

# **The Effects of Regional Tax and Subsidy Coordination on Foreign Direct Investment\***

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## **Abstract**

This paper analyses the effects of a regionally coordinated profit tax or location subsidy in a model with three active countries, one of which is not part of the union, and a globally mobile firm. We show that regional coordination can lead to two types of welfare gain. First, for investments that would take place in the union in the absence of coordination, a coordinated tax increase can transfer location rents from the firm to the union. Second, by internalizing all of the union's benefits from foreign direct investment, a coordinated tax reduction can attract more welfare-enhancing investment than when member states act in isolation. Depending on which motive dominates, tax levels may thus rise or fall under regional coordination.

**Keywords:** tax and subsidy competition, regional coordination, foreign direct investment

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## 1 Introduction

It is frequently argued that the increasing international mobility of firms is the main reason for governments offering ever more favourable conditions to attract companies to their jurisdictions. The more footloose the factor, the more easily it can avoid taxation by migrating to a tax haven. Consequently, greater mobility intensifies the competition between jurisdictions, leading to reduced tax rates or even outright location subsidies. In line with this argument is the evidence of statutory corporate tax rates having declined from an OECD average of almost 50 per cent in 1980 to roughly 35 percent in 2000.<sup>1</sup> A second, parallel observation is of the increasing number of cases in which governments in Europe and North America pay location subsidies to firms in order to attract them to their jurisdictions.<sup>2</sup>

In the European Union, these developments have led to simultaneous debates on both a formal coordination of corporate taxes between member states and a tightening of the existing rules that limit state aid to businesses. With respect to corporate taxation, the EU adopted a Code of Conduct for business taxation, in which member states committed themselves to refrain from 'unfair' tax policies that discriminate against (less mobile) domestic firms in favour of (more mobile) multinational firms (see European Communities, 1998). It is by no means clear, however, that this measure will prove sufficient to prevent tax competition for internationally mobile firms.<sup>3</sup> For example, in response to the Code of Conduct, Ireland introduced in 2003 a general corporate income tax rate of 12.5 percent, underbidding all of its EU competitors by a margin of more than 10 percentage points. Moreover, as a result of the 2004 enlargement of the EU, several Eastern European countries with corporate income tax rates well below the average of the current EU members are entering the internal market. A more far-reaching coordination measure would be the introduction of a minimum statutory corporate tax rate, as proposed in the Ruding Report (1992). An important

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<sup>1</sup> If effective average rates of corporation tax are considered, and account is thus taken of simultaneous changes in the corporate tax base, the reduction is somewhat less, but is nonetheless substantial. See Devereux, Griffith and Klemm (2002) for a recent account of these developments.

<sup>2</sup> Several cases in which US and UK governments have paid large location subsidies to firms are reported in Görg and Greenaway (2002). Other cases of subsidy payments by EU governments are collected in Neumann (2001, pp. 184-186).

<sup>3</sup> Keen (2001) has shown that a non-discrimination policy may even be counterproductive, because it extends the range of tax bases over which countries compete.

constraint of this policy measure is, however, that EU members can only achieve a *regional* coordination of tax policies. Critics argue that, in response to such an intra-union coordination of tax rates, firms may leave the EU altogether and settle in third countries.

With respect to state subsidies, there is already some coordination at the EU level, as the Commission has to be notified of, and agree to, all state aid to firms in excess of five million euro. Moreover, EU-wide ceilings to state aid, which are staggered by the volume of the investment and the characteristics of the host region, are already in effect. These coordination measures are based on Article 87 of the EC Treaty, which generally rules out discriminatory state subsidies to specific firms, but also lists a wide range of exceptions under which subsidies may nonetheless be permissible. Recently, the EU has specified the existing rules with respect to state aid in more detail, aiming at a stricter enforcement of these rules in order to avoid a “subsidy race” (Council regulation EC 659/1999). On the other hand, if the subsidies paid by EU member states are curtailed, there is again the danger of losing firms to third countries, as with a minimum EU corporate tax rate.<sup>4</sup>

