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Country size and tax competition for foreign direct investment

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Abstract

We analyse tax competition between two countries of unequal size trying to attract a foreign-owned monopolist. When national governments have only a lump-sum profit tax (subsidy) at their disposal, but face exogenous and identical transport costs for imports, then both countries will be willing to offer a subsidy to the firm. At the same time, the firm prefers to locate in the larger market where it will be able to charge a higher producer price. In equilibrium the large country receives the investment and may even be able to charge a positive tax, if the difference in the sizes of the national markets is sufficiently great. The profit tax paid in equilibrium rises further if countries are given an additional instrument of either a tariff or a consumption tax.

Keywords: Tax competition; Foreign direct investment; Regional location

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1. Introduction

When a firm chooses to become a multinational enterprise and establish a foreign production plant, it seldom builds a factory to service only the domestic

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market of the country in which it is investing. Instead, it establishes a base from which it supplies consumers in surrounding countries. This foreign direct investment (FDI) may have been triggered by efforts at increasing the level of integration between countries in the region, as have recently been taken by regional economic groupings such as the European Union (EU), NAFTA and the ASEAN countries.

Thus, for example, the EU's Single Market Initiative has reduced the remaining barriers to trade between member states and has raised the level of competition within the region (see Smith and Venables, 1988). Even if external trade barriers are unchanged, these policies of reducing intra-regional trade costs put suppliers from outside the region at a disadvantage (for example, transforming the EU into ''Fortress Europe''). The foreign firms may respond by setting up production within the region in order to avoid the external trade barriers and avail themselves of access to the single market. Consequently the tariff-jumping incentive to build a branch plant is increased when trade barriers within the region are lowered (Norman and Motta, 1993).

In this paper, we investigate what influences a foreign-owned firm in its choice of country in which to invest, once it has opted for foreign direct investment rather than exporting from its home base. In particular, we focus on foreign direct investment in a region in which the population is asymmetrically distributed between countries and there are some remaining barriers to intra-regional trade (though these are lower than on trade with countries outside the region).

The existence of trade costs creates a ''home market bias'' familiar from the new trade theory (e.g. Krugman, 1980), which interacts with tax policy as governments attempt to attract the foreign firm by offering investment incentives. Recent empirical work has shown that both market size and the effective tax rate on capital are important factors in influencing multinational firms' choices of countries in which to invest (Devereux and Freeman, 1995; Devereux and Griffith, 1998; Grubert and Mutti, 1996).

These empirically relevant determinants of FDI lead us to draw on two fields which have traditionally been largely separated in the literature—the new trade theory on the one hand and the public finance related literature on international tax competition on the other.

Recent work in the trade literature has focused on imperfectly competitive markets and has introduced transport costs as a model element that plays an important role either as an agglomerating force (Krugman, 1991), or for the equilibrium market structure and the production decision of multinational firms (Horstmann and Markusen, 1992).

In the last few years, several papers have also incorporated tax competition in a framework of imperfectly competitive markets. Thus Ludema and Wooton (1998) introduce tax competition for mobile workers to the Krugman model. Markusen et al. (1995) study a model where governments compete through environmental taxes when production activity causes local pollution and a multinational firm may

operate plants in one, both, or none of the competing countries. Environmental tax policy is also studied in Rauscher (1995), who compares noncooperative and cooperative outcomes when countries compete for the location of a foreign-owned monopolist. Other papers combine oligopolistic behaviour and international mobility of firms when governments compete either through local public inputs (Walz and Wellisch, 1996) or profit taxes (Janeba, 1998). Finally, Lahiri and Ono (1996) consider a small host country that optimally deploys profit taxes and local content rules when a variable number of identical foreign and domestic firms compete in its domestic market.

On the other hand, most contributions on tax competition in the public finance tradition have adopted a framework of perfect competition, but have introduced various sources of asymmetries between countries and have studied the interaction between different tax instruments.

One branch in this literature which is directly relevant for the present work focuses on asymmetric tax competition between countries of different size (Bucovetsky, 1991; Wilson, 1991; Kanbur and Keen, 1993; Trandel, 1994). A general result from this literature is that the small country chooses the lower tax rate and achieves the higher per-capita utility level in the Nash equilibrium, relative to the large country. Another strand in this literature considers the optimal mix of source- and residence-based capital taxation when there is cross-hauling of foreign direct investment and rents from fixed factors cannot be (fully) taxed by a separate instrument (Mintz and Tulkens, 1996; Huizinga and Nielsen, 1997). A still different set of papers with links to the present analysis considers subsidy competition for interregionally mobile firms (Black and Hoyt, 1989; Haaparanta, 1996). However, none of these papers incorporates trade costs between the competing jurisdictions. Hence differences in market size—if they exist—do not affect the location decision of the multijurisdictional firm.

The present paper combines the trade cost element from the new trade literature with the existence of differences in country size and multiple tax instruments. As we will see, this setting produces results that differ critically from those established in the previous literature. Our analysis considers two different settings. Initially, we assume that there are exogenously determined trade costs which are incurred when goods are shipped between countries. In this case, the only instrument available to each government is the ability to tax or subsidise the operations of a firm that invests within its national frontiers.

We find that the existence of trade costs reverses the answer to the question whether the large or the small country ''wins'' the competition for internationally mobile capital. Later, we shall replace the trade costs by a second policy instrument which can either be interpreted as a tariff or—closer to the European setting—as a consumption tax. We show that in the presence of this second instrument the large country will not only be able to attract the firm, it will also quite likely be able to impose a positive profit tax in the locational equilibrium.

