Journal of International Economics 22 (1987) 257–279. North-Holland

FOREIGN DIRECT INVESTMENT WITH UNEMPLOYMENT AND ENDOGENOUS TAXES AND TARIFFS

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Received April 1985, revised version received June 1986

It is well known that high tariffs can induce foreign direct investment or 'tariff jumping'. This paper analyzes tariff jumping in the context of a host government which can set specific tariffs and taxes subject to the credibility constraint that the chosen levels be optimal once capital is irreversibly in place. The foreign multinational is assumed to choose its location and level of investment strategically, taking into account the induced tax and tariff levels. In the presence of unemployment, the optimal tariff exceeds the optimal tax for any given level of capital investment, leading to foreign direct investment.

1. Introduction

If a casual observer were asked about the determinants of foreign direct investment, he (or she) might first suggest the simple 'tariff jumping' argument: if a country has high import tariffs then firms might choose not to export to it, but to invest in that country and undertake local production instead. Not surprisingly, professional economists have devoted a reasonable amount of attention to the tariff jumping idea[1] and it has become an important part of the received theory of foreign direct investment. There are, however, two directions in which we feel that the standard theory of tariff jumping, as represented particularly by Horst (1971), should be extended.

*This paper was first presented at a conference sponsored by the Centre for Economic Policy Research (London) and the International Economics Study Group, where Elhanan Helpman and John Sutton made particularly helpful comments. We also thank Lorraine Eden and Colin Lawrence for useful comments and an anonymous referee for thoughtful and constructive criticism. J. Brander gratefully acknowledges financial support from the Center for International Business Studies of the University of British Columbia. Barbara Spencer gratefully acknowledges support from Boston College in the form of a Faculty Research Fellowship.

[1]The evidence on tariff jumping as a determinant of foreign direct investment is surveyed by Caves (1982), where it is argued that tariff structures appear to be major influences on direct investment decisions by multinationals.

The two extensions are to treat the tariff as an endogenous variable, and to allow unemployment in the host country economy. The objective of this paper is, therefore, to incorporate these ideas into the tariff jumping approach to foreign direct investment.

At the most general level the structure of our argument is as follows. First, a host country government perceives differential benefits from foreign direct investment as opposed to having a foreign firm export to the host country. The source of the differential benefits is that there is domestic unemployment in the host country: unemployment is reduced by foreign direct investment and the associated local production. One would expect these differential benefits to be reflected in tax and tariff policy, leading to a bias in favor of investment in the host country.

This paper is a particular example of the general structure just described. Many features of the specific model could be changed without departing from this general structure. One specific feature of the model is that credibility constraints are imposed on the tariff and tax policies of the host country. The idea is that once foreign investment is in place, there is no structural barrier to high levels of taxation. Multinational firms might be expected to take potential taxation into account in making investment decisions. We assume therefore that at each stage in the strategic decision sequence or 'game' played by government and firm each agent assumes that the other will act in its own best interests at subsequent stages.[2] For example, threats or promises by a host country government to do something other than set its best tax or tariff would be ignored. This approach is consistent with a recent theme in the macroeconomics literature[3] and with recent papers by Eaton and Gersovitz (1981, 1984) where default and expropriation by host country governments are examined.

This treatment of taxes and tariffs differ sharply from most work in international trade and public finance. Normally, government policies are regarded as having innate credibility: a government announces a particular tax and/or tariff policy, and firms respond by choosing profit maximizing investment levels, taking the announced taxes and tariffs as given. We would like to emphasize that one could easily construct a model of this sort and still make the same general point about tariff-jumping. Such a model would, in effect, involve adding an optimal tariff argument to Horst (1971) to construct a complete model of tariffs and investment. The implicit assump-

[2]This requirement that agents look ahead to the self-interested behavior of themselves and other agents at future decision points is referred to as 'subgame perfection' in the game theory literature. Other terminology for the same or very similar ideas includes 'dynamic consistency', 'credibility' and 'feedback solution'.

[3]The imposition of a credibility (or 'dynamic consistency') constraint on government policy has been an important recent idea in the macroeconomics literature. See, in particular, Kydland and Prescott (1977) and Buiter (1981).

tion in such models is that firms believe that governments will not systematically change tax or tariff rates once investment is in place.

In practice, no government policy has complete innate credibility, while all government policies in place have some inertia associated with them. Innate credibility is really a matter of degree rather than something which either exists or not. The degree of innate credibility is essentially determined by the costs of making policy changes. These costs might be associated with reputation effects in some larger game embracing many policy areas, or with administrative difficulty. Governments which have elaborate legislative and administrative procedures for changing policy have more credibility than governments whose policies can be changed at the whim of a single person. Furthermore, some policy areas are more subject to precommitment than others. For example, in the United States, policies arising directly from Constitutional Amendments have a good deal more credibility than policies which are determined by government agencies, because the latter can be changed relatively easily. From the modelling point of view it is convenient to ignore credibility constraints if credibility is not a central issue (implicitly assuming innate credibility), or alternatively, to use credibility constraints explicitly if endogenous credibility is an important consideration. We have opted for the second of these approaches.

An important feature of the paper is the incorporation of unemployment in the host country economy. The government, whose objective is to maximize national welfare, is therefore influenced by the employment consequences of tax and tariff policy. Treating unemployment as an influence on tax and tariff policy and consequently on foreign direct investment is clearly a departure from traditional theories of international trade and investment. One reason for this departure is our perception that employment concerns dominate the political debate over trade policy in many countries and that this is not adequately reflected in economic theories of tariff formation. We accept that there is merit in the standard argument that unemployment is a short-run cyclical problem, best treated by stabilization policy and left out of theories concerned with the longer run pattern of trade and investment flows. However, this argument is perhaps less persuasive today than it was a decade ago. Structural unemployment, while a long standing problem in less developed countries, appears to have become a major concern in many developed countries as well. In any case, we do not wish to take an extreme methodological position concerning the appropriate role of unemployment in economic theory. We would argue, however, that it is reasonable to at least consider structural unemployment in microeconomic theories of trade and investment. The standard treatment of rigid wage induced unemployment in trade theory is associated with Brecher (1974a, 1974b).