Despite the obvious policy relevance of the subject, there are few theoretical contributions dealing with regional tax and subsidy coordination in a multi-country world where only a subset of countries coordinate their policies. Moreover, virtually all of the existing literature is cast in terms of regional tax, rather than subsidy, coordination. Konrad and Schjelderup (1999) extend the basic tax competition model by considering a coordinated capital tax increase amongst a subgroup of countries that is able to influence the world rate of return to capital. They show that this policy will be welfare improving if tax rates are strategic complements, such that countries that are not part of the agreement will find it in their own self-interest to raise their domestic tax rates as well.<sup>5</sup> Similarly, Huizinga and Nielsen (2000) find that a tax increase in an EU tax haven will increase welfare in the EU partner country, despite the presence of an outside tax haven, if there are differential transaction costs for investments within the EU and in third countries. Finally, Sørensen (2000, 2004) carries out a set of

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<sup>4</sup> A recent example of global competition for FDI is that for a therapeutic protein plant to be built by a subsidiary of the US-based Merck & Co. Ltd. After being offered substantial financial support by the local government, the company has chosen a location in Germany, despite competition from other EU countries (Ireland and Spain), Switzerland, and non-European nations (Singapore, Taiwan, and the USA). See IPAWorld, 2003.

simulation analyses in a multi-country model where the countries that coordinate their policies are not symmetric. His calculations confirm the result that a regionally coordinated increase in capital tax rates benefits the union as a whole, but they also show that regional tax coordination promises only a fraction of the gains that could be achieved by worldwide tax coordination.

In sum, the existing theoretical literature argues that a regionally coordinated *increase* in the corporate tax rate is likely to bring welfare gains to a large economic union such as the EU, and therefore supports the possible policy move to establish an EU-wide minimum corporation tax, or a stricter enforcement of EU-wide ceilings to state subsidies. The main purpose of the present paper is to show that such a policy may well be counterproductive, in that the optimal coordinated policy may instead be a *reduction* of profit taxes or an increase in location subsidies.

We develop this argument in a model with three active countries, one of which is outside the region, a profit-making firm that is freely mobile internationally, and a positive spillover that foreign direct investment (FDI) has on both the host economy and the neighbouring country in the region. In our model the incentive to attract FDI arises from a desire to avoid trade costs. These costs are encountered in any international transaction but they are lower on trade within the union than between the union and the outside country. This fact gives a location rent to the firm if it settles in one of the union countries. The size of this rent depends on the relative trade costs for trade within and outside the union and on the relative size of the three different markets.

The basic assumptions and mechanisms underlying this model find support in the empirical literature. First, several studies show a robust positive relationship between market size and the likelihood to attract FDI (e.g. Devereux and Griffith, 1998; Head and Mayer, 2002). Second, there is empirical evidence for a positive “EU dummy”: controlling for other relevant characteristics of the host country, a firm will be more likely to invest in a country that is a member state of the EU, whereas a similar effect cannot be observed for members of other regional trade agreements (Grubert

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<sup>5</sup> The model of Konrad and Schjelderup (1999) thus has very similar implications as those of the standard model of capital tax competition (Zodrow and Mieszkowski, 1986). The latter shows that, starting from a situation in which a large number of small jurisdictions competes for internationally mobile capital, a simultaneous tax increase in *all* jurisdictions yields a strict Pareto improvement. For a recent overview of the theory of tax competition, see Wilson (1999).

and Mutti, 2000). Third, there is by now almost unanimous agreement that the corporate tax rate of the host country has a significant, negative effect on inward FDI.<sup>6</sup>

Our analysis is related to existing two-country models of tax and subsidy competition that incorporate positive spillovers from FDI arising from scale economies in the provision of public goods (Black and Hoyt, 1989), the existence of regional unemployment (Haaparanta, 1996), or vertical industry linkages that reduce the production costs of existing firms (Haaland and Wooton, 1999; Fumagalli, 2003). In these settings, a subsidy competition for the firm will result if the potential host countries have similar characteristics.<sup>7</sup> When trade costs are incorporated in this type of model, firms will have an incentive to locate in either the larger market (Haufler and Wooton, 1999) or in the country that already hosts an agglomeration (Kind *et al.*, 2000; Baldwin and Krugman, 2004). The host country may then be able to levy a positive tax on mobile firms in equilibrium, even if it benefits from the investment. All of these models consider only two competing nations, however, and therefore cannot explicitly consider the issue of *regional* tax coordination. The present paper can be seen as a (partial) extension of this literature to a three-country framework.