The remainder of this paper is organised as follows: Section 2 describes the

basic model, which applies to both policy settings discussed thereafter. Section 3 analyses profit tax competition between the two governments when trade costs are exogenous and represent a source of pure waste. Section 4 then turns to the case where trade costs take the form of an additional policy instrument (tariff or consumption tax) and provide a source of tax revenues. Section 5 compares our results with those established in previous contributions on interregional capital tax competition and Section 6 concludes.

2. The model

2.1. The households

Consider a model of a region composed of two countries, labelled A and B. Two goods are consumed in each country: the numeraire good Z is produced by competitive firms, while good X is produced under conditions of imperfect competition (see below). Preferences in both countries are identical and equal to:

$$u_i = \alpha x_i - \frac{1}{2}\beta x_i^2 + z_i \quad \forall\, i \in \{\text{A, B}\}, \tag{1}$$

where u_i is the utility of a representative household and x_i and z_i are its consumption of goods X and Z, respectively.[1] We assume that there is a single household in country B and $n>1$ identical households in country A. Therefore, without loss of generality, country A is the large marketplace for good X in the region.

Each household supplies one unit of labour for which it receives a wage of w, in units of the numeraire good Z. Furthermore, we assume that in each country all revenues that the government obtains from taxation are distributed equally and in a lump-sum fashion across the population. If these revenues are negative, then our treatment implies symmetrically that each government can impose lump-sum taxes on its population. Denoting per capita tax revenues by T_i, the budget constraints facing a representative household in each country are:

$$w + T_i = z_i + q_i x_i \quad \forall\, i \in \{\text{A, B}\}, \tag{2}$$

where q_i is the consumer price of good X in country i. Maximisation of (1) subject to the budget constraint (2) yields the representative household's inverse demand for good X:

[1]The quadratic utility functions in (1) are frequently used in the new trade literature because they offer a simple way to compare welfare levels in discrete choice problems as the one studied here (see, for example, Horstmann and Markusen, 1992 and Markusen et al., 1995) As we will point out, however, some of our results do not depend on this specific utility structure.

$$\alpha - \beta x_i = q_i \quad \forall\, i \in \{\text{A, B}\}.$$

Note that the individual's tax receipts or payments do not enter the demand function for good X since, at the margin, income changes affect only the demand for the numeraire good Z. Aggregating over households in country A and rewriting yields the market demand curves for the two countries:

$$X_{\text{A}} = nx_{\text{A}} = \frac{n(\alpha - q_{\text{A}})}{\beta},\ X_{\text{B}} = x_{\text{B}} = \frac{\alpha - q_{\text{B}}}{\beta}. \tag{3}$$

Hence the market demand curve of the small country B is steeper than the demand curve of country A. This has immediate implications for the optimal price policy of the monopolist, to which we now turn.

2.2. The firm

We assume that the regional market for good X is served by a foreign-owned monopolist intent on establishing production facilities in either country A or B. The assumption of a monopolistic market structure is frequently made in models focusing on strategic interaction between governments, as it avoids additional strategic considerations at the firm level (see, e.g., Markusen et al., 1995, or Rauscher, 1995). It is known from more general models (Horstmann and Markusen, 1992) that monopoly emerges as an equilibrium market structure when firm-specific fixed costs (representing, for example, investments in R & D) are sufficiently high to render market entry unprofitable for a second firm.

Given this market structure there are, in principle, four options open to the foreign-owned monopoly: it can (*i*) locate only in country A; (*ii*) locate only in country B, (*iii*) set up a plant in both countries A and B; (*iv*) export to the entire region from its home base. While there are no conceptual difficulties to analysing all the four cases in our framework, the comparison between options (*i*) and (*ii*) is the most interesting in a setting of asymmetric country size. We therefore exclude options (*iii*) and (*iv*) in the following in order to save space.[2]

The firm cannot price discriminate between markets and consequently charges the same producer price p (the consumer price net of trade costs), irrespective of the country in which the good is sold. This assumption can be motivated either by

[2]Again, it is known from earlier work that this can be done without loss of generality by making appropriate assumptions on the values of exogenous parameters: the two-plant strategy (*iii*) will be unprofitable when the fixed costs at the plant level are sufficiently high, relative to the (intra-regional) transportation costs saved (Horstmann and Markusen, 1992). Furthermore, option (*iv*) of serving the two countries' markets from outside the region becomes less profitable, relative to FDI, when economic integration causes intra-regional trade costs to fall significantly below the costs of inter-regional trade (Norman and Motta, 1993). The detailed conditions under which these options will be dominated by the strategies considered in our paper can be found in a technical appendix available to the interested reader upon request.

the existence of a common competition policy as in the EU (Smith and Venables, 1988), or by international antidumping regulations which prohibit price discrimination between markets (Haaland and Wooton, 1998).The consumer price of good X in country i will, however, depend on whether it is locally produced or imported from the other country in the region, as imports incur a trade cost of τ_i per unit.[3] We therefore have to distinguish between the cases of the monopolist setting up in country A and its establishing production facilities in country B. Let q_i^j denote the consumer price of good X in country i when it is manufactured in country j. This leads to the following price relations:

$$q_A^A = p_A,\ q_B^A = p_A + \tau_B \quad \text{for FDI in country A,}$$

$$q_A^B = p_B + \tau_A,\ q_B^B = p_B \quad \text{for FDI in country B.} \tag{4}$$

The production structure of our model is very simple. There is a symmetric fixed cost F of setting up production in either country, which is sufficiently large to ensure that the firm will not choose to operate plants in both countries. Labour is the single factor of production and the production technology has constant returns to scale. The input of one unit of labour is necessary for the production of one unit of good X so that marginal cost is equal to the wage rate w. In order to focus on differences in country size we assume the wage rate to be the same in both countries.

