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**Tax Competition and the International Distribution of  
Firm Ownership: An Invariance Result**

by

Ben Ferrett and Ian Wooton

## **The Authors**

Ben Ferrett is a Research Fellow in the Leverhulme Centre for Research on Globalisation and Economic Policy (GEP), University of Nottingham. Ian Wooton is a Professor of Economics at the University of Strathclyde and an External Research Fellow in GEP.

### *Contact Details:*

Ben Ferrett: School of Economics, University of Nottingham, University Park, Nottingham, NG7 2RD, United Kingdom. E-mail: [ben.ferrett@nottingham.ac.uk](mailto:ben.ferrett@nottingham.ac.uk)

Ian Wooton: Department of Economics, University of Strathclyde, Sir William Duncan Building, 130 Rottenrow, Glasgow, G4 0GE, United Kingdom. E-mail: [ian.wooton@strath.ac.uk](mailto:ian.wooton@strath.ac.uk)

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# **Tax Competition and the International Distribution of Firm Ownership:**

## **An Invariance Result**

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### **Abstract**

Intuition suggests that the international distribution of firm ownership ought to affect tax/subsidy competition for mobile plants. One might expect that the greater the share of a firm owned within a potential host country that offers a relatively profitable production location, the more that nation will be prepared to pay to attract the firm's production facility. We show this intuition to be false. In equilibrium, both plant location and the tax/subsidy offers are independent of the international distribution of ownership. The reason is that the tax/subsidy competition equalises the firm's post-tax profits across countries, making owners of capital indifferent towards the location of production.

**JEL classification:** F12, F23, H25, H73.

**Keywords:** tax/subsidy competition; foreign direct investment; international distribution of firm ownership.

### **Outline**

1. *Introduction*
2. *A model of tax competition*
3. *The role of ownership*
4. *Conclusion*

## Non-Technical Summary

In many economic theory and policy contexts, we are accustomed to thinking of national governments as competing with tax and subsidy instruments for the production plants of “foreign” firms whose profits flow abroad. This assumption might be reasonable, for example, in the case of competition between European states for the investments of Japanese multinational enterprises (MNEs). However, in many cases (e.g., competition between EU member countries for the investments of European MNEs), substantial portions of the firms concerned are owned within the bidding countries themselves. Moreover, in the presence of globally integrated financial markets, a sizeable share of a firm labelled “Japanese” due to its historical origins or the location of its headquarters may be owned by citizens of countries other than Japan. In such cases, a benevolent government will care about how tax/subsidy competition affects the profit income accruing to its own citizens. We examine the implications of this concern for both equilibrium tax/subsidy offers and plant locations, and we ask how a government’s strategy to attract this foreign direct investment (FDI) should change with the international distribution of the firm’s ownership.

These are important policy issues. Given the substantial sums that national governments often pay to mobile MNEs for each job created, the question of what constitutes the optimal corporate tax/subsidy is fundamental to economic policy. A particularly striking case study concerns the US state of Alabama, which in 1994 offered Mercedes an incentive package worth approximately \$230 millions for a new plant to employ 1,500 workers. However, examples are not confined to the US. In the UK, Siemens was offered £50 millions in 1996 to locate a 1000-worker semiconductor plant in Tyneside, northeast England. The factory closed 18 months later, with the company having to repay £18 millions in grants.

It is natural to expect that, if the bidding countries own shares in the mobile firm, their setting of corporate taxes/subsidies will reflect the preference of domestic capital owners to have production located where operating profits are maximized. This intuition is, however, misleading. We show that the outcome of a tax/subsidy competition game between two governments seeking to attract a firm’s investment is independent of how the ownership of the firm is distributed internationally. This independence applies both to the equilibrium location of the firm’s plant and to the countries’ equilibrium tax/subsidy offers. This striking result means that the nationality of the firm is irrelevant to the strategy that a potential host country should pursue in offering investment incentives.