Finally, a still different strand in the literature considers the effects of regional integration on the likelihood of a firm from a third country to invest in the integrating region (Norman and Motta, 1993; Motta and Norman, 1996). The trade setting underlying our analysis is similar to these models, but our focus is on the optimal policies adopted in the integrating countries.

In our analysis, we consider a union of two countries that competes with a third potential-host country for the location of a monopolistic firm. Relative to a benchmark scenario where all countries compete against each other, we show that there are two types of gains for the union when regional tax or subsidy policies are coordinated while the union as a whole still competes with the third country. First, in situations where the firm's location rent in the union is large, eliminating competition within the union allows an *increase* in the equilibrium tax, or a decrease in the equilibrium subsidy, and leads

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<sup>6</sup> See Hines (1999) for a survey of the empirical evidence focussed on U.S. data, and de Mooij and Ederveen (2003) for a synthesis that incorporates empirical studies from the EU. Evidence for positive effects of regional policies (subsidies) on FDI is considerably weaker (Boldrin and Canova, 2001; Crozet *et al.*, 2004). However, as Crozet *et al.* (2004, 46-48) note, the issue underlying the latter set of studies is really a different one, as the subsidies (structural funds) are granted to lagging regions in order to improve local infrastructure, rather than being offered directly to firms as a location subsidy.

to a transfer of rents from the firm to the regional governments. This corresponds to the results derived in the previous literature on regional tax coordination. A second scenario arises, however, when the firm has no strong preference between locating within the union or in the outside country. A coordinated *reduction* in the tax offered to the firm, or a coordinated increase in the subsidy, will then be able to attract the investment and leave the union with a collective welfare gain. In this latter case, regional policy coordination overcomes a free-riding problem arising when both countries in the union benefit from the investment. Our results thus indicate that the direction that regionally coordinated tax or subsidy policies should take is fundamentally ambiguous.

The analysis proceeds as follows. Section 2 presents the model, describing in turn the behaviour of households, firms, and governments. Section 3 considers the benchmark case where all countries (both those in the union and the outside country) compete to host the monopolist. Section 4 analyzes the effects of tax or subsidy coordination between the two countries in the region. Section 5 discusses our results and compares them to related literature. Section 6 concludes.

## 2 The model

Our argument is developed in a simple partial equilibrium model of three countries. Countries  $A$  and  $B$  are located in the same region or union, while country  $C$  lies outside the union.<sup>8</sup> Each country has at its disposal a single lump-sum policy instrument  $t_i$ ,  $i \in \{A, B, C\}$  that can be positive or negative. This instrument can alternatively be interpreted as a location subsidy to the firm ( $t_i < 0$ ) or as a corporate tax that falls on the firm's pure profits or rents ( $t_i > 0$ ).<sup>9</sup> The three countries compete for the location of a single firm that is a monopoly supplier in the world market and has its home base outside the active countries considered in the model. Due to high plant-specific costs, the firm will set up in only

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<sup>7</sup> Conversely, non-cooperative capital taxation may lead to excessively high tax rates when the location of a firm causes negative externalities for the host country, for example by polluting its environment (see Markusen *et al.*, 1995).

<sup>8</sup> In the following, we refer to countries  $A$  and  $B$  equivalently as a "region" or "union" of countries. The latter term may imply that the two countries have agreed on some form of policy coordination other than the issue under discussion here, but such pre-existing arrangements have no consequences for our analysis.