The host country can levy a lump-sum tax (subsidy, if negative) on the firm's profits if it sets up operations within its frontiers. In a stylised form, this tax instrument incorporates both direct investment subsidies paid to firms and (cash flow) taxes on pure profits.[4] In general, these profit taxes can serve to appropriate any location-specific rent, for example the possession of a natural resource (as in the case of the British Petroleum Revenue Tax). Our focus in the following will, however, be on the rents generated by savings in aggregate transportation costs.

Let the tax set by host country i be t_i. Net profits of a firm based in country i will be its profits from sales in both countries less the (symmetric) fixed set-up cost F and the country-specific profit tax t_i. Since X_i are the firm's aggregate sales in each country this gives[5]

$$\Pi_A = (p_A - w)[X_A(q_A^A) + X_B(q_B^A)] - F - t_A \quad \text{for FDI in country A,}$$

[3] In Section 4, the price wedge between markets will take the form of a tariff or a consumption tax. Good Z is assumed to be freely traded at all times (that is, without trade costs or tariffs).

[4] We have chosen lump-sum profit taxes rather than (more realistic) proportional taxes since the latter complicate the algebra without affecting any of the qualitative or quantitative results of the paper. The algebraic expressions for the case of proportional profit taxation can be found in the technical appendix already referred to in footnote 2.

[5] Our treatment implies that the source principle of taxation is relevant for foreign direct investment; this is generally accepted in the literature (cf., e.g., Tanzi and Bovenberg, 1990).

$$\Pi_B = (p_B - w)[X_A(q_A^B) + X_B(q_B^B)] - F - t_B \quad \text{for FDI in country B.}$$

Substituting the demand Eq. (3) and the consumer price definitions (4) yields

$$\Pi_A = \frac{(p_A - w)}{\beta}[(\alpha - p_A)(n+1) - \tau_B] - F - t_A,$$

$$\Pi_B = \frac{(p_B - w)}{\beta}[(\alpha - p_B)(n+1) - n\tau_A] - F - t_B. \tag{5}$$

The optimal price policy of the firm will generally depend upon its choice of location. Differentiating each of the profit expressions in (5) and solving for the optimal prices yields:

$$\hat{p}_A = \frac{1}{2}\left[\alpha + w - \frac{\tau_B}{(n+1)}\right] \quad \text{for FDI in country A,}$$

$$\hat{p}_B = \frac{1}{2}\left[\alpha + w - \frac{n\tau_A}{(n+1)}\right] \quad \text{for FDI in country B.} \tag{6}$$

Note that prices are independent of the lump-sum taxes on establishment set by each country, but do depend on the trade cost. If trade costs are the same in both directions ($\tau_A = \tau_B$), then the firm will charge a lower producer price if it settles in the smaller country B than if it were to establish in country A. This result is obtained because the majority of trade costs are avoided by the firm producing in its larger market. Hence there is an incentive for the firm to locate in the large market—the ''home market bias'' familiar from the new trade literature—if wages and tax rates are equal in the two countries.

Inserting (6) into (5) gives the maximum profits attainable from locating in a particular country:[6]

$$\hat{\Pi}_A = \frac{[(n+1)(\alpha - w) - \tau_B]^2}{4(n+1)\beta} - F - t_A,$$

$$\hat{\Pi}_B = \frac{[(n+1)(\alpha - w) - n\tau_A]^2}{4(n+1)\beta} - F - t_B. \tag{7}$$

The firm will be indifferent between locating in country A or country B if $\hat{\Pi}_A = \hat{\Pi}_B$. We define by $\Gamma \equiv t_A - t_B$ the amount by which country A's tax can exceed that of country B and still leave the firm indifferent between production locations. This ''tax premium'' that the firm is willing to pay for locating in country A is given by:

[6]We assume that gross profits are strictly positive in both countries, i.e., the profit margin implied by the choice of the exogenous parameters α, w and τ is sufficiently large to cover the fixed costs F.

$$\Gamma = \frac{[2(n+1)(\alpha - w) - n\tau_A - \tau_B](n\tau_A - \tau_B)}{4(n+1)\beta}. \tag{8}$$

Eq. (8) determines the location decision of the firm for any given set of tax rates t_i and transport costs τ_i. In the following we will consider two different cases. In Section 3, transport costs are exogenous and assumed to be equal across countries so that tax competition between national governments occurs solely with respect to the lump-sum tax t_i. In Section 4, the transport costs are reinterpreted as tariffs or—equivalently in the present framework—consumption taxes on good X. Hence governments have two instruments at their disposal and we will analyse how this affects the outcome of tax competition between the large and the small country.

3. Tax competition with symmetric trade costs

In this section we assume that trade costs (transportation costs) are exogenous and equal to τ per unit, no matter in which direction good X is shipped. In this case Eq. (8) simplifies to:

$$\Gamma = (n-1)[2(\alpha - w) - \tau]\frac{\tau}{4\beta}. \tag{9}$$

This expression is zero when countries are of equal size ($n=1$); the model is then completely symmetric and the firm has no preferences for locating in either country. For $n>1$, however, Γ must be unambiguously positive since $\alpha - w - \tau/2 > 0$ gives the average of the gross profits earned from selling the *first* unit of output in the two national markets. Thus country A can set a higher tax rate than country B, yet still attract the firm. We note that this result is not confined to the case of linear demand functions, but will hold for any downward-sloping market demand curve as long as preferences in the two countries are identical. Furthermore, differentiating (9) with respect to τ gives:

$$\frac{d\Gamma}{d\tau} = \frac{(n-1)(\alpha - w - \tau)}{2\beta},$$

which is positive for positive sales in the importing country. Hence the tax premium that the firm is willing to pay for locating in country A is larger, the greater are the per-unit trade costs τ.