# 1 Introduction

In many economic theory and policy contexts, we are accustomed to thinking of national governments as competing with tax and subsidy instruments for the production plants of “foreign” firms whose profits flow abroad. This assumption might be reasonable, for example, in the case of competition between European states for the investments of Japanese multinational enterprises (MNEs). However, in many cases (e.g., competition between EU member countries for the investments of European MNEs), substantial portions of the firms concerned are owned *within* the bidding countries themselves. Moreover, in the presence of globally integrated financial markets, a sizeable share of a firm labelled “Japanese” due to its historical origins or the location of its headquarters may be owned by citizens of countries other than Japan. In such cases, a benevolent government will care about how tax/subsidy competition affects the profit income accruing to its own citizens. We examine the implications of this concern for both equilibrium tax/subsidy offers and plant locations, and we ask how a government’s strategy to attract this foreign direct investment (FDI) should change with the international distribution of the firm’s ownership.

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<sup>1</sup> Kozul-Wright and Rowthorn (1998, p. 86) provide further examples.

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The remainder of the paper is organised as follows. In section 2, we set up our model, which focuses on the competition between two potential host countries to attract the plant of a monopoly firm. Our theoretical model is deliberately simple with minimal structure in order to highlight the drivers of government and firm choices as clearly as possible. At the same time, our analysis is consistent with a very wide range of government motivations in tax/subsidy competition, such as the employment and wage gains from inward FDI, the technological spillovers from this FDI to indigenous firms, as well as increased tax revenues, larger profit incomes for capital owners, and greater consumer surplus, etc.

In section 3, we establish what effect changing the international distribution of the MNE's ownership has on the equilibrium tax/subsidy offers made to the firm and its equilibrium plant location. As a benchmark, we begin by analysing the case where the firm is entirely owned outside the bidding countries, so that citizens of the bidding countries derive no capital income from the firm. We then determine how the outcome changes when some or all of the shares of the firm are owned within the bidding countries themselves. We take the international distribution of the firm's ownership as exogenous, and place no restrictions on

how it is divided between the two bidding countries and the rest of the world. Given this, we derive our “Invariance Result”, which shows that under tax/subsidy competition both the equilibrium plant location and tax/subsidy offers are independent of the international distribution of firm ownership.

In the conclusion, we present two important implications of the Invariance Result and we defend our model’s generality against two specific charges.

## 2 A model of tax competition

We model the tax/subsidy competition between two host countries for the production plant of a monopoly firm. We want to investigate how the international distribution of the firm’s ownership affects the countries’ equilibrium tax/subsidy offers and the plant’s equilibrium location. For this purpose, we partition the world into a region, which contains the potential host countries  $A$  and  $B$ , and the rest of the world,  $RoW$ . If the MNE wishes to serve consumers in the region, it must invest in either  $A$  or  $B$  as we assume that trade costs between the region and  $RoW$  are prohibitive. As for intra-regional trade barriers, our analysis makes no specific assumptions (in terms of either levels or symmetry) about trade costs between  $A$  and  $B$ .

Tax/subsidy competition is represented by a three-stage game of complete information. In stage one, countries  $A$  and  $B$  simultaneously and irreversibly post bids,  $B_A$  and  $B_B$ , which can be either taxes (negative) or subsidies (positive) and act as location-specific fixed costs. In stage two, the monopolist decides where to locate its plant, choosing between locating in country  $A$ , country  $B$  or opting for  $\emptyset$ , where  $\emptyset$  represents choosing not to invest in the region. Finally, the product markets in  $A$  and  $B$  are served in stage three. We solve the game backwards to isolate its subgame perfect Nash equilibrium in pure strategies.

## 2.1 Profits of the Firm

We denote by  $\Pi_j$  the firm's pre-tax profits on its operations within the region when its plant is located in country  $j \in \{A, B\}$ . If, for example, the firm chooses  $A$ , then it serves consumers in market  $A$  with local production and those in market  $B$  with exports. The  $\Pi_j$  terms comprise variable profits, earned on the basis of monopoly pricing in both countries, and a plant fixed cost.<sup>2</sup> However, as with trade costs, we place no restrictions on the firm's variable or fixed production costs in the two countries.<sup>3</sup> If the firm's cost structures are identical in both  $A$  and  $B$  and if intra-regional trade is costless, then  $\Pi_A = \Pi_B$ . However,  $\Pi_A \neq \Pi_B$  could arise for several obvious reasons. With costless trade, it could occur if one country were a cheaper production location than the other. If trade were costly, we could get  $\Pi_A \neq \Pi_B$  due to differences in national market sizes.<sup>4</sup>