Our analysis draws on several themes in the literature of international trade and related areas. The most direct connection is to the theory of

multinational corporations and foreign direct investment,[4] including the previously mentioned paper by Horst (1971). Other relevant work in the area includes Copithorne (1971) (who develops a model similar to Horst), Eden (1983), and Itagaki (1979). Good general references include Caves (1982) and Dunning (1974). In addition, chapters 12 and 13 of Helpman and Krugman (1985) offer a theory of multinationals incorporating imperfect competition in output markets in a full general equilibrium trade model.

The theory of foreign direct investment based on the behavior of (imperfectly competitive) multinational firms is distinct from the view of investment flows associated with the mainstream literature of international trade. In that literature investment flows are seen as the outcome of competitive owners of capital changing the location of their capital so as to equalize the rate of return across nations. Mundell (1957) is a standard reference. See also the May 1983 issue of the *Journal of International Economics.*

Our approach to tariff formation builds on Brander and Spencer (1984a, 1984b) and bears some relation to Dixit (1984). The credibility constraint is associated with a major set of developments in game theory. The basic point is due to Schelling (1956), and early formal treatment is usually attributed to Selten (1975), who coined the term 'subgame perfection'. The problems of expropriation and default by host country governments subject to credibility constraints have, as mentioned, been treated by Eaton and Gersovitz (1981, 1984).

2. Overview

We consider a monopoly multinational firm whose first decision concerns whether to undertake direct investment and local production in a potential host country, or whether to supply the country from other sources. These two options are referred to as the investment and export regimes, respectively. We abstract from licensing and from the possibility that the firm might simultaneously produce locally and export to the host country.[5]

If the firm decides to invest, it must then decide how much capital to invest, the host country then chooses a tariff, and finally the firm sets output. Should the firm decide to export, a similar sequence follows: the firm must choose the amount of capital for the offshore facility, the importing country

[4]Tariff jumping is of course only one of several reasons for foreign direct investment. One interesting possibility is that local production actually increases local demand for the firm's output.

[5]Such an abstraction could be formally rationalized by appealing to some indivisibility, such as a large fixed cost. More importantly, the abstraction is made to keep the analysis as simple as possible. Including the possibility of simultaneous export and foreign direct investment would raise interesting issues but would not change the economic principles associated with the issues we focus on.

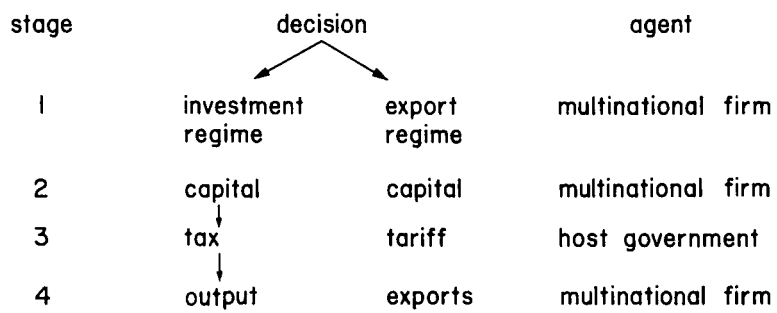

Fig. 1

then sets the tariff, and output (exports) are chosen in the last stage. The sequential structure of this game is illustrated schematically in fig. 1.

Our main result is that, in the presence of unemployment, the host government will have a credible tax schedule, as a function of capital, that lies uniformly below the corresponding tariff schedule. As a result, if cost conditions are equal in the two regimes, the firm will strictly prefer foreign investment to exporting: the presence of unemployment leads to a simple but strategically complete theory of tariff jumping.

Section 3 sets out the basic model for the investment regime and derives the subsidiary result that the strategic structure leads to underinvestment in capital in the sense that cost is not minimized for the output chosen. Section 4 develops the corresponding model for the export case. Section 5 contains our main comparison between the investment and export regimes and gives brief consideration of the neoclassical (full employment) case. Section 6 contains concluding remarks.

3. The foreign investment model

The first ingredient in the model is a representation of the host country. Demand conditions are assumed to arise from the following utility function:

$$U(x, y) = x + u(y). \tag{1}$$

The variable x represents consumption of a locally produced good, and y is local consumption of a good produced by a foreign-based multinational. The assumption that demands can be modelled as arising from a well-defined function abstracts from the usual problems of preference aggregation and the quasi-linearity of the utility function rules out demand interactions that would obscure the basic mechanisms under consideration. In addition, good x is the natural numeraire good and, since U is linear in x, the marginal

utility of income is constant, greatly simplifying income effects and welfare analysis.[6]

The economically important feature of the host country economy, for our analysis, is the presence of unemployment. By unemployment we mean excess supply (or rationing) in the labor market: some workers who would like to work at the going wage are unemployed, yet wages do not fall to market clearing levels. Accurate modelling of unemployment remains, of course, one of the central problems of economics, and we are not about to solve that problem here. One way or another, however, excess supply of labor seems empirically important, and if we are to understand international trade policy motivations it should be included in at least some of our models. The most straightforward approach is simply to assume that there is a fixed wage above the market clearing level. That is the approach followed in this paper. We appeal to the idea that an aggregate labor market with a disequilibrium fixed wage might reasonably approximate, for our purposes, the complex structure, including heterogeneous workers, asymmetric information, and market imperfections, that leads to unemployment in real economies.[7]

As has been shown by Brecher (1974b), the optimal policy in the presence of minimum wage induced unemployment involves a wage subsidy. We rule out wage subsidies as possible policy tools because of our view that real unemployment is too complex a phenomenon to be addressed using simple economy-wide wage subsidies, and because we wish to focus on the trade policy aspects of the problem.