<sup>9</sup> If interpreted as a corporation tax, the lump-sum instrument considered here captures only one of the functions of existing corporation taxes, that is to tax pure profits or rents (see Mintz, 1996). None of the intertemporal effects associated with existing corporate taxes, in particular the taxation of private savings and of the firm's marginal investment choices, is covered by our model.

one of the three countries and serve the other markets from this base. Location matters because of trade costs, which are different for intra-union trade and trade with the outside country.<sup>10</sup>

## 2.1 Households

There are two consumption goods in each country, the good produced by the monopolist ( $x$ ) and a numeraire good ( $z$ ) produced in a perfectly competitive market. Consumers in all countries are identical and have quadratic, quasi-linear preferences of the form

$$u_i = \alpha x_i - \frac{1}{2} \beta x_i^2 + z_i, \quad \forall i \in \{A, B, C\}. \quad (1)$$

In all countries, each household inelastically supplies one unit of labour, receiving the wage  $w_i$ . Denoting consumer prices by  $q_i$  and letting  $t_i/n_i$  be per-capita tax revenues (which will be negative if the government pays a subsidy to the firm), the budget constraint in each country is given by

$$w_i + \frac{t_i}{n_i} = z_i + q_i x_i, \quad \forall i \in \{A, B, C\}. \quad (2)$$

In the following we assume that countries  $A$  and  $B$  are of equal size and that the population in each of these countries is normalised to unity ( $n_A = n_B \equiv 1$ ). The population of the outside country  $C$  is  $n_C \equiv n$ . Thus our analysis allows for exogenous variations in the relative size of the regional market ( $A + B$ ) vis-à-vis country  $C$ . The relevant range for  $n$  is  $1 \leq n \leq 2$ , i.e., country  $C$  is neither smaller than any individual country in the union, nor larger than the two union countries taken together.

Maximizing (1) subject to the budget constraint (2) and aggregating over households yields the market demand curve  $X_i$  in each country

$$X_A = \frac{\alpha - q_A}{\beta}, \quad X_B = \frac{\alpha - q_B}{\beta}, \quad X_C = \frac{n(\alpha - q_C)}{\beta}. \quad (3)$$

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<sup>10</sup> This set-up extends our earlier analysis in Haufler and Wooton (1999). It also has similarities with the models of Norman and Motta (1993) and Motta and Norman (1996), who examine the effects of market integration and external trade restrictions on the investment decisions of foreign firms.

## 2.2 Firms

Labour is the only input in the production of both goods. The production function for the numeraire good ( $z$ ) is the same in all countries and this good is freely traded with no trade costs. This ensures that wage costs will be equalised across countries ( $w_i = w$ ).

In contrast, commodity  $x$  is produced by a monopolist<sup>11</sup> that has its home base outside of countries  $A$ ,  $B$ , and  $C$ .<sup>12</sup> It is well known that the decision whether to export from the home base or engage in FDI will depend on the comparison between trade costs and fixed set-up cost (Horstmann and Markusen, 1992). Since little can be gained from restating these conditions in the present context, we simply assume that firm-specific set-up costs are sufficiently low to make FDI profitable, and plant-specific costs are sufficiently high so that all FDI is concentrated in a single production unit. Finally, we assume that the monopolist is able to segment its market, discriminating between national markets in setting the price of good  $x$ .<sup>13</sup>

In this setting, consumer price differences between countries will be influenced by the cost of delivering the goods to them. There is a fixed trade cost of  $\tau$  per unit of good  $x$  shipped between regions  $A$  and  $B$ . For trade between either of these countries and country  $C$ , the per-unit trade cost is  $\sigma$ . Trade costs should be interpreted in a wide sense, incorporating all of the differences between countries that make market integration less than perfect (including, but not limited to, transport costs). Throughout the analysis we assume that  $\sigma > \tau$ .<sup>14</sup> Let  $c_{ji}$  be the marginal costs of servicing market  $j$  from location  $i$ , a combination of the cost of the labour input  $w$  and the trade cost ( $0$ ,  $\sigma$ , or  $\tau$ ):

$$\begin{aligned}
 c_{AA} &= w, & c_{BA} &= w + \tau, & c_{CA} &= w + \sigma, & \text{FDI in } A; \\
 c_{AB} &= w + \tau, & c_{BB} &= w, & c_{CB} &= w + \sigma, & \text{FDI in } B; \\
 c_{AC} &= w + \sigma, & c_{BC} &= w + \sigma, & c_{CC} &= w, & \text{FDI in } C.
 \end{aligned} \tag{4}$$

<sup>11</sup> The monopoly assumption is needed to keep the model tractable analytically. In the context of environmental tax competition, Rauscher (1995) introduces the same assumption in the oligopoly model of Markusen *et al.* (1995). This assumption allows Rauscher to derive analytical results without changing the qualitative implications of the model.