In order to avoid an extensive and unrewarding taxonomy, we assume

$$\Pi_A \geq \Pi_B \geq 0. \tag{1}$$

There are two elements to this assumption. The first ( $\Pi_A, \Pi_B \geq 0$ ) is that the firm would find it profitable to set up in either country under *laissez faire* ( $B_A = B_B = 0$ ). Thus, while the countries may choose to offer subsidies ( $B_A, B_B > 0$ ) in order to attract the MNE's investment, these are not required to make local production profitable in absolute terms. Such subsidies would merely alter the *relative* profitability of alternative locations.

Of course, the host countries may seek to tax the MNE's investment. We assume that such

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<sup>2</sup> Our results hold independently of whether markets  $A$  and  $B$  are integrated/segmented—that is, whether consumers can arbitrage between the two markets. However, it is perhaps most straightforward to assume segmentation so the firm sets the textbook monopoly prices.

<sup>3</sup> In line with much of the existing literature, we rule out two-plant entry, where the firm sets up plants in both countries, for simplicity. However, it would be straightforward to introduce a plant fixed cost  $F$  explicitly that is sufficiently large to rule out a choice of two plants (which is done in Haufler and Wooton, 1999).

<sup>4</sup> For example, with identical cost structures and costly trade, we would have  $\Pi_A > \Pi_B$  if  $A$ 's market were larger than  $B$ 's.

corporate taxes (represented by  $B_A, B_B < 0$ ) are source-based<sup>5</sup> and that no double taxation of dividend income occurs in the capital owner's country of residence.

The second element of assumption (1) is that country  $A$  is, for whatever reason, the more profitable country in which to invest:  $\Pi_A \geq \Pi_B$ .<sup>6</sup> Thus, in the absence of any inducements from the competing governments, the MNE will choose  $A$  over  $B$ . Let  $\Gamma = \Pi_A - \Pi_B \geq 0$ , the international profit differential, be called country  $A$ 's *geographic advantage*.

The firm attempts to maximize the aggregate income accruing to owners of capital.<sup>7</sup> It therefore chooses its location and prices to maximize its post-tax profits, given by

$$\Pi_j^* = \begin{cases} \Pi_j + B_j & \text{if } j = A, B, \\ 0 & \text{if } j = \emptyset, \end{cases}$$

where  $j \in \{A, B, \emptyset\}$  represents the firm's location choice.  $\Pi_\emptyset^* = 0$  given our assumption of prohibitive two-way trade barriers between the region and  $RoW$ .<sup>8</sup>

In the Figure we illustrate the firm's location choice when faced with different offers from the competing potential host nations. The bid space is divided into three regions. Region  $\emptyset$  corresponds to the case where both countries set such high taxes on the MNE that its after-tax profits would be negative in both  $A$  and  $B$ , and it chooses not to invest. If  $B_A \geq -\Pi_A$  and  $B_B \geq -\Pi_B$ , then the firm chooses between investing in  $A$  and  $B$ , both of which offer positive post-tax profits. In the absence of offers from either government ( $B_A = B_B = 0$ ),  $A$ 's geographic advantage means that the firm will invest there. Otherwise, if  $B$ 's financial inducement  $B_B$  is sufficiently large to offset both  $A$ 's geographic advantage and  $A$ 's own

<sup>5</sup> See Keen (1993) for an empirical defence of this assumption.

<sup>6</sup> The choice as to which country is the more profitable is innocuous and is merely a labeling convention.

<sup>7</sup> It might be objected that a firm should maximize the utility of owners, rather than their income. When a firm has market power, these two do not necessarily coincide. Since profit maximization is simpler to analyse (it avoids the need to specify utility functions for owners), one could assume that capital owners' preferences are such that they choose not to consume the good in question.