Labor supply is assumed to be exogenously and inelastically set at L. In the initial situation the host country economy is isolated and produces and consumes only good x. Good x is produced by a purely competitive industry using labor, L^x, and some fully employed factor, T, which is specific to the industry. The production function for each identical firm i is

$$x = x(L_i^x, T_i), \tag{2}$$

which is assumed to exhibit diminishing marginal productivity in each factor. Each firm chooses L_i^x and T_i to maximize

$$\pi^{iD} = x(L_i^x, T_i) - wL_i^x - \rho T_i, \tag{3}$$

[6]As always, one must be alert to possible qualifications of the results that could result from more complex demand structures or income effects. In this paper is is reasonably clear what effects such generalizations would have.

[7]No attempt will be made to conscientiously reference the large literature on theories of unemployment. As we see it, the fundamental problem is to explain why wages do not fall in the presence of excess supply of labor. One interesting class of explanations derives from the so-called 'efficiency wage hypothesis'. This hypothesis is that employers find it against their best interests to strive to reduce wages even if there is an excess supply of labor at the going wage. See Yellen (1984) for a review of efficiency wage models.

where ρ is the per unit return to factor T, and the price of the (numeraire) good x is taken to be 1. The first-order condition with respect to L_i^x, $\pi_L^{iD}=0$, ensures that $x_L(L_i^x, T_i)=w$, where x_L denotes the marginal product of labor. If there are n identical firms, then this implies

$$L^x = nL_i^x(w, T/n), \tag{4}$$

so that the total demand for labor depends only on the fixed wage, T, and n. If the multinational invests capital, k, in the host country, it uses host country labor, L^y, to produce output, y, according to the production function:

$$y = y(L^y, k). \tag{5}$$

We assume that additional labor reduces the marginal product of labor, while additional capital increases it:

$$y_{LL}<0 \quad \text{and} \quad y_{Lk}>0, \tag{6}$$

where y_{LL} and y_{Lk} are second partial derivatives of (5).

In specifying the timing of any sequential game it is not important when a player has its first opportunity to announce the level of some strategy variable. What is important is when the last opportunity occurs, for it is only the last opportunity that carries irreversibility with it. (More accurately, it is only when the costs of changing the policy become high that the policy can be taken as settled.) For example, a host country could announce tax rates before investment occurred. Unless the government could bind itself to these tax rates, however, they could always be changed after investment was put in place. The initial announcement, while technically feasible, is strategically irrelevant. The correct modelling procedure, therefore, is to specify tax rates as being set after capital is in place.[8] It also seems logical to suppose that the multinational chooses its level of capital prior to its output decision and that it can always alter its output after tax rates are set.

Assuming that the firm has decided to invest, the sequence of decisions is therefore: investment (by the firm), tax rate (by the government), and output (by the firm), as shown in fig. 1. At each stage the agent involved is assumed to act in its own best interest, given previous decisions, and given its expectations of future decisions. Those expectations are formed on the assumption that the other agent will also be acting in its own best interest. The solution will then be credible or subgame perfect.

[8]If, on the other hand, one believed that government announcements have innate credibility (perhaps because of reputation effects in some larger game), then the appropriate sequence would involve taxes first, followed by capital, along the lines of Spencer and Brander (1983).

In modelling the taxation decision of the host government it is convenient at this stage to specify the tax instrument. Natural candidates for a tax instrument include a specific output tax, an ad valorem tax on output, a profits tax, and a revenue tax. In fact, there is a potential vector of taxes. We choose to work with a specific output tax only. As pointed out by a referee, this is equivalent to assuming that the host country government can precommit itself to using a particular tax instrument, even though it cannot precommit itself to particular levels of tax instruments.

This implicit assumption may strike some readers as inconsistent, so some discussion is warranted. A minor point to make is that, as indicated earlier, levels of innate policy credibility vary with the policy under consideration. A change in the nature of tax instruments could well be costlier in both reputation effects and transaction costs than a change in just the levels of tax instruments currently in use. It is, therefore, not totally unreasonable to treat the type of tax instrument as precommitted while the level is not, even from the point of view of descriptive accuracy.

This, however, is not the main point. The main issue is one of modelling strategy. Our central economic idea is that foreign direct investment and local production create different tax incentives for a host country government than does exporting to the host country. In our model, this difference arises because local production creates a tradeoff between the employment effects and the revenue-generating effects of output taxes, whereas exports to the host country do not have local employment effects. If we were to allow a profits tax or license fees, then once investments were in place, the host country government would have an incentive to charge a 100 percent profits tax, or an equivalent license fee, leaving the firm with only enough to cover variable costs. (In our simple framework, a license fee or profits tax has no marginal employment effects, once the investment is in place.) Anticipating this, no firm would undertake any committed investment connected with the host country. In practice, countries do not adopt such policies, in part because of reputation effects in a wider game, and in part because of informational asymmetries.

We could incorporate license fees and profits taxes in a model with reputation effects and informational asymmetries which would limit the extent to which these taxes would be used.[9] Some direct investment could now take place, although it would be distorted by the expectation of these taxes. Because all taxes are distortionary in this complex world, the optimal

[9]To make this point concrete, consider a reputation model: potential firms are unsure about preferences of the host government and in particular are unsure about how much taxation to expect. Every time the host government raises taxes on some firm, all potential investors revise their view of the government's reputation and lower planned investment. Different tax instruments might cause reputations to be revised in different ways, depending on the structure of uncertainty about the host government. Informational asymmetries prevent the government from knowing exactly what profits are and may limit taxation through other channels.

tax mix would, in general, include output taxes, and in any case, there would still be a tradeoff involving employment effects, consumer surplus, and tax revenue. This effect would, however, be buried in a complicated model. In the interest of focusing on one issue at a time, we abstract from profits taxes and license fees, and the interesting but tangential economic phenomena that would limit them. We confine our attention to specific output taxes because it is output taxes that affect the employment issue most directly.[10] We take t to be a scaler specific tax on output.