<sup>12</sup> This implies that the monopolist's profits will not enter the calculations of any of the active countries. The case where the monopolist is partly or wholly owned by residents of the active countries is discussed in Section 5.

<sup>13</sup> This last modelling assumption departs from that in our discussion paper (Hauffer and Wooton, 2001) where we assumed that the market for good  $x$  was integrated. The qualitative results are the same regardless of this market assumption. As the algebra is simpler under market segmentation, we have adopted it here. We are grateful to Tanguy van Ypersele for first suggesting this approach.

<sup>14</sup> Different arguments can be given to support this specification. The two markets in the union may be geographically closer to each other than to the third country, there may be fewer administrative hurdles for trade between them, or the two markets in the union may be more similar so that locating in one reduces the information cost of selling in the other.



Given the firm's ability to segment its market, it will generally set a different consumer price for goods sold in each market. Let  $q_{ji}$  be the consumer price of the good when it is manufactured in country  $i$  and sold in country  $j$ . The firm's optimal consumer price will depend on the cost of servicing the market, which will be less for the domestic market than for export markets, as the former avoids trade costs. Since marginal costs of production are constant, the profit-maximising price and quantity can be calculated for each market independently.

A firm located in country  $i$  maximises its operating profits in each location  $j$ :

$$\pi_{ji} = (q_{ji} - c_{ji})X_j, \quad \forall i, j \in \{A, B, C\}. \quad (5)$$

Substituting the market demand curves (3) and marginal costs (4) into (5) and differentiating, yields profit-maximising consumer prices for each location:

$$q_{ji} = \frac{\alpha + c_{ji}}{2}. \quad (6)$$

Substituting (6) into (5) gives optimised profits for each market. Total gross profits for the firm will be the sum of its operating profits in each market. From these gross profits, fixed, plant-specific costs must be deducted. We assume that these are the same across all countries and equal to  $F$ . Further, the host country uses its policy instrument, setting a lump-sum tax  $t_i$  that can be positive or negative<sup>15</sup>

$$\pi_i = \sum_j \pi_{ji} - F - t_i, \quad \forall i, j \in \{A, B, C\}. \quad (7)$$

Due to symmetry, these profits are identical if the firm locates in either union country,  $A$  or  $B$ . In the following we adopt the convention, with no loss of generality, that the firm always locates in country  $A$  whenever it is indifferent between the two locations in the union. To simplify the notation we therefore confine our profit comparison to countries  $A$  and  $C$ :<sup>16</sup>

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<sup>15</sup> To ensure consistency in our notation, we will generally speak of taxes in the following, even though governments will actually grant subsidies in most of the cases analyzed.

<sup>16</sup> Throughout the analysis, we assume that the market-size parameter  $\alpha$  is sufficiently large, relative to wages, trade costs, and fixed set-up costs, to ensure positive profits for the firm in every location.

$$\begin{aligned}\pi_A^* &= \frac{(\alpha - w)^2 + (\alpha - w - \tau)^2 + n(\alpha - w - \sigma)^2}{4\beta} - F - t_A, \\ \pi_C^* &= \frac{2(\alpha - w - \sigma)^2 + n(\alpha - w)^2}{4\beta} - F - t_C.\end{aligned}\tag{8}$$

Subtracting these two values from each other yields the net profit surplus that can be earned in location  $A$  vis-à-vis location  $C$ :

$$\pi_A^* - \pi_C^* = \frac{[2(\alpha - w) - \sigma][(2 - n)\sigma - \tau] - \tau(\sigma - \tau)}{4\beta} - t_A + t_C.\tag{9}$$

The firm will be indifferent between locating in countries  $A$  and  $C$  if  $\pi_A^* - \pi_C^* = 0$ . Rewriting equation (9) we can then define  $\lambda$  as the “tax premium” that the firm is willing to pay for locating in country  $A$  as opposed to country  $C$ :

$$\lambda \equiv t_A - t_C = \frac{[2(\alpha - w) - \sigma][(2 - n)\sigma - \tau] - \tau(\sigma - \tau)}{4\beta}.\tag{10}$$