<sup>8</sup> This assumption means that the firm's choice between serving the region (and, if so, where to locate) is independent of the corporate taxes/subsidies set by  $RoW$ .

offer  $B_A$ , then the firm will invest in  $B$ . Thus,  $B$  wins the competition if  $B_B - B_A > \Gamma$ . Clearly, the MNE will be indifferent between locations  $A$  and  $B$  when post-tax profits are equal ( $\Pi_A^* = \Pi_B^*$ ). This condition may be rewritten as

$$\Gamma + B_A - B_B = 0. \quad (2)$$

[INSERT FIGURE ABOUT HERE]

The firm's post-tax profits  $\Pi_j^*$  are assumed to be distributed internationally to its owners according to their equity shares  $e_A$  and  $e_B$ , which measure the proportions of the firm owned in countries  $A$  and  $B$  respectively. We take  $e_A, e_B$  to be exogenous, and they must satisfy  $e_A, e_B \geq 0$  and  $e_A + e_B \leq 1$ , where  $1 - e_A - e_B$  is the share of the firm owned in *RoW*.

## 2.2 Governments and Welfare

We assume that governments  $A$  and  $B$  are benevolent, both motivated by national social welfare, and that they set their taxes/subsidies independently. Furthermore, the governments must balance their budgets, and their only function is to redistribute income in a lump-sum manner between their citizens and the firm's owners.<sup>9</sup> We assume that the social welfare of country  $i$  when the firm chooses plant location  $j$  takes the following form:

$$W_{ij} = \begin{cases} e_i \Pi_j^* + S_{ij} - B_i & \text{if } i = j, \\ e_i \Pi_j^* + S_{ij} & \text{if } i \neq j, \end{cases} \quad (3)$$

where  $i \in \{A, B\}$  and  $j \in \{A, B, \emptyset\}$ .

The welfare function in (3) is intuitively appealing, and it can be generated formally by quasi-linear preferences.<sup>10</sup> The first term measures the income of capital owners in country  $i$

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<sup>9</sup> Although the assumption of lump-sum transfers eases exposition, we do not believe it is necessary for our results. See the Conclusion for a brief discussion. Likewise, our results would be unaffected if the governments placed a greater weight on profit income than on other components of social welfare.

<sup>10</sup> See, e.g., Ottaviano and van Ypersele (2005).

from the profits of the MNE.  $B_i$  measures country  $i$ 's total subsidy payments to the firm, which are paid only when the MNE invests in that country.<sup>11</sup> The final welfare term,  $S_{ij}$ , captures all other components of national social welfare.<sup>12</sup>

### 2.2.1 Social Benefits

For the sake of brevity, we focus on the following case, which appears to be the most empirically relevant, in solving the game:

$$S_{ii} \geq S_{ij} \geq S_{i\emptyset} \quad \text{for all } i, j \in \{A, B\}, i \neq j \quad (4)$$

We are making two assumptions in (4). The first ( $S_{ij} \geq S_{i\emptyset}$ ) is that social benefits are created when the market is served, even if only by imports from the other country in the region. This reflects the notion that countries derive benefits (e.g., in terms of increased consumer surplus) whenever the product market is served, compared to the good being unavailable in the marketplace. Thus, even if the production takes place in another country in the region, there are consumption benefits arising from importing the good. The second assumption in (4) is that local production of the good yields higher social benefits than imports ( $S_{ii} \geq S_{ij}$ ). This reflects what seems to be a widely-held government view. There are many possible reasons why, independently of capital income and tax/subsidy payments, host countries may favour local production, and our model's generality makes it consistent with all of them. For example, there may be labour market benefits from inward FDI. MNEs may offer wage premia above workers' outside options, a polar case of which occurs when inward FDI relieves involuntary unemployment (Haaparanta, 1996, and Bjorvatn and Eckel, 2006). Alternatively, inward FDI may be associated with localized technological spillovers

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<sup>11</sup> Note that corporate tax receipts add to social welfare because  $B_i < 0$  for taxes.