The most convenieint method of analysis is to consider the last stage first and work backwards. The profit function can be written as follows:

$$\pi(y; t, k) = py(L^y, k) - C(y; k) - vk - ty(L^y; k), \tag{7}$$

where $p = u'(y)$, the (relative) price of good y, π represents profit, $C(y; k) = wL^y$, the variable cost of production given wage rate w, and v is the cost of capital. In the last stage k and t are taken as fixed, and w is exogenous. Maximization of π with respect to y then yields the following first-order condition:

$$\pi_y = p + yp' - C_y - t = 0, \tag{8}$$

where subscripts are used to denote (partial) derivatives and p' is the derivative of inverse demand function $p(y)$. The second-order condition is

$$\pi_{yy} = 2p' + yp'' - C_{yy} < 0. \tag{9}$$

Eq. (8) implicitly defines y as a function of k and t, provided the conditions of the implicit function theorem hold. This function is represented by the letter q:[11]

$$y = q(t, k). \tag{10}$$

Eq. (10) is the firm's only credible threat concerning output. One could imagine that the firm might try to establish a threat of the form: 'if any tax rate above zero is imposed, no output will be produced', in an effort to avoid having taxes imposed. Such a threat would not be credible because it would call upon the firm to violate its own self-interest in the event that a tax were imposed. The host country government assumes that eq. (10) will be followed

[10]The choice between specific and ad valorem taxes is inessential, as their economic properties are very similar in this context. Dealing with specific taxes only, rather than both, simply has the effect of making the analysis as algebraically transparent as possible.

[11]For (8) to define y as a function of k and t the solution to (8) must exist and be unique for all relevant values of k and t.

and uses (10) in solving its decision problem. Eq. (10) implicitly defines the tradeoff between employment and tax revenue for the host country.

Before proceeding, we note that the effect of changes in k or t on output can be easily calculated by totally differentiating eq. (8). For comparative static effect $\partial q/\partial t$ we have:

$$d\pi_y = \pi_{yy}\,dy + \pi_{yt}\,dt = 0,$$

yielding:

$$q_t = \partial y/\partial t = 1/\pi_{yy} < 0. \tag{11}$$

Similarly, for comparative static effect $\partial q/\partial k$,

$$q_k = \partial y/\partial k = -\pi_{yk}/\pi_{yy} > 0, \tag{12}$$

since π_{yy} is negative from (9) and $\pi_{yk} = -C_{yk}(y, k)$ is positive.[12]

Increases in capital increase the marginal productivity of labor and consequently lower marginal cost. Expression (11) shows that, naturally enough, increases in the tax rate would lower output, while (12) shows that higher capital investment leads, other things (including t) equal, to higher output.

We turn now to stage 3 of fig. 1, the determination of t by the host country government. We assume that the host country government seeks to maximize domestic welfare, $U = x + u(y)$, given by expression (1). The implicit assumption that U represents a welfare aggregate is an additional assumption beyond what has already been assumed about demand and utility. One might also question whether it is reasonable to assume that governments act purely in the (national) public interest. It is possible to incorporate 'public choice' considerations, which focus on the private interests and incentives of the individuals who make up a government and who are charged with carrying out government policy, without changing the structure of the problem. Such considerations are no doubt important in explaining government behavior; however, in this paper we restrict attention to the 'public interest' view of government.

The amount of y consumed is equal to the amount produced, as given by (10), which is sold at (relative) price p. In effect good y is paid for in units of the numeraire, good x. The amount of good x left for consumption in the home country is equal to host country income minus expenditure on y. This

[12] $C_{yk}(y, k)$ is obtained by differentiating $C_y(y, k) = w/y_L$, recognizing that with y held fixed, the marginal rate of technical substitution dL^y/dk equals $-y_k/y_L$. Therefore $C_{yk} = -w(y_{LL}(-y_k/y_L) + y_{Lk})/(y_L)^2$, which is negative from (6).

follows from the observation that expenditure equals income:

$$x+py=w(L^x+L^y)+\rho T+ty, \tag{13}$$

from which one solves for x by subtracting py from both sides and substituting in (1) to obtain:

$$B(t,k)=U(x,q(t,k))=u(y)-py+\rho T+w(L^x+L^y)+ty, \tag{14}$$

where B represents domestic welfare (or 'benefit') as a function of t and k through the relationship $y=q(t,k)$. This structure implicitly assumes that tax revenue is refunded to host country residents and that international payments are balanced.[13]

Before maximizing $B(t,k)$ to determine the country's optimal tax rate based on the committed level of capital, it is important to establish that the domestic industry is unaffected by changes in t or k. We have already shown that labor demand and therefore the level of output of industry x depend only on w, T and n, which are independent of the existence of the multinational corporation. From the assumption of free entry, $\rho T=x-wL^x$ [see(3)], indicating that the return to factor T is a residual after payment of wages and is also independent of t and k.

The host country maximizes (14) with respect to t. Using $dL^x/dt=0$ and $d\rho/dt=0$, the first-order condition is

$$B_t=u'q_t-pq_t-yp_t+w\,dL^y/dt+y+tq_t=0. \tag{15}$$

Noting that $u'=p$ and $dL^y/dt=(dL^y/dy)q_t=q_t/y_L$, solving for t yields:

$$t=-y(1-p_t)/q_t-w/y_L. \tag{16}$$

The first term in expression (16) tends to be positive because $q_t<0$ [from (11)] and $p_t(=p'q_t)$ will normally be less than unity.[14] This term reflects the host country's incentive to use a tax to extract rent from a foreign owned monopoly firm.[15] The second term is defninitely negative (incorporating the minus sign), indicating the influence of the employment effect in moderating incentives to tax the multinational. A higher tax rate leads to lower output,

[13]In effect exports of x are exactly equal to the sum of factor payments to capital and profits repatriated to the shareholders of the multinational firm. This is not so much an assumption as a requirement for consistency of the model, since there are no financial assets.

[14]As described in Brander and Spencer (1984b), it is possible that an increase in the tax could cause price to rise by more than the tax increase ($p_t>1$), but only if demand is very convex. For most reasonable demand structures price rises by less than the tax increase: $p_t<1$.