This tax premium can be positive or negative. Intuitively, the optimal profit margin of the firm rises in each market when trade costs fall. Hence, in making its location decision, the firm takes *aggregate* trade costs into account. The requirement that profits in each market, (8), are positive means that  $\alpha - w - \sigma > 0$ . It can then be seen that country  $A$  can charge a higher tax (or offer a smaller subsidy) than country  $C$  and still leave the firm indifferent between locations, if the market of the third country is not larger than the regional market ( $n < 2$ ) and intra-union trade costs are small, relative to trade costs between the union and  $C$  ( $\tau \ll \sigma$ ).

\*\*\*\*\* Figure 1 about here \*\*\*\*\*

Figure 1 summarises the parameter combinations under which union country  $A$  is able or unable to attract the investment in the absence of taxes or subsidies. The figure is drawn for the parameter values  $\alpha = 2.5$ ,  $w = 1$  and  $\sigma = 1$ , while the market size of country  $C$  ( $n$ ) and trade costs within the union ( $\tau$ ) are allowed to vary. The boldface line in the graph is the locus  $n_\lambda(\tau)$  along

which the firm is indifferent between locating in the union and locating in country  $C$ . From (10), this has the form:<sup>17</sup>

$$n_\lambda(\tau) = \frac{(2\sigma - \tau)[2(\alpha - w) - \sigma] - \tau(\sigma - \tau)}{\sigma[2(\alpha - w) - \sigma]}. \quad (11)$$

For parameter combinations below this line the firm will settle in the union, whereas it will settle in country  $C$  for combinations above the line. It can be directly inferred from Figure 1 that further economic integration in the union, defined as a reduction in  $\tau$ , increases the ability of country  $A$  to attract the FDI. This corresponds to the results of Motta and Norman (1996), who consider the importance of relative country size, intraregional market access, and external trade barriers on the incentives for firms to choose foreign direct investment in a particular country.

### 2.3 Governments

Each government compares the welfare of its representative consumer in the scenarios where it is host to the firm and where good  $x$  has to be imported from abroad. Due to international differences in trade costs, it also matters to the union countries,  $A$  and  $B$ , whether the good is imported from the neighbouring country in the union or from the outside country  $C$ . To compute the welfare level  $u_{Ai}$  for country  $A$  when the firm locates in country  $i$ , we use the budget constraint (2) to substitute for  $z_i$  in the utility function (1) and then employ (3), (4), and (6). Noting that the tax term  $t_A$  is zero when country  $A$  is not host to the firm, we get

$$\begin{aligned} u_{AA} &= \frac{(\alpha - w)^2}{8\beta} + w + t_A, \\ u_{AB} &= \frac{(\alpha - w - \tau)^2}{8\beta} + w, \\ u_{AC} &= \frac{(\alpha - w - \sigma)^2}{8\beta} + w. \end{aligned} \quad (12)$$

The welfare expressions for country  $B$  are analogous. For country  $C$ , there are only two different welfare levels, since that country is indifferent as to whether the firm locates in  $A$  or  $B$ :

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<sup>17</sup> Two benchmark cases can be directly inferred from equation (11). For  $\tau = \sigma$  it follows that  $n_\lambda = 1$  and all three countries have the same size and the same level of trade costs between them. For  $\tau = 0$  we get  $n_\lambda = 2$ . In this case the two union

$$\begin{aligned}
u_{CA} &= \frac{(\alpha - w - \sigma)^2}{8\beta} + w, \\
u_{CC} &= \frac{(\alpha - w)^2}{8\beta} + w + \frac{t_C}{n}.
\end{aligned} \tag{13}$$

These equations determine the *best offer* (that is, the minimum tax) that each country is willing to grant to the firm in order to attract the investment. For country  $A$ , the tax depends upon whether the firm would otherwise locate in its union partner country  $B$  or in the outside country  $C$ . In the former case, the minimum tax is obtained by equating  $u_{AA}$  and  $u_{AB}$  in (12); whereas, in the latter case, the minimum tax equalises  $u_{AA}$  and  $u_{AC}$ . We denote the best offers that country  $A$  would be prepared to accept to prevent the firm from investing in country  $B$  and country  $C$  as  $\mu_{AB}$  and  $\mu_{AC}$ , respectively, where:

$$\begin{aligned}
\mu_{AB} &= \frac{-\tau[2(\alpha - w) - \tau]}{8\beta}, \\
\mu_{AC} &= \frac{-\sigma[2(\alpha - w) - \sigma]}{8\beta}.
\end{aligned} \tag{14}$$