<sup>12</sup> In particular, note that  $S_{ij}$  contains profit income from all other firms in the global economy.

to indigenous firms (Fumagalli, 2003, and Olsen and Osmundsen, 2003). Finally, in the case where trade between  $A$  and  $B$  is costly, the market price will be lower, and consumer surplus higher, under local production, and benevolent governments will recognise this (Hauffer and Wooton, 1999).

Of course, one can envisage factors that would tend to push  $S_{ij}$  above  $S_{ii}$  ( $i \neq j$ ). For example, environmental pollution that is localized around the plant or the existence of lower variable production costs abroad would favor foreign over local production. However, the fact that governments frequently offer inducements to inward FDI in practice suggests that such apparently perverse effects are generally not so strong as to overturn the ranking in (4).

### 3 The Role of Ownership

How does the international pattern of firm ownership affect both the offers made to the firm to induce it to invest and the firm's choice of location in equilibrium?

#### 3.1 Extra-regional Ownership

Before solving the general model, we investigate the special case of extra-regional ownership, where the firm is entirely owned outside the region and hence  $e_A = e_B = 0$ . In the Figure,  $R_A$  and  $R_B$  are the countries' best response functions in the bidding stage for this case.  $R_A$  and  $R_B$  are qualitatively identical, so we concentrate our exposition on  $R_A$ . It is clear that if  $A$  chooses to set a bid that attracts the firm, it will always set the lowest possible such bid. Therefore,  $R_A$  will never lie above the lower boundary of the  $A$  region in the Figure.

If  $B_B < -\Pi_B$ , so that the firm prefers  $\emptyset$  to  $B$ , then country  $A$  effectively chooses between plant locations of  $A$  and  $\emptyset$  when setting  $B_A$ . Under our assumptions (1) and (4), it is clear that country  $A$  will choose to attract the firm with a bid of (just above)  $-\Pi_A$  in this case. Local production generates both tax revenue ( $\Pi_A \geq 0$ ) and wider social benefits for  $A$  over

the  $\emptyset$  outcome ( $S_{AA} \geq S_{A\emptyset}$ ). Therefore,  $R_A$  lies along the horizontal bottom border of the  $A$  region in the Figure.

If  $B_B \geq -\Pi_B$ , then the firm locates in either  $A$  or  $B$ . With  $e_A = 0$  in (3), we get  $W_{AA} = S_{AA} - B_A$  and  $W_{AB} = S_{AB}$ . The maximum amount that  $A$  is willing to pay for the firm would make  $A$  indifferent between attracting the firm and having the firm locate in  $B$  (i.e.,  $W_{AA} = W_{AB}$ ) and is given by its *valuation*  $V_A$ , where we define each country's valuation of receiving the investment as

$$\begin{aligned} V_A &= S_{AA} - S_{AB}, \text{ and} \\ V_B &= S_{BB} - S_{BA}. \end{aligned} \tag{5}$$

Assumption (4) implies that  $V_A, V_B \geq 0$ . We assume that the countries never post weakly dominated bids, which rules out all  $B_A > V_A$  and  $B_B > V_B$ .<sup>13</sup> Therefore, whenever government  $A$  can attract the firm with a bid less than  $V_A$ , it does so. Otherwise,  $A$  sets  $B_A = V_A$ . This accounts for the kink in  $R_A$  at  $B_A = V_A$ .

It follows from our construction of the  $R_A$  function that there exists a unique perfect equilibrium along the 45-degree line in the Figure at point  $E$ . The identity of the winning country depends on whether

$$V_B - V_A \gtrless \Gamma. \tag{6}$$

In other words, the firm's choice of investment location turns crucially upon whether  $B$ 's valuation is sufficiently greater than that of  $A$  to overcome the latter's geographic advantage. We shall refer to  $V_B - V_A$  as the *valuation premium* that  $B$  places on the firm.

Using this terminology, the following Proposition describes our game's perfect equilibrium under extra-regional ownership of the firm:  $e_A = e_B = 0$ .