Each government compares the welfare of its representative household when the country is host to the firm to that when it is not. The income of the representative household in a country arises from the earnings from employment together with its share of any tax revenues collected (and redistributed lump-sum) by the government. The per capita tax revenues for each country are:

$$T_A = \frac{t_A}{n}, \; T_B = 0 \text{ for FDI in country A,}$$

$$T_A = 0, \; T_B = t_B \text{ for FDI in country B.} \tag{10}$$

The revenue terms (10) are introduced in the budget constraint (2), which is in turn substituted for z_i in the utility function (1). Further substituting (3), (4), and (6) yields for country A:[7]

$$u_A^A = \frac{1}{2\beta}\left[\frac{(n+1)(\alpha - w) + \tau}{2(n+1)}\right]^2 + w + \frac{t_A}{n} \text{ for FDI in country A,}$$

$$u_A^B = \frac{1}{2\beta}\left[\frac{(n+1)(\alpha - w) - (n+2)\tau}{2(n+1)}\right]^2 + w \text{ for FDI in country B.} \tag{11}$$

The government of country A (and its citizens) will be indifferent between being the host and importing the good when $u_A^A = u_A^B$. This equality determines the minimal tax rate, or the maximum subsidy, that country A is willing to offer in order to attract the firm. Solving for this tax rate, which is denoted by $\tilde{t}_A$, gives:

$$\tilde{t}_A = \frac{-n(n+3)\tau[2(\alpha - w) - \tau]}{8(n+1)\beta} < 0. \tag{12}$$

Thus country A would be prepared to subsidise the firm in order to induce it to locate within its borders. As home production reduces the consumer price for good X in country A, relative to importing, a lump-sum subsidy can be paid to the firm that still leaves consumers in country A equally well off than if they had to import good X from country B.[8]

Carrying out similar calculations for country B, we find the tax rate at which this country is indifferent between having good X produced at home or abroad:

$$\tilde{t}_B = \frac{-(3n+1)\tau[2(\alpha - w) - \tau]}{8(n+1)\beta} < 0. \tag{13}$$

Thus, country B is also ready to offer a subsidy in order to get the foreign direct investment and save transportation costs. To see which of the two countries offers the higher subsidy we compare the tax rates in (12) and (13) and define $\Delta \equiv \tilde{t}_A - \tilde{t}_B$ to be the difference between the profit tax rates at which both countries would be indifferent between being host and importer. This gives:

$$\Delta = \frac{-(n^2-1)\tau[2(\alpha - w) - \tau]}{8(n+1)\beta} < 0. \tag{14}$$

[7] For economy of space, we derive fully only the expressions for country A. The method for deriving those of country B is analogous.

[8] Note that q_A^A (the consumer price with home production) is less than q_A^B (the consumer price with importing) even though the firm's producer price will be higher if it locates in country A (cf. Eq. (6)). However, the difference in producer prices will be less than the trade cost per unit; this follows from the well-known result that a monopolist will not find it optimal to fully shift a cost increase into consumer prices if demand functions are linear.

Hence country A is always prepared to offer a bigger subsidy to the firm than would be offered by country B. This result seems surprising at first glance since the firm's producer price will be lower if it settles in country B. However, the per capita costs of the subsidy are smaller in country A since there are a larger number of residents who share in the aggregate tax burden. For the utility specification chosen here, this ''club-good effect'' dominates and country A offers the higher subsidy.[9]

From (9) we know that the firm is willing to accept a higher tax level in country A and still locate there, whereas (14) states that the maximum subsidy country A would be willing to offer is higher than that of country B. Hence it is immediately clear in this setting of exogenous and equal transport costs that the firm will settle in the large country A.

However, to attract the firm, country A need not actually pay the subsidy $\tilde{t}_A$; it suffices to slightly improve (from the perspective of the firm) on the best offer of country B in order to get the investment.[10] Country A's *optimal* tax rate is thus $\hat{t}_A \equiv \tilde{t}_B + \Gamma$. Given country B's best offer, this is the maximum tax that country A can charge while keeping the firm indifferent between locations.[11] Taking country B's best offer from (13) and substituting into (9) yields:

$$\hat{t}_A = \frac{(2n^2 - 3n - 3)\tau[2(\alpha - w) - \tau]}{8(n+1)\beta}. \tag{15}$$

A slightly lower tax (higher subsidy) than given in (15) will guarantee that the firm sets up in country A. From the quadratic equation in the numerator of Eq. (15), one can establish that country A will actually be able to charge a positive profit tax if its market is sufficiently large, relative to that of country B. The critical value at which country A's optimal tax rate turns positive is $n \approx 2.19$. Differentiating $\hat{t}_A$ with respect to relative market size gives

$$\frac{d\hat{t}_A}{dn} = \frac{n(n+2)\tau[2(\alpha - w) - \tau]}{4(n+1)^2\beta} > 0.$$

Intuitively, $\hat{t}_A$ balances the firm's gains from locating in country A (as expressed by Γ in Eq. (9)) and country B's gains from attracting the firm, as incorporated in the negative value of $\tilde{t}_B$ (Eq. (13)). Raising n will increase the firm's interest in

[9]We note that, with more general utility and demand functions, it may not be possible to unambiguously sign the term Δ in Eq. (14). However, as the following discussion will show, this is also not required for our main argument.

[10]This is a standard result from the theory of auctions: the winner of the auction pays a price equal to the valuation of his last remaining rival and earns some economic rent. See, e.g., McAfee and McMillan (1987).