Both of these expressions are unambiguously negative, indicating country  $A$ 's willingness in either situation to subsidise the firm in order to save trade costs and ensure lower prices for consumers. Analogous best offers,  $\mu_{BA}$  and  $\mu_{BC}$ , are obtained for country  $B$ . To answer the question as to which alternative location induces a higher subsidy from country  $A$ , we calculate

$$\mu_{AC} - \mu_{AB} = \frac{(\tau - \sigma)[2(\alpha - w) - (\tau + \sigma)]}{8\beta} \leq 0. \tag{15}$$

For  $\tau = \sigma$ ,  $\mu_{AC} - \mu_{AB} = 0$  as country  $A$  views the alternative locations as being equivalent. As trade costs within the union fall ( $\tau < \sigma$ ),  $\mu_{AC} - \mu_{AB} < 0$  indicating that country  $A$  is prepared to pay a higher subsidy to avoid importing the good from outside of the union.

For country  $C$ , equating  $u_{CC}$  and  $u_{CA}$  in (13) yields its minimum tax:

$$\mu_C = \frac{-n\sigma[2(\alpha - w) - \sigma]}{8\beta}, \tag{16}$$

which, being unambiguously negative, means that country  $C$  is always prepared to offer a subsidy to induce local investment. Comparing (16) with  $\mu_{AC}$  in (14) shows that, for  $n > 1$ , country  $C$  is willing to offer a higher subsidy than would country  $A$ . This is because country  $C$  has the larger population and thus the higher absolute savings in trade costs (cf. Haufler and Wooton, 1999).

### 3 Tax and subsidy competition amongst all countries

In choosing its investment location, the firm will take into account both the location preference of the firm for a union country compared to country  $C$  (as reflected in the tax premium  $\lambda$ ) and the taxes (or subsidies) being offered by the competing countries. We adopt a simple bidding approach where all countries know the location preferences of the firm, as given by (10), and continuously improve their offers (that is, reduce their profit taxes). In equilibrium, the firm will locate in the country where its net-of-tax profits are (marginally) higher than those in any other location, and neither of the countries failing to get the investment has an incentive to reduce its tax further.

If all countries compete against each other, union country  $A$  must outbid both its union partner  $B$  and the outside country  $C$  in order to attract the investment. Country  $C$ 's best offer is always  $\mu_C$ . To outbid country  $C$ , country  $A$ 's tax must match country  $C$ 's best offer, taking account of the tax premium  $\lambda$  that the firm is willing to pay in the union vis-à-vis country  $C$ . We denote this profit-adjusted best offer of country  $C$  by  $\mu_C^\lambda$ . From equations (16) and (10), we derive:

$$\mu_C^\lambda \equiv \mu_C + \lambda = \frac{[2(\alpha - w) - \sigma][(4 - 3n)\sigma - 2\tau] - 2\tau(\sigma - \tau)}{8\beta}. \quad (17)$$

This acts as a critical tax for country  $A$  that will be negative if both  $n$  and  $\tau$  are relatively large. However, it is positive for sufficiently low levels of both  $n$  and  $\tau$ , in which case the firm has a strong incentive to settle in the union.

Tax competition between the two union countries is complicated by the fact that there are two best offers for each of countries  $A$  and  $B$ , depending on where the firm locates should the bidding

country fail to attract the investment. For different values of the exogenous parameters  $(n, \tau, \sigma)$ , and for the corresponding set of best offers  $\mu_{ij}$ , we can distinguish four regimes.

**Regime I** ( $\mu_C^\lambda > \mu_{AB} > \mu_{AC}$ )

In this regime, even the higher tax  $\mu_{AB}$  will attract the firm to the union. Hence, it is a dominant strategy for country A to offer  $\mu_{AB}$  and for country B to offer  $\mu_{BA}$  ( $= \mu_{AB}$ ). By our convention country A will be able to attract the firm and its equilibrium tax rate is  $t_A^* = \mu_{AB}$ . The welfare levels of countries A and B coincide in equilibrium.