[15]Using a tax to extract rent from a multinational firm is analogous to using a tariff to extract rent as described by Katrak (1977) and Brander and Spencer (1984b).

less employment, and lower employment income. A higher tax rate also leads to a higher price for y and to less consumer surplus from the consumption of y. The optimum occurs where these two negative effects just offset the positive effect of higher tax revenue.

Provided second-order condition $B_{tt}<0$ is satisfied, expression (16) characterizes the solution for t given k. If this solution is unique for all feasible values of k, then (16) implicitly defines

$$t=t(k). \tag{17}$$

No matter what the host country government threatens or promises to do, only tax rate t is credible. Expression (17) is a credibility constraint,[16] just as expression (10) is. We rule out the possibility of outright expropriation of capital by the host country. One can imagine that the multinational has some essential knowledge without which k is of little value, or that wide-ranging reputation effects inhibit outright expropriation. Expression (17) shows the full range of taxes that the multinational can anticipate in response to its investment decision. Just as (10) was incorporated in the decision problem of the host country government, both (10) and (17) will be incorporated in the decision problem faced by the multinational in setting k.

The effect of changes in k on the tax rate can be calculated by totally differentiating (15) with respect to t and k to obtain:

$$t_k=\mathrm{d}t/\mathrm{d}k=-B_{tk}/B_{tt}. \tag{18}$$

B_{tt} is negative by the second-order condition for maximization of B. Therefore $\mathrm{d}t/\mathrm{d}k$ has the same sign as B_{tk}. Differentiation of (15) with respect to k and some algebraic manipulation, as shown in the appendix, yields:

$$B_{tk}=q_tq_k(\pi_{yy}+p')-yq_{tk}/q_t, \tag{19}$$

where $q_{tk}=-(q_t)^2[(3p''+yp''')q_k-\mathrm{d}C_{yy}/\mathrm{d}k]$. The first term of B_{tk} is always positive, but the sign of q_{tk} in the second term is ambiguous. If q_{tk} is sufficiently negative arising from $\mathrm{d}C_{yy}/\mathrm{d}k<0$ or from convex demand ($p''>0$), then it is possible that B_{tk} and therefore $\mathrm{d}t/\mathrm{d}k$ are negative. (With $q_{tk}<0$ an increase in capital would magnify the fall in output from a small increase in the tax rate, lowering the optimal tax.) If, however, q_{tk} is small and/or positive, then $B_{tk}>0$ and $\mathrm{d}t/\mathrm{d}k>0$. We would normally expect that B_{tk} is positive, leading to an optimal tax rate that would be increasing in the invested capital stock.

[16]Expressions (8) and (17) might be referred to as 'reaction functions' but we refrain from adopting that usage here so as to avoid confusion with simultaneous move games.

The next step is to consider the capital investment decision by the firm, which corresponds to stage 2 of the game. At stage 2, the firm's profits are solely a function of k (and of exogenous variables) because t and y are functions of k via credibility constraints (10) and (17). The profit function can therefore be written as a function of k:

$$\pi(q(t(k),k);t(k);k)=py-C(y;k)-ty-vk, \tag{20}$$

where $t=t(k)$ and $y=q(t(k),k)$. Maximization of (20) with respect to k leads to the following first-order condition:

$$d\pi/dk=(\partial\pi/\partial y)(q_k+q_t t_k)+(\partial\pi/\partial t)t_k+\partial\pi/\partial k=0. \tag{21}$$

From (8), $\partial\pi/\partial y=\pi_y=0$, and from differentiation of (7), $\partial\pi/\partial t=-y$ and $\partial\pi/\partial k=-C_k-v$. Eq. (21) then reduces to

$$d\pi/dk=-yt_k-C_k-v=0. \tag{22}$$

Expression (22) is, in implicit form, a solution for k in terms of the exogenous variables. Formally, it completes the basic characterization of the solution in the foreign investment regime, as expressed in Proposition 1.

Proposition 1. Expressions (10), (17), *and* (22) *determine the values of* y, t, *and* k, *which characterize the solution to the foreign investment model.*

Proposition 1 is a summary of the preceding analysis. In principle, one solves for k from (22) then, using this solution, obtains t from (17) and finally solves for y from (8).

An interesting observation that follows from (22) is that the multinational firm will not install the cost-minimizing level of capital for the final output chosen. Cost minimization with respect to capital would require $\partial\pi/\partial k=-(C_k+v)=0$: the extra cost of a unit of capital would just offset the saved labor cost. In the foreign investment model of this paper, however, the installation of capital also has a strategic affect on the government,[17] reflected in the term $y\,dt/dk$. Changing the capital stock will change profits by inducing a change in the tax rate charged by the host country. Eq. (22) indicates that cost would be minimized only if dt/dk were equal to zero. In general, if production has neoclassical properties then $C_{kk}>0$, and the

[17]This strategic effect of capital is analytically similar to the strategic effect of capital in the variable coefficients model in Dixit (1980), in Eaton and Lipsey (1980), and in other related papers. In those papers, however, the player is another firm and the strategic role of capital is in deterring or at least influencing entry.

underuse or overuse of capital can be linked to the sign of dt/dk, as expressed in Proposition 2.

Proposition 2. If dt/dk *is positive the multinational firm invests insufficient capital for cost-minimizing production of* y*, while if* dt/dk *is negative, the firm invests excess capital. In particular, if demand is nonconvex, and* p''' *and* dC_{yy}/dk *are small, then too little capacity is installed.*

Proof. The proof of Proposition 2 follows from the observation that, if $dt/dk>0$, then $C_k+v<0$. A sufficient increase in capital would, since $C_{kk}>0$, cause C_k to become less negative and equate C_k+v to zero, which would be the cost minimizing point. Hence, too little capital is used initially. The relation between excess capital and the structure of demand and cost follows directly from eq. (19) since B_{ik} has the same sign as dt/dk. □

As already mentioned, we take the case $dt/dk>0$ as the standard case, leading to underuse of capital as far as cost minimization is concerned. Because installed capital is hostage to the taxing authority of the host country government, it is perhaps not surprising that the multinational normally has an incentive to economize on the use of capital to an extent beyond that implied by simple cost minimization. It is interesting that this need not always be the case. Furthermore, it should be noted that the underuse of capital and concomitant overuse of labor are not necessarily suboptimal from the social point of view, since the social opportunity cost of labor is something less than the wage rate (and is, in fact, zero in the simplified model of this paper).