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<sup>13</sup> All  $B_A > V_A$  are weakly dominated by  $B_A = V_A$ . Pick any  $B'_A > V_A$ . For all  $B_B < B'_A + \Gamma$ , country  $A$ 's welfare is strictly higher with  $B_A = V_A$  (either  $S_{AA} - V_A$  or  $S_{AB}$ ) than with  $B_A = B'_A$  ( $S_{AA} - B'_A$ ). For all  $B_B > B'_A + \Gamma$ , country  $A$  is indifferent between  $B_A = V_A, B'_A$ .

**Proposition:** (i) If pre-tax profits are equal in the two countries,  $\Pi_A = \Pi_B$ , then the country with the higher valuation wins the firm and pays a subsidy of just above the other country's valuation. (ii) If pre-tax profits are higher in  $A$  than in  $B$ ,  $\Pi_A > \Pi_B$ , then country  $B$  wins the plant if and only if its valuation premium exceeds the geographic advantage offered by  $A$ .

When  $\Pi_A = \Pi_B$ , the tax/subsidy competition is a standard first-price auction. When  $\Pi_A > \Pi_B$ , the extent of country  $A$ 's geographic advantage matters for the equilibrium. If the countries' bids are equal, then the firm will choose country  $A$  because of its geographic advantage. Therefore, in order to win the bidding contest, country  $A$  need not match  $B$ 's bid. Indeed, it can undercut  $B$  by the exact amount of its geographic advantage and still leave the firm indifferent between locations. Such a recognition by the bidding countries of the importance of geographic advantages underlies the result in part (ii).

It is worth highlighting that there are obvious circumstances where one country would possess both a valuation premium *and* a geographic advantage. As an example, consider the case where the countries' fixed/variable cost structures are identical but trade is costly and country  $A$  contains more (identical) households than  $B$ . Here  $\Pi_A > \Pi_B$  due to  $A$ 's larger market. However, we would also expect  $V_A > V_B$  because the aggregate benefits from inward FDI to both workers (e.g., wage premia) and indigenous firms (e.g., technological spillovers) will be greater in the larger market, where the MNE will employ more workers and where (reasonably) there will be more indigenous firms to benefit from non-rivalrous spillovers. This is the specific case illustrated in the Figure.

In the perfect equilibrium illustrated at point  $E$  in the Figure, country  $A$  wins the plant and  $B$  offers a subsidy equal to its valuation,  $V_B$ . Country  $A$ 's winning bid,  $B_A^*$ , just exceeds

$B$ 's subsidy minus  $A$ 's own geographic advantage:

$$B_A^* = V_B - \Gamma + \varepsilon. \quad (7)$$

Country  $A$ 's winning bid of (7) therefore leaves the firm (approximately) indifferent between the two production locations as (2) holds (again, approximately). If  $\Gamma$  is sufficiently large, the possibility therefore emerges that the monopolist could be *taxed* by  $A$  in equilibrium.

### 3.2 General Ownership Distribution

We now allow the firm's ownership to be distributed internationally in any arbitrary proportions between  $A$ ,  $B$  and  $RoW$ . Since the countries' decision problems are qualitatively identical, we again focus for concreteness on that of country  $A$ , which owns share  $e_A$  of the firm. For the moment, we assume that  $\Pi_B^* \geq 0$ , locating in  $B$  dominates  $\emptyset$ , so the firm chooses between  $A$  and  $B$ . We shall drop this assumption below.

If it hosts the firm, country  $A$ 's social welfare is

$$W_{AA} = e_A (\Pi_A + B_A) - B_A + S_{AA},$$

while  $A$ 's welfare if  $B$  hosts the firm is

$$W_{AB} = e_A (\Pi_B + B_B) + S_{AB}.$$

Therefore,  $A$ 's welfare gain from local production compared to importing is

$$W_{AA} - W_{AB} = e_A (\Gamma + B_A - B_B) - B_A + S_{AA} - S_{AB}. \quad (8)$$

This welfare change is just the sum of the changes in the income of  $A$ 's capital owners, in corporate tax revenues, and in the welfare of the rest of society.

