation. Recently, the Brander/Spencer framework has been extended to allow for direct investment as an alternative to trade, in papers by Horstman and Markusen (1992) and Motta (1992). They consider the impact of tariffs on the choice between exporting and making a direct investment in an imperfectly competitive market. They show that there is a complex relationship between the parameters of the model and the welfare maximizing tariff. The complexity is due to the fact that the interest of domestic consumers (low prices) is contrary to the interest of domestic

producers.[12] In addition, these papers only consider quantity competition, and would surely display even more complexity if the mode of market interaction were considered as well.[13] Thus, if one were to argue that governments in fact try to maximize the sum of profit and consumers' surplus, these papers —like Dixit (1987)—are bad news.

The present paper, while maintaining the assumption that markets are imperfectly competitive, assumes that the government cares chiefly about industry profit and neglects the interest of poorly organized consumers. As we have shown, the model is then capable of delivering simple predictions which do not depend on details of the market interaction.

As indicated above, the positive theory of protection has largely ignored the possibility of direct investment. An exception is the theory of *quid pro quo* foreign direct investment, as formulated by Bhagwati in a series of papers (see e. g. Bhagwati (1987)). There, the idea is that firms may make direct investments abroad to influence the foreign country to reduce protection. That framework is very different from ours, as it rests on the beneficial effects of FDI on the host country's economy.[14] The government in Bhagwati's story does not primarily listen to the multinational's domestic competitors.

The idea that declining industries are less susceptible to new entry and therefore may desire higher tariffs can be found in Baldwin (1982, 270–271). He argues that lobbying by incumbent firms generates a positive externality on future entrants, creating a free-rider problem that is absent if the industry is declining and no new entry will take place.[15] However, he did not notice that the incumbents may even *prefer* a low tariff, which is the key to our results.

While there have been several different explanations for the choice of quotas over

[12] In Motta's model complications also arise from the endogeneity of the domestic firm's entry decision.

[13] As is now well known, strategic trade theory is riddled by results that depend on whether the firms' choice variables are strategic complements or strategic substitutes. See, e. g., Krugman (1990, ch.14) for an overview.

[14] Indeed, we have ignored all beneficial effects of FDI for the host country. Countries sometimes set high tariffs exactly in order to attract foreign entrants—notably large multinational corporations. However, this is the case mainly when local competition is weak or missing—not least in developing countries. Our theory is applicable only when there is a domestic industry to protect.

[15] Hillman (1982, 1182) also notes that declining industries are less susceptible to entry, but in his model this is not the basic reason they receive more protection.

tariffs,[16] the literature on VER's usually assumes a rationale for leaving rents with foreigners, either because multinationals can influence domestic politicians as in Hillman and Ursprung (1988), or because of fears of retaliation if foreign interests are harmed too much. In the current paper on the other hand, multinationals do not care about the type of protection, since their equilibrium profit is unaffected. The lower tariff is exactly counterbalanced by the smaller size of the quota. Thus, the analysis ties in with that of Bhagwati and Brecher (1987), who also question whether a VER is preferable to other import restrictions seen from the foreign country's point of view.[17]

Finally, section 4 relates to Levinsohn (1989), who studies a model with endogenous location in which a country can choose whether to impose a tariff or a quota. His main result is that the two are equally effective. Levinsohn's model differs from ours in two important respects, however. His government maximizes welfare rather than domestic profit. Also, there are no fixed costs, so the foreign firm can costlessly split its production between countries.

7 Final Remarks

Previous work on endogenous protection has largely supposed that the domestic industry wants unlimited protection. In a world where a large proportion of all production is carried out by multinational corporations, this is a questionable assumption. To the domestic industry, the risk of facing competition from transplants is a real cost of import protection. In the present paper, therefore, we model the trade–off between import protection and the risk of FDI.

The model provides a new explanation for several observed regularities, and in particular the correlations between protection on one hand and cost and demand conditions on the other.

Future empirical work may show whether the theory stands up to more tailor made

[16]Notably, the social cost of quotas is less transparent than that of tariffs; see Feenstra (1984), the quota rent can be more easily assigned to domestic industry interests; see Cassing and Hillman (1985), and quotas may facilitate collusion; see Krishna (1989).

[17]In the Bhagwati and Brecher paper, it is general equilibrium effects and costly lobbying that are the sources of foreign rent dissipation.

tests as well. The most obvious test is to compare industries with much firm specific capital and easy technology transfer to industries where there is little firm specific capital and/or where such capital is hard to utilize abroad. (The first group of industries contains, e. g., products where trademarks are more important than the actual production technology.) The latter should have systematically higher protection.

We emphasize that the theory does not only apply to industries in which multinational firms are currently active, as the activity is an endogenous feature of an equilibrium. Consider the example of agriculture. This is an industry with little firm-specific knowledge and almost exclusively domestic investment; it is as if k is infinitely large. According to our model, a country's agricultural protection should therefore be comprehensive in all products where there is domestic production. Certainly, the high worldwide levels of agricultural protection is consistent with the present theory.[18]

Of course, the paper neglects several potentially important factors. We do not wish to deny that labor unions have political influence or that multinational firms are capable of exerting pressure in a foreign country. These are factors which, if introduced into the model, may moderate our conclusions, but not we believe, undermine the framework.

An implicit assumption has been that the domestic industry cannot seek protection against FDI. This is unrealistic. Many countries have long traditions in preventing foreigners from investing in domestic production facilities. The insistence by the U. S. auto industry on various domestic content rules can also be explained as a way of making direct investment more costly to Japanese car makers. In the future it would be desirable to study the interaction between barriers to trade and barriers to investment.

One reason why it is harder to erect barriers to investment than to trade, is that regions and countries may be played against each other by the multinational firm. E. g., even if the U. S. car industry as such was opposed to Japanese investments, a number of states were competing for their investment once it was clear that they moved in.[19] This

[18]Several countries forbid imports of various foreign agricultural products permanently or during the domestic season. On the other hand, average agricultural protection is very low in some other countries, including the United States. This can be explained, however, by the superior efficiency of domestic farms. In the U. S., for instance, protection is hardly needed to keep out foreign grain or beef.

[19]Reportedly, the state of Kentucky lured Toyota to establish a plant there by promising free land, $47 million in new roads and a training program worth $65 million (see Graham and Krugman (1991)).

issue, as well as the issue of trading blocs,[20] require an extension of the model to include more than one host region. That, however, must await future work.

[20]Trading blocs raises a number of new questions, such as trade diversion within and between blocs, industry flight, and other conflicts of interest.

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