[11]Note that this always implies positive net profits to the firm in equilibrium since gross profits are positive in country B (cf. footnote 6) and country B's best offer involves a subsidy to the firm.

locating in country A, but leave $\tilde{t}_B$ unchanged; hence country A's optimal tax can unambiguously be raised.[12]

One caveat to our analysis—already mentioned in Section 2.2 above—is that the firm always has the outside option of not locating in the region at all, but rather to export to both countries A and B from its home base. Thus there may be an additional limit to the taxing power of the large country A which is not modelled in the present paper. However, as long as the difference between extra-regional and intra-regional trade costs is sufficiently high, relative to the fixed costs F, the firm will have an incentive to directly invest in country A at all relevant levels of $\hat{t}_A$. The precise conditions under which the firm's exporting option does not constrain the taxing power of country A are stated in our technical appendix (cf. footnote 2).

4. Tax competition with two instruments

We now assume that the wedge between the consumer prices in the two markets arises not from an exogenous trade cost, but from a trade tax chosen optimally by the importing country. For simplicity we will generally refer to this trade tax as a tariff, but we emphasise that tariffs and consumption taxes are equivalent instruments in our model since there is no domestic production of good X in the importing country.[13] The interpretation of the trade tax as a consumption tax is, of course, especially important in a EU context. As is argued, for example, in Keen (1987), (1989) there is evidence that nationally chosen levels of specific commodity taxation in the EU include a strategic element to discriminate against imports. As under the tariff, domestic consumption is distorted by the consumption tax in order to influence the international terms of trade.

The trade tax instrument introduces a third stage into the game played between the two countries in the region. In the first stage, each country sets its profit tax rate t_i. In the second stage, the firm locates in either country A or country B and in the third stage the importing country chooses its optimal tariff. Hence countries

[12]In contrast, a variation in the level of transport costs τ will lead to a proportional increase in both the firm's willingness to pay a tax premium in country A, and in country B's willingness to subsidise the firm. Hence τ represents a 'net multiplier' for country A's optimal tax rate, for both positive and negative values of $\hat{t}_A$. In the borderline case $\hat{t}_A = 0$ the two effects net out to zero; this explains why the threshold level at which country A's optimal tax rate turns positive is independent of the level of τ.

[13]If the additional instrument is interpreted as a consumption tax, then it is also available, in principle, to the host country. However, since both countries can levy lump-sum taxes on their residents in our model, the host country will choose *not* to employ the distortive commodity tax. In a more general framework where lump-sum subsidies to the firm must be financed by distortive commodity taxes, the welfare costs of investment subsidies increase and the optimal subsidy rates will thus be reduced in both countries. However, this extension will not change the qualitative results of our analysis as to which country offers the higher subsidy rate, or receives the investment.

commit to profit taxes *before* the firm settles in a particular country whereas tariffs are chosen *after* the location decision has been made. This order of play can be motivated as follows: since the firm knows that each country would like to raise its profit tax rate once it has settled in their jurisdiction and incurred the fixed cost F, it will insist that the host country commits to an announced profit tax policy or subsidy payment. One example where such a commitment is clearly possible is when the subsidy takes the form of investments in public infrastructure. In contrast, trade or commodity tax policies are less directly tied to the location decision of the firm and are generally subject to change at any point in time, for example because of changing revenue needs. Hence countries will not be able to credibly commit to a given level of tariffs or consumption taxes before the firm makes its locational choice.

As usual, the game is solved by backward induction. To incorporate the additional policy instrument, we must first modify the budget constraints to take into account that tariffs—in contrast to transportation costs—represent a source of revenues for the importing country. Per capita tax and tariff revenues are now:

$$T_A = \frac{t_A}{n},\ T_B = \tau_B x_B \ \text{ for FDI in country A,}$$

$$T_A = \tau_A x_A,\ T_B = t_B \ \text{ for FDI in country B.} \tag{16}$$

Governments again compare the utility of the representative consumer in the situations where the monopolist locates at home or abroad. Substituting (16) in (2) and using (3), (4) and (6) in the utility function (1) gives for country A:

$$u_A^A = \frac{1}{2\beta}\left[\frac{(n+1)(\alpha - w) + \tau_B}{2(n+1)}\right]^2 + w + \frac{t_A}{n} \ \text{ for FDI in country A,}$$

$$u_A^B = \frac{1}{2\beta}\left[\frac{(n+1)(\alpha - w) + n\tau_A}{2(n+1)}\right]^2 + w - \frac{\tau_A^2}{2\beta} \ \text{ for FDI in country B.} \tag{17}$$

Comparing (17) with the analogous expressions in the case of exogenous transportation costs (Eq. (11)) shows that the utility expression is unchanged if A is the host country, except that it now depends on the tariff in country B rather than the exogenous transportation cost. In contrast, the utility level in the importing regime is changed through the additional revenue collected from the tariff.[14]

From the expression for u_A^B in Eq. (17) we can determine country A's optimal tariff when it fails to induce the firm to set up local production facilities. Country

[14]Note that the tariff terms in the squared bracket are positive in the expression for u_A^B above, whereas trade costs entered negatively into the corresponding expression in Eq. (11). Hence tariff revenue will enter the importing country's utility level with a positive sign, even though the last term in the importing regime of (17) is negative.