What is country  $A$ 's valuation of the plant, the maximum it is willing to pay?  $A$  behaves optimally and will post the smallest bid necessary to attract the investment, meaning that

the MNE will be left indifferent between locations. Consequently (2) will hold. Substituting (5) and (2) into (8) yields  $A$ 's welfare gain from hosting the plant:

$$W_{AA} - W_{AB} = V_A - B_A \quad (9)$$

Therefore, for any international distribution of ownership, country  $A$  is willing to pay at most  $V_A$  in subsidies to win the plant. Likewise, for any share  $e_B \in [0, 1 - e_A]$  of the firm owned in  $B$ , country  $B$ 's valuation is  $V_B$ . These maximum bids are identical to those in the case of extra-regional ownership examined in section 3.1. It follows immediately that the countries' best response functions,  $R_A$  and  $R_B$ , and consequently the equilibrium point  $E$  are all identical to those given in the Figure above.<sup>14</sup>

Therefore, our central result is established:

**Invariance Result:** For any international distribution of firm ownership, the equilibrium plant location and tax/subsidy offers are identical to those in the special case of extra-regional ownership.

This Invariance Result is striking in its simplicity. The international spread of the firm's owners is irrelevant to the equilibrium of the tax/subsidy competition for its plant.<sup>15</sup> However, at first glance it also seems counter-intuitive. For example, assume that  $\Pi_A > \Pi_B$ . In this case, a sensible hypothesis would seem to be that increasing  $e_A$ ,  $A$ 's ownership share, would strictly increase  $A$ 's willingness to bid (valuation) for the plant because the income of capital owners in  $A$  would be highest under local production in the more profitable location. This intuition is false because it links capital income directly to pre-tax profits,  $\Pi_A$  and  $\Pi_B$ . In fact, the owners of capital derive income from the firm's *post-tax* profits,  $\Pi_A^*$  and

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<sup>14</sup> If  $B_B < -\Pi_B$ , then  $A$  optimally sets  $B_A = -\Pi_A + \varepsilon$  for all  $e_A \in [0, 1]$ , as in the Figure. Government  $A$  captures all the firm's profits plus a welfare gain due to  $S_{AA} \geq S_{A\emptyset}$ .

<sup>15</sup> The Invariance Result is also very strong. Not only is the equilibrium point independent of the international distribution of ownership, but also the entire best response plot in bid space.

$\Pi_B^*$ , which are endogenously determined and equal across the two countries in equilibrium. The tax/subsidy competition equalises post-tax profits across countries because the winning country never pays more for the plant than it has to.<sup>16</sup> This makes owners of capital indifferent to the location of production and means that income from capital falls out of the countries' welfare comparisons between local and foreign production.

## 4 Conclusion

The key contribution of this paper is our Invariance Result, which states that the equilibrium of the tax/subsidy competition between two countries for a monopoly firm's plant is, in all respects, independent of how the firm's ownership is distributed internationally. Our initial intuition was that, if the bidding countries own shares in the firm, their bidding behaviour will tend to reflect a preference on the part of the owners of capital for production to be located where operating profits are maximized. We have shown this to be wrong because capital owners care about profits after tax. A country has to determine at what point, as its rival for the investment posts higher bids, trumping that country's bid is no longer worthwhile. As trumping leaves the firm (approximately) indifferent between locations, the owners of capital in a country essentially do not care where production takes place. Thus any gain in welfare from local production must originate with the rest of society.

Two implications of our Invariance Result are worth pointing out. The first concerns its relation to debates on the informational requirements for optimal policy choices. If a country's reservation price for a plant is independent of how the firm's ownership is distributed internationally, then it follows directly that a country does not need to know the distribution of ownership in order to work out its reservation price. Consequently, optimal behaviour

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<sup>16</sup> It might be thought that in the  $e_A = 1$  case, country  $A$  is indifferent between all  $B_A$  because any subsidy payment is recycled entirely to domestic capital owners. However, this is false. If, for example,  $B_B$  is extremely large, then  $A$  will strictly prefer losing the contest because this will result in huge profit income from abroad for its citizens.

in tax/subsidy competition is possible *without* any knowledge of how firm ownership is distributed. This is a very useful result as such information is often very hard to obtain.<sup>17</sup>

Secondly, our Invariance Result suggests that tax/subsidy competition for its plants should not play a role in *explaining* the international distribution of a firm's ownership, which our analysis takes as exogenous. For example, if firm owners gained much more from tax/subsidy competition under some international ownership distributions than others, then one could reasonably expect the "best" distributions to tend to arise in the capital-market equilibrium. However, our Invariance Result renders such a selection between ownership distributions impossible.