**Regime II** ( $\mu_{AB} > \mu_C^\lambda > \mu_{AC}$ )

In this regime, the best offer of country A will depend on the offer of country B and vice versa. If country B offers (slightly less than)  $\mu_C^\lambda$ , and thereby attracts the firm from country C, then country A's best response is not to attempt to "steal" the firm, but to benefit from cheaper imports resulting from the lower intra-union transport costs. This is ensured by any offer  $\mu_A > \mu_C^\lambda$ . If country B were to set  $\mu_B > \mu_C^\lambda$ , then country A must offer  $\mu_C^\lambda$  in order to prevent the firm from settling in country C. Formally:

$$\mu_A \begin{cases} > \mu_C^\lambda & \text{if } \mu_B = \mu_C^\lambda \\ = \mu_C^\lambda & \text{if } \mu_B > \mu_C^\lambda \end{cases},$$

and analogously for country B. There are two sets of equilibria in this regime: one with country B attracting the firm; and another with country A getting the investment. By our convention we concentrate on the case where country A hosts the firm, and its equilibrium tax rate is  $t_A^* = \mu_C^\lambda$ . Note that welfare in country B will then exceed that of country A in equilibrium. But, given that country B's tax rate is too high to attract the firm to the union, country A's best response is to attract the firm to its country and earn a location rent equal to the difference between  $\mu_C^\lambda$  and  $\mu_{AC}$ . If country A attracts the firm there is in turn no reason for country B to change its initial tax offer.

**Regime III** ( $\mu_{AB} > \mu_{AC} > \mu_C^\lambda$  and  $\lambda > 0$ )

In this regime even the lower tax  $\mu_{AC}$  is unable to attract the firm to the union as country  $C$ 's best offer is more attractive for the firm, even if the location rent in the union is taken into account ( $\mu_{AC} - \lambda > \mu_C$ ). Hence, the firm will settle in country  $C$  with an equilibrium tax rate of  $t_C^* = \mu_{AC} - \lambda$ . In the absence of taxes, however, the firm would have chosen to locate in the union because  $\lambda > 0$ . As our discussion of equation (16) has shown, this is because country  $C$  is larger than country  $A$  and therefore willing to offer a lower tax rate.

**Regime IV** ( $\mu_{AB} > \mu_{AC} > \mu_C^\lambda$  and  $\lambda < 0$ )

This regime has the same characteristics as Regime III. However, since  $\lambda < 0$ , country  $C$ 's equilibrium tax now exceeds the best offer of country  $A$  ( $t_C^* = \mu_{AC} - \lambda > \mu_{AC}$ ) and country  $C$  will be able to attract the firm even if taxes and subsidies are absent.

A graphical illustration of the different regimes is given in Figure 2. The borderline between Regimes I and II is calculated by equating  $\mu_{AB}$  and  $\mu_C^\lambda$  in equations (14) and (17). This yields

$$n_{AB}(\tau) = \frac{(4\sigma - \tau)[2(\alpha - w) - \sigma] - \tau(\sigma - \tau)}{3\sigma[2(\alpha - w)\sigma]} \quad (18)$$

In Figure 2 this condition is shown by the new line that cuts the horizontal axis at  $n = 1.33$ . To the left of this line, in Regime I, the intra-union rivalry dominates the competition for the investment. To the right of this line, in Regime II, the union must match the best offer of country  $C$ .

\*\*\*\*\* Figure 2 about here \*\*\*\*\*

Similarly, by equating  $\mu_{AC}$  and  $\mu_C^\lambda$  in (14) and (17), we can calculate the frontier  $n_{AC}(\tau)$  which gives the borderline between Regimes II and III:

$$n_{AC}(\tau) = \frac{(5\sigma - 2\tau)[2(\alpha - w) - \sigma] - 2\tau(\sigma - \tau)}{3\sigma[2(\alpha - w) - \sigma]} \quad (19)$$

In the diagram, this locus cuts the horizontal axis