B's optimal tariff is obtained in a similar fashion. Partial differentiation with respect to τ_i yields:

$$\hat{\tau}_A = \frac{n(n+1)(\alpha - w)}{(n+2)(3n+2)} > 0, \quad \hat{\tau}_B = \frac{(n+1)(\alpha - w)}{(2n+1)(2n+3)} > 0. \tag{18}$$

Thus each country will set a positive tariff if it imports good *X*. The intuition underlying this result is a conventional terms-of-trade argument since the tariff reduces the producer price chosen by the monopolist located in the other country (Eq. (6)). Furthermore, for $n>1$ we can see that $\hat{\tau}_A$ must exceed $\hat{\tau}_B$; the numerator is larger, but the denominator is smaller in the optimal tariff formula for country A. Of course, this is because country A, as the larger country, enjoys the greater monopoly power in trade.

The optimal tariffs obtained above can now be substituted into the conditions under which both the firm and the governments are indifferent between alternative location decisions. Given that each country will optimally tax its imports when it cannot attract the firm, the profit tax differential $\Gamma \equiv t_A - t_B$ that leaves the firm indifferent between the two locations is given by inserting (18) into (8). This gives, after straightforward manipulations:

$$\Gamma = \frac{(\alpha - w)^2 (n+1)^4 (n-1)}{\beta \gamma^2} [\gamma + 8(n+1)^4 + 16n(n+1)^2 + 3n^2], \tag{19}$$

where

$$\gamma = (2n+3)(2n+1)(3n+2)(n+2) > 0.$$

Hence the firm is again willing to pay a ''tax premium'' for locating in the large market. This premium is now due to two distinct factors: if the firm should locate in country B, then a larger number of its customers face the tariff, and the tariff imposed by country A is higher than the tariff that would be chosen by country B. While the first of these two effects corresponds to the transportation cost analysis of the previous section, the second effect stems from the endogeneity of the trade cost component in the present setting. Overall then, the availability of the new tax instrument tends to further strengthen the incentive for the firm to locate in the large country A.

To derive the profits tax at which the government of country A would be indifferent between importing the good and having local production, we substitute (18) into (17) and find the value at which $u_A^A = u_A^B$. This gives the minimum tax (maximum subsidy) that country A is willing to offer the monopolist:

$$\tilde{t}_A = \frac{n(n+1)^2 (\alpha - w)^2 \delta_A}{2\beta\gamma(2n+3)(2n+1)}, \tag{20}$$

where $\gamma>0$ is given in (19) and

$$\delta_A = 4n^4 + 8n^3 - 4n^2 - 16n - 7.$$

It is easily seen that δ_A is negative for small values of n but turns positive as n increases, with a critical value of $n \approx 1.40$ where country A's best offer involves a profit tax of zero. Hence, in contrast to the case of exogenous transportation costs, country A will not generally offer a subsidy to attract the firm. The reason is that, as n increases, country A will set higher tariffs on the import of good X and benefit from reduced producer prices forced by its tariff. The existence of the second tax instrument thus increases the bargaining power that country A has vis-a-vis the monopolist and will generally enable country A to offer a less favourable tax treatment to the firm.

Proceeding analogously for country B, we get this country's best offer to the firm:

$$\tilde{t}_B = \frac{(n+1)^2(\alpha - w)^2 \delta_B}{2\beta\gamma(3n+2)(n+2)}, \tag{21}$$

where

$$\delta_B = -7n^4 - 16n^3 - 4n^2 + 8n + 4 < 0.$$

As in the previous section, country B will thus offer a subsidy to the firm for all values of $n \geq 1$. Next, we again compare the best offers made by countries A and B. Forming $\Delta \equiv \tilde{t}_A - \tilde{t}_B$ and substituting in from (20) and (21) gives:

$$\Delta = \frac{(\alpha - w)^2(n+1)^2(n-1)}{2\beta\gamma^2}\left\{\gamma n + 12(n+1)^4\left[(n+1)^2 + n\right]\right\} > 0. \tag{22}$$

Comparing (22) with the analogous expression in the case where trade costs were exogenous and symmetric (Eq. (14)) shows that country A now offers fewer—rather than more—location incentives to the firm, relative to country B. This change in the relative tax levels arises because country A now has an improved alternative to local production. If it has to import, it applies a relatively high optimal tariff and collects the tariff revenues.

When trade costs were exogenous, country A was always willing to subsidise the firm's investment more than was country B. Given the preference of the firm for the larger market, this guaranteed that country A was able to induce the firm to set up there. With endogenous tariffs, however, country A is less willing to subsidise foreign direct investment, raising the question whether country A will still attract local production. Thus we have to compare $\Gamma - \Delta$ from (19) and (22). This gives, after straightforward manipulations:

$$\Gamma - \Delta = \frac{(\alpha - w)^2(n+1)^2(n-1)}{2\beta\gamma^2}\left\{(2n^2 + 3n + 2)\gamma + 2(n+1)^2[2(n+1)^4 + 10n(n+1)^2 + 3n^2]\right\} > 0. \tag{23}$$

Since this difference is unambiguously positive, country A will still get the firm, even though its best offer implies a higher profit tax. Hence it is again the efficient solution that prevails in equilibrium—a smaller number of consumers faces a lower tariff as compared to production in country B. These aggregate efficiency gains can be divided up between the firm and the government of country A, ensuring that the tax premium that the firm is willing to pay for locating in country A exceeds the tax premium implied by country A's best offer.[15]

In the following we assume again that country A is able to appropriate the entire locational rent by offering a tax rate $\hat{t}_A$ that leaves the firm only marginally better off than if it accepted the best offer of country B. Hence $\hat{t}_A = \Gamma + \tilde{t}_B$ and substituting in from (19) and (21) gives:

$$\hat{t}_A = \frac{(\alpha - w)^2(n+1)^2}{2\beta\gamma^2}\,\varepsilon, \tag{24}$$

where

$$\varepsilon \equiv 2(n-1)(n+1)^2\left[\gamma + 8(n+1)^4 + 16n(n+1)^2 + 3n^2\right] + [4(n+1)^2 - 1]\delta_B$$

and $\delta_B < 0$ is given in (21). To interpret (24), let us first consider the benchmark case where countries are of equal size. For $n = 1$ the positive first term in ε disappears and country A must offer a subsidy to the firm to induce home production. For sufficiently small differences in size, country A's optimal profit tax rate will thus still be negative, even if it has the additional tariff instrument. However, as n increases, the optimal tax rate $\hat{t}_A$ grows more rapidly now than in the case of exogenous transportation costs, and turns positive at a value of $n \approx 1.08$. This compares with a critical value of $n \approx 2.19$ in the case without tariffs. Hence the existence of a second tax instrument raises the likelihood that country A is able to charge a positive profit tax rate in the locational equilibrium.