4. The export regime

The alternative to foreign direct investment is to produce good y elsewhere and export to the country in question, which, for conveience, we will continue to refer to as the host country. There is some flexibility possible in the modelling of this alternative. Our meodelling objective is to put investment and export regimes on as equal a footing as possible, apart from the asymmetry of central interest. The central asymmetry is that in the investment regime it is host country labor that is used to produce y, while in the export regime outside labor is used. Secondary asymmetries such as wage differences, different alternative uses for capital, transport costs, and so on, are suppressed so as to focus clearly on the economic effects we are trying to isolate.

Accordingly, we assume that wage rates and production functions, and therefore cost functions, are the same in both regimes. Transport costs are zero, and capital, in the export regime, is put in place specifically for the

production of exports and has no other use. Also, the strategic structure of the export regime is, as illustrated in fig. 1, identical to the strategic structure of the investment regime, except that it is a tariff rather than a tax that is set by the host country in stage 3.

Note that we are implicitly assuming that the government is able to precommit itself to using the same type of tax instrument on imports as on local production: specific output taxes. It is not obvious, for example, why the export regime should not be subject to license fees. In general the host government might commit itself to using different policy instrument mixes in investment and export regimes, reflecting the differential incentives that lie at the heart of our analysis. In a fully realistic model, confiscatory (effectively lump-sum) taxes would not appear, because of reputation effects and informational asymmetries, as discussed in section 3. The comparison between tariffs and output taxes would therefore remain significant. In trying to demonstrate and understand differential incentives in the two regimes, we abstract from everything else and focus only on the parallel instruments of specific taxes on local production by the multinational and specific tariffs on exports from the multinational.

These assumptions imply that the last stages in each case are analytically identical in the sense that eq. (10) applies to both. Given common levels of k, and a tariff rate equal to the tax rate, the multinational would produce the same output in both cases. We introduce the variable r to represent the specific tariff rate. The output decision of the multinational firm in the last stage (stage 4) is therefore characterized by

$$y = q(r, k), \tag{23}$$

where q stands for the same functional relationship as in expression (10). The difference arises in stage 3, the tariff determination stage. The objective function of the host country government is now

$$B(r, k) = U(x, q(r, k)) = u(y) - py + \rho T + wL^x + ry. \tag{24}$$

There is no L^y term because production of y is carried out using outside labor. As before, x, L^x, and ρ are unaffected by changes in r, so taking the derivative of B with respect to r yields:

$$B_r = -yp_r + y + tq_r = 0, \tag{25}$$

and solving for r gives:

$$r = y(p_r - 1)/q_r. \tag{26}$$

Comparison of expressions (16) and (26) indicates, rather obviously, that the tax rate, t, has an extra negative term, suggesting that t tends to be less than the tariff rate, r. The complication is that p_r and q_r will be evaluated at different points on the demand curve than are p_t and q_t, so it does not immediately follow that $t<r$.

In any case, expression (26) implicitly defines r as a function of k, just as (17) was defined from (16):

$$r=r(k). \tag{27}$$

The function represented by $r(k)$ is different from the function $t(k)$ that appears in eq. (17). It is the comparison of these two functions that is at the essence of the comparison between the export and investment regimes. Stage 2, at which the firm sets its (offshore) capital, is much like the corresponding stage in the investment regime. The difference is that (27) rather than (17) is substituted in the profit function to represent the anticipated behavior of the host country government. The profit function is, then,

$$\pi(q(r(k),k);r(k);k)=py-C(y;k)-ry-vk, \tag{28}$$

where $y=q(r(k),k)$ and $r=r(k)$. Maximization of π with respect to k then implies:

$$\mathrm{d}\pi/\mathrm{d}k=(\partial\pi/\partial y)(q_k+q_r r_k)+(\partial\pi/\partial r)r_k+\partial\pi/\partial k=0. \tag{29}$$

As in the investment regime, there is the usual envelope property that $\partial\pi/\partial y=0$ by final stage maximization of profit with respect to output. Also, as before, $\partial\pi/\partial k=-C_k-v$, while $\partial\pi/\partial r=-y$, so (29) simplifies to

$$\mathrm{d}\pi/\mathrm{d}k=-yr_k-C_k-v=0. \tag{30}$$

Expression (30) is, for the export regime, an implicit solution for k in terms of the exogenous variables. Analogs to Propositions 1 and 2 follow immediately, as described in Proposition 3.

Proposition 3. Expressions (23), (27), *and* (30) *characterize the solutions for* y, r, *and* k *in the export regime. As in the investment regime, the capital decision has the property that cost will not be minimized for the levels of output chosen. Although the direction of the capital bias is ambiguous in general, there is a presumption that insufficient capital will be installed.*

The proofs of the claims concerning the bias of the capital decision are almost identical to and slightly simpler than the corresponding claims for the investment regime and are not reported here.

The economic point is that even offshore capital plays a strategic role in this model, as represented by the term $r_k(=\mathrm{d}r/\mathrm{d}k)$. This is a result of the assumption that capital, even if put in place offshore, is committed to the importing country (which we have been referring to as the host country). In practice, offshore production facilities may have the advantage that they can more easily be used to supply alternative destinations. It might even be argued that this flexibility is one of the major considerations in foreign investment decisions. Our position would be that offshore investment probably constitutes a less rigid commitment to the market in the target importing country than onshore investment would, and that the strategic effect of capital would consequently be smaller, although still significant. This particular asymmetry between investment and exporting is not, however, the asymmetry we are tying to investigate in this paper; accordingly, we abstract from it.