Finally, we close with a brief defence of our model's generality in two respects. The first relates to our assumption that corporate taxes are location-specific fixed costs. Clearly, this assumption is analytically convenient because it allows us to reduce a country's tax/subsidy choice to one variable (i.e.,  $B_A$  and  $B_B$ ). However, the question arises whether our Invariance Result would continue to hold with proportional profits taxes. As nothing in the intuition behind our Result relies upon the lump-sum assumption, we believe that proportional taxes will not change the result. Indeed, the crucial step in understanding the Invariance Result is the recognition that tax/subsidy competition tends to equalise post-tax profits across countries, and this could just as well be achieved with proportional taxes.<sup>18</sup>

A second line of criticism relates to our assumption of a monopolized industry because, in practice, firms tend to face rivals on the product market. However, our model could be applied to oligopoly by assuming discriminatory tax/subsidy setting. In such a case, the

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<sup>17</sup> Our Invariance Result also suggests that the recent concern, expressed at the policy level by both the OECD (1998) and the EU (European Commission, 1998), that foreign firms tend to receive preferential tax treatment *because they are foreign* may be misplaced.

<sup>18</sup> Moreover, in their analysis of tax/subsidy competition under extra-regional ownership, Haufler and Wooton (1999) generate qualitatively identical results with both lump-sum and proportional profit taxes.

profit income from rival firms in the same industry would flow into our  $S_{ij}$  terms. Our Invariance Result thus can be readily generalized. In an international oligopoly where its rivals' plant locations are fixed, the equilibrium of the bidding contest for any given firm is independent of its ownership distribution. Thus "own-firm" effects continue to be absent, but "cross-firm" effects will matter. We leave the more complex question of how the bidding contests for rival firms in the same industry interact for future work.

## References

- Bjorvatn, Kjetil and Carsten Eckel (2006), "Policy Competition for Foreign Direct Investment between Asymmetric Countries." *European Economic Review* 50, 1891-1907.
- European Commission (1998), "Conclusions of the ECOFIN Council Meeting on 1 December 1997 Concerning Taxation Policy." *Official Journal of the European Communities* C2, 6/1/98, 1-6.
- Fumagalli, Chiara (2003), "On the Welfare Effects of Competition for Foreign Direct Investments." *European Economic Review* 47, 963-983.
- Haaparanta, Pertti (1996). "Competition for Foreign Direct Investments." *Journal of Public Economics* 63, 141-153.
- Haufler, Andreas, and Ian Wooton (1999), "Country Size and Tax Competition for Foreign Direct Investment." *Journal of Public Economics* 71, 121-139.
- Head, Keith (1998). "Comment on Doms and Jensen." In Robert Baldwin, Robert Lipsey, and J. David Richardson (eds.), *Geography and Ownership as Bases for Economic Accounting*. Chicago: The University of Chicago Press, pp. 255-258.
- Keen, Michael (1993), "The Welfare Economics of Tax Co-ordination in the European Community: A Survey." *Fiscal Studies* 14, 15-36.
- Kozul-Wright, Richard, and Robert Rowthorn (1998). "Spoilt for Choice? Multinational Corporations and the Geography of International Production." *Oxford Review of Economic Policy* 14(2), 74-92.
- OECD (1998). *Harmful Tax Competition: An Emerging Global Issue*. Paris: Organisation for Economic Co-operation and Development.
- Olsen, Trond E., and Petter Osmundsen (2003). "Spillovers and International Competition for Investments." *Journal of International Economics* 59, 211-238.
- Ottaviano, Gianmarco I. P., and Tanguy van Ypersele (2005). "Market Size and Tax Competition." *Journal of International Economics* 67, 25-46.