5. Discussion of results

Comparing the results derived in our above analysis with those obtained in the earlier literature, a first difference concerns the sign of the profit tax rate that is imposed on the firm in the locational equilibrium. Haaparanta (1996) considers two countries that differ both in their exogenously fixed wage rate (creating unemployment) and in country size. There are no trade costs in his model, however. Under these conditions it turns out that differences in market size are inessential for the optimal tax policy. Both countries will always subsidise foreign direct investment in equilibrium in an attempt to alleviate domestic unemploy-

[15]This efficiency result is well known for auctions of the simple type modelled here (McAfee and McMillan, 1987). It is also emphasised in Black and Hoyt (1989).

ment. An alternative reason for subsidy payments to the firm is given in Black and Hoyt (1989) where the labour market is cleared but countries attempt to realise scale economies with respect to the provision of public goods and services. Black and Hoyt show that under these conditions the maximum bid of both countries always involves a subsidy to the firm, even if countries differ with respect to a nonlabour cost component.

In contrast, there is a distinct possibility in the present model that the large country is able to extract a positive tax rate from the firm that locates within its borders. In the presence of trade costs, the difference in country size gives rise to a location-specific rent that the firm can earn in the large country, and this in turn allows the large country to tax these rents in equilibrium. This links our paper to contributions by Mintz and Tulkens (1996) and Huizinga and Nielsen (1997) where countries are small in perfectly competitive capital markets but location-specific rents derive from fixed domestic factors.

A second—and critical—difference to previous results concerns the question whether the large or the small country ''wins'' the competition for mobile capital. Bucovetsky (1991) and Wilson (1991) have shown that when two countries of different size, but with equal per capita endowments, compete for internationally mobile capital, then the small country faces the more elastic tax base and hence chooses the lower tax rate in the noncooperative tax equilibrium. As a consequence, the smaller country attracts a more than proportional share of mobile capital and achieves a higher per-capita utility level than the larger country.

Instead, the large country ''wins'' the competition for foreign direct investment in the present model in that it attracts the foreign firm. The core reason for this new result lies again in the existence of trade costs, which imply that population size has *two* counteracting effects in the present model. The first effect is that the large country will (in the second model with endogenous trade costs) charge the higher profit tax rate in equilibrium. At the same time, however, there is a second effect of country size since the existence of transport costs gives the firm an incentive to locate in the larger market.[16] As our analysis has shown, the second effect will dominate in equilibrium and the large country is able to attract the firm. When trade costs are excluded, however, then only the first of these two effects is present and capital always locates in the low-tax country.

In the new trade literature it has become common to distinguish sharply between the modelling of portfolio investments on the one hand and foreign direct investment on the other (e.g. Cantwell, 1994). With respect to the latter, trade costs

[16]This is the ''backward linkage'' of models of economic geography where workers rather than firms are mobile across jurisdictions (see, for example, Krugman, 1991). In these models, trade costs play a critical role as an 'agglomerating force' since they raise the price of imported vis-a-vis home produced goods and thus increase the real wage of workers in highly industrialised regions (where many varieties of a differentiated good are produced). This offers an incentive to mobile workers in the other region to also move to the industrial core.

have become a standard model element that allows the role of country size to be captured in a simple way. In contrast, models of tax competition in the public finance tradition typically do not consider trade costs, so there is often no clear analytical distinction between the two types of foreign investment. We argue here that this distinction can be critical in a setting where countries of unequal size engage in tax competition. To give a simple example, Luxembourg attracts a large amount of foreign portfolio capital through low taxes, quite in line with the results of Bucovetsky (1991) and Wilson (1991) that small countries win tax wars. At the same time, Luxembourg is clearly a less attractive host country for foreign direct investment, even though corporate taxes are low by international standards. This suggests to us that while agglomeration effects—or trade costs—may be relatively unimportant for portfolio investment, they cannot be neglected in a model of foreign direct investment.

6. Conclusion

The previous literature on fiscal competition between countries of unequal size has led to a general notion that (sufficiently) large countries 'win' tariff wars, whereas small countries gain from capital tax competition (see Wilson, 1991). In this paper we have introduced an element of the new trade literature—trade costs, capturing agglomeration effects—to reconsider this issue in a framework where two countries compete for the location of a foreign-owned monopolist. Two alternative settings have been analysed. In the first case, countries had only a lump-sum profit tax (subsidy) at their disposal, but faced exogenous and identical transport costs for imports. In the second scenario, countries were given an additional instrument of either a tariff or a consumption tax. In both cases the equilibrium outcome was that the firm locates in the larger market, paying a profit tax that is increasing in the relative size of this market and which is made greater when the tariff (consumption tax) instrument is permitted. Hence, in a setting with trade costs, both tax and tariff competition work in favour of the large country.