Having examined investment and export regimes separately, we now consider stage 1 of the problem: the firm's selection of whether to invest or export.

5. Comparison of investment and export regimes

The main line of reasoning in making the comparison between investment and exports is as follows. We show that the tax schedule, $t(k)$, is uniformly lower than the tariff schedule, $r(k)$. This implies that maximum profits in the investment regime are higher than in the export regime; therefore, with the same exogenous structure, except for the employment effect, the multinational will choose to undertake foreign direct investment. We now establish these results rigorously.

Proposition 4. The tax schedule as a function of capital, $t(k)$, lies uniformly below the tariff schedule, $r(k)$.

Proof. From (15) we obtain:

$$B_t = y(1-p_t) + tq_t + wq_t/y_L, \tag{31}$$

whilst from (25):

$$B_r = y(1-p_r) + rq_r. \tag{32}$$

Recall that $q(r,k)$ is the same function as $q(t,k)$. Therefore if k is the same in both regimes and $r=t$, it follows that y is the same in both regimes and that $q_r=q_t$. Also, since inverse demand $p(y)$ is unchanged, $p_r(=p'q_r)=p_t(=p'q_t)$. Therefore, for given k and $r=t$, the first two terms of (31) coincide exactly with the two terms of (32). Furthermore, the term wq_t/y_L is unambiguously

negative, since the wage, w, and the marginal product of labor, y_L, are obviously positive, while q_t is negative by (11). Therefore, evaluated at $t=r$,

$$B_t(t,k) < B_r(r,k). \tag{33}$$

Given global concavity of $B(t,k)$ and $B(r,k)$ in t or r (for a given k) (or that $B_{tt}<0$ and $B_{rr}<0$ globally), these functions have unique maxima in t and r, and from (33), when $B_t=0$, B_r is still positive. Therefore, as illustrated in fig. 2, the value of t that maximizes B, for a given k, must be less than the value of r that would maximize B. □

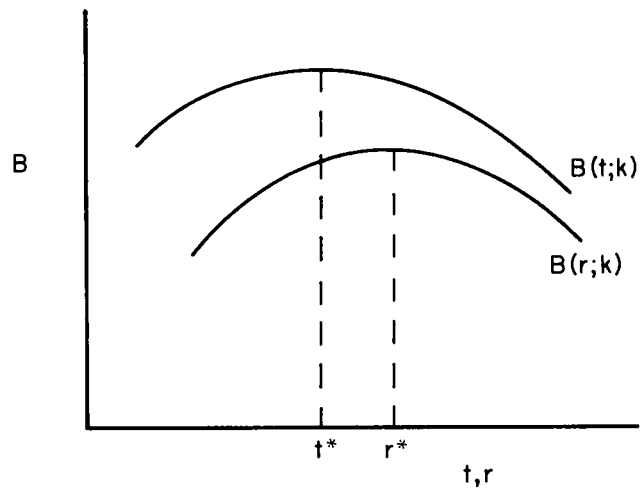

Fig. 2

It is no great surprise that $r>t$ for a given k. The cost to the host country of raising the tax in the investment regime is higher because increases in t reduce wage income. This effect is entirely absent in the export and tariff case. Proposition 4 implies that the tariff and tax schedules are as illustrated in fig. 3.

The firm maximizes profit, through its choice of k, in either regime, taking into account the tax or tariff schedule, as illustrated in fig. 3, that it anticipates. The essential point is that, for any given level of invested capital, k, the firm would always be better off if the tax or tariff rate were lowered. This follows from applications of the envelope therorem to profit functions (20) and (28):

$$d\pi/dt = \pi_y q_t + \partial\pi/\partial t = -y < 0,$$

and similarly for $d\pi/dr$.

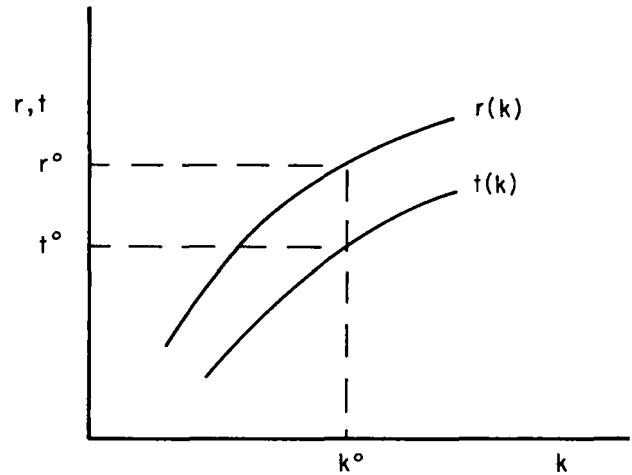

Fig. 3

It is now clear that the foreign investment regime must yield higher profits than the export regime. This is most easily seen by contradiction: Suppose that the export regime yielded higher maximum profits. Let the optimal level of capital for this regime be denoted k^0, and let the associated tariff be r^0. If the multinational had opted for the investment regime, it could have chosen k^0 as the investment level, in which case it would have encountered tax rate t^0, which is less than r^0 (see fig. 3), and earned unambiguously higher profits. (In addition, of course, the firm may choose a different level of k in the investment regime and earn still higher profits.) Thus, the export regime must be less profitable, as stated in Proposition 5.

Proposition 5. Suppose the wage rate and the production function are the same in the potential host and offshore facilities. Given unemployment in the host country, the multinational will choose to locate in the host country rather than export.

Proposition 5 is the basic tariff jumping idea. In the presence of local unemployment a potential host country can credibly threaten a higher tariff schedule on imports than tax schedule on local production. The anticipated higher tariff will, other things equal, induce foreign direct investment. Rather obviously, cost advantages or disadvantages in the host country would strengthen or weaken, respectively, the incentive to undertake foreign direct investment. Cost disadvantages might, however, be overcome by the strategic tariff jumping effect.