The model presented in this paper can be extended in several ways. A first extension is to introduce strategic interactions between firms, as in Horstmann and Markusen (1992). It is known from their analysis, however, that endogenous changes in market structure introduce fundamental discontinuities to the optimal tax problems in the competing countries, and solutions can often be found only for numerical examples. Another extension is to consider the case of more than two countries competing for FDI. If countries differ only in population size, then we would expect that it is again the largest market which attracts the firm. However, the optimal tariff (or consumption tax) of the largest country will now depend on its relative size vis-a-vis all other countries. Furthermore, the size of the second largest country will be critical in determining which offer the biggest country has to beat. Essentially, the equilibrium profit tax that the largest country can extract

from the firm will then depend on its market size advantage over the next *largest* competitor.

Finally, our partial equilibrium analysis has neglected the factor market repercussions of foreign direct investment. In particular, if there is unemployment in the potential host countries then the incentives to attract the firm will increase (Brander and Spencer, 1987). Furthermore, the employment effects of a given level of foreign direct investment—and thus the per capita gain from attracting the firm—are likely to be stronger in the small country. Hence incorporating general equilibrium effects in factor markets may widen the gap between the best offers made by the large and the small country. This could lead to less clear-cut answers as to where the firm will settle in equilibrium and may offer an explanation for the success of some small countries (such as Ireland) in attracting foreign direct investment by means of very low tax rates.

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References

Black, D.A., Hoyt, W.E., 1989. Bidding for firms. American Economic Review 79, 1249–1256.

Brander, J.A., Spencer, B.J., 1987. Foreign direct investment with unemployment and endogenous taxes and tariffs. Journal of International Economics 22, 257–279.

Bucovetsky, S., 1991. Asymmetric tax competition. Journal of Urban Economics 30, 167–181.

Cantwell, J., 1994. The relationship between international trade and international production. In: Greenaway, D., Winters, L.A. (Eds.), Surveys in International Trade. Blackwell, Oxford, pp. 303–328.

Devereux, M.P., Freeman, H., 1995. The impact of tax on foreign direct investment: Empirical evidence and the implications for tax integration schemes. International Tax and Public Finance 2, 85–106.

Devereux, M.P., Griffith, R., 1998. Taxes and the location of production: Evidence from a panel of US multinationals. Journal of Public Economics 68, 335–367.

Grubert, H., Mutti, J., 1996. Do taxes influence where U.S. corporations invest? Paper presented at the Trans-Atlantic Public Economics Seminar, Amsterdam.

Haaland, J., Wooton, I., 1998. Antidumping jumping. Reciprocal antidumping and industrial location. Forthcoming in: Weltwirtschaftliches Archiv 134.

Haaparanta, P., 1996. Competition for foreign direct investment. Journal of Public Economics 63, 141–153.

Horstmann, I.J., Markusen, J.R., 1992. Endogenous market structures in international trade (natura facit saltum). Journal of International Economics 32, 109–129.

Huizinga, H., Nielsen, S.B., 1997. Capital income and profits taxation with foreign ownership of firms. Journal of International Economics 42, 149–165.

Janeba, E., 1998. Tax competition in imperfectly competitive markets. Journal of International Economics 44, 135–153.

Kanbur, R., Keen, M., 1993. Jeux sans frontières: Tax competition and tax coordination when countries differ in size. American Economic Review 83, 877–892.

Keen, M., 1987. Welfare effects of commodity tax harmonization. Journal of Public Economics 33, 107–114.

Keen, M., 1989. Pareto-improving indirect tax harmonization. European Economic Review 33, 1–12.

Krugman, P., 1980. Scale economies, product differentiation, and the pattern of trade. American Economic Review 70, 950–959.

Krugman, P., 1991. Increasing returns and economic geography. Journal of Political Economy 99, 483–499.

Lahiri, S., Ono, Y., 1996. Foreign direct investment, local contents, and profit taxation. Mimeo, University of Essex and Tokyo Institute of Technology.

Ludema, R.D., Wooton, I., 1998. Regional integration, trade, and migration: Are demand linkages relevant in Europe? In: Faini, R., de Melo, J., Zimmermann, K. (Eds.), Trade and Factor Mobility. Cambridge University Press, Cambridge, in press.

Markusen, J.R., Morey, E.R., Olewiler, N.D., 1995. Competition in regional environmental policies when plant locations are endogenous. Journal of Public Economics 56, 55–77.

McAfee, R.P., McMillan, J., 1987. Auctions and bidding. Journal of Economic Literature 25, 699–738.

Mintz, J., Tulkens, H., 1996. Optimality properties of alternative systems of taxation of foreign capital income. Journal of Public Economics 60, 373–399.

Norman, G., Motta, M., 1993. Eastern Europe economic integration and foreign direct investment. Journal of Economics and Management Strategy 2, 483–507.

Rauscher, M., 1995. Environmental regulation and the location of polluting industries. International Tax and Public Finance 2, 229–244.

Smith, A., Venables, A.J., 1988. Completing the internal market in the European Community: Some industry simulations. European Economic Review 32, 1501–1525.

Tanzi, V., Bovenberg, L.A., 1990. Is there a need for harmonizing capital income taxes within EC countries? In: Siebert, H. (Ed.), Reforming Capital Income Taxation. Mohr, Tübingen, pp. 171–197.

Trandel, G.A., 1994. Interstate commodity tax differentials and the distribution of residents. Journal of Public Economics 53, 435–457.

Walz, U., Wellisch, D., 1996. Strategic provision of local public inputs for oligopolistic firms in the presence of endogenous location choice. International Tax and Public Finance 3, 175–189.

Wilson, J.D., 1991. Tax competition with interregional differences in factor endowments. Regional Science and Urban Economics 21, 423–451.