Having argued that unemployment creates an incentive structure in which a host country can credibly threaten investment-inducing tariffs, we should

devote some attention to the implicit comparison case, the case of full employment. If the optimal investment of the multinational firm would be too small to have a noticeable impact on the market clearing wage in the host country, then the comparison is straightforward. The term $w\,\mathrm{d}L^s/\mathrm{d}t$ simply disappears from (15), and w/y_L correspondingly disappears from (16). The investment and export regimes become identical and the firm will be indifferent between the two. Minor cost differences could then tip the balance one way or the other, but either way there is no scope for strategic tariff jumping. Foreign investment might evade a tariff, but it would induce an equivalent tax.

The argument is somewhat more difficult if the multinational is large enough to appreciably bid up real wages in the host country economy. In this case, some of the incentives present in the unemployment model can be restored. Specifically, the host country government may have an incentive to offer lower tax than tariff rates because of the real wage effect arising from investment by the multinational. The firm, however, experiences the rising real wage as an increase in marginal cost and may be less inclined to invest, depending on the wage structure in the alternative production location.

6. Concluding remarks

This paper contains a theory of 'tariff jumping' foreign direct investment in which tariff or tax levels are treated as endogenous variables. A multinational firm, which is trying to decide whether to invest in a potential host country, or export to it, is viewed as playing a simple strategic game with the host country government. The firm anticipates that taxes or tariffs charged will be set by the host country government so as to maximize its national welfare objective once capital is in place. Thus, the government's proposed actions are subject to credibility constraints, as are the actions of the firm. The principal result is that, in the presence of local unemployment, the host can, for any particular committed capital stock, credibly threaten higher tariffs on imports than taxes on local production. This would lead a profit maximizing multinational, other things equal, to undertake foreign direct investment rather than export. In effect, the paper completes the tariff jumping argument in that it analyzes why the tariff itself can be set at a high enough level to attract investment, despite the fact that taxes are always available once investment is in place.[18]

We have developed what seems to us the simplest model possible containing the two elements of economic structure on which we wanted to focus: credibility constraints in the interaction between firm and government,

[18]In general, comparative taxes seem to be an important determinant of investment location. See Frisch and Hartman (1984) for recent evidence.

and unemployment in the host country. As a result the paper clearly illustrates the influence that unemployment may have on credible government strategies and investment flows.

We would also like to emphasize that unemployment is not the only source of differential benefits from foreign direct investment. Similar policy incentives would follow, for example, from positive externalities caused by technology transfer. Any source of differential benefits can form the logical foundation of a tariff jumping theory of foreign direct investment.

The paper is admittedly restrictive in its specification. One particular restriction is that the only policy instruments considered are specific taxes on output and, correspondingly, specific tariffs. As described in the paper, however, it seems clear that the basic asymmetry between investment and export regimes would persist in more complex and realistic policy environments. If one were to include profits taxes and license fees, one would need to include reputation effects and informational asymmetries to limit the use of these instruments and avoid unrealistically trivial outcomes.

One natural extension is consideration of the strategic position of the 'home government' of the multinational firm, or of other governments generally. One might easily imagine that the source country in the export regime would have incentives to use tax (or possibly subsidy) instruments. Similarly, one could entertain the possibility that there might be more than one firm interested in investment to produce good y. In short, a small numbers setting with a few (perhaps two) firms and governments would introduce new strategic elements. The effects outlined in this paper would form the basis of strategies in such a world if the simultaneous Nash equilibrium were used as a solution concept. Another direction of generalisation is that the firm may choose to simultaneously export to and produce locally in a host country.

There is one final caveat to consider. This paper offers a positive theory of incentives facing multinational firms and host country governments. It argues that there is a unilateral incentive to use tariff policy to attract investment. We do not argue that such tariffs should be used or should be allowed under GATT. On the contrary, we would argue that this paper offers support for the GATT type multilateral approach to trade liberalization, because unilateral incentives are not in the direction of trade liberalization and are likely to lead to inefficient beggar-thy-neighbor outcomes. It is, however, important to understand the nature of these unilateral motives, especially in the presence of phenomena such as imperfect competition, strategic interaction, and unemployment, which are important in real world policy debates.

Appendix

The principal steps in the derivation of expression (19) follow. Starting

with (15) and using $u' = p$, $dL^y/dt = (dL^y/dy)q_t = q_t/y_L$ and $C_y = w/y_L$ yields:

$$B_t = q_t(y(1-p_t)/q_t + C_y + t). \tag{A.1}$$

At the optimum, since $B_t = 0$, the partial derivative of (A.1) with respect to k is

$$B_{tk} = q_t[(1-p_t)q_k/q_t - y(q_t p_{tk} + (1-p_t)q_{tk})/(q_t)^2 + dC_y/dk]. \tag{A.2}$$

Note that $dC_y/dk = C_{yy}q_k + C_{yk}$. Since, from (12), $q_k = C_{yk}/\pi_{yy}$ and from (9), $dC_y/dk = C_{yk}(\pi_{yy} + C_{yy})/\pi_{yy} = (2p' + yp'')q_k$. Also, using $p_t = p'q_t$, we have $p_{tk} = p''q_k q_t + p'q_{tk}$. Substituting for dC_y/dk and p_{tk} in (A.2), we obtain:

$$B_{tk} = q_t[(1-p_t)q_k/q_t - yp''q_k - yq_{tk}/(q_t)^2 + (2p' + yp'')q_k]. \tag{A.3}$$

Noting again that $p_t = p'q_t$, where $q_t = 1/\pi_{yy}$ from (11), and cancelling terms, (A.3) reduces to

$$B_{tk} = q_t q_k(\pi_{yy} + p') - yq_{tk}/q_t, \tag{A.4}$$

which is expression (19) of the text.

Also, $q_{tk} = -(d\pi_{yy}/dk)/(\pi_{yy})^2 = -(q_t)^2(d\pi_{yy}/dk)$. Recalling $\pi_{yy} = 2p' + yp'' - C_{yy}$, q_{tk} becomes:

$$q_{tk} = -(q_t)^2[(3p'' + yp''')q_k - dC_{yy}/dk]. \tag{A.5}$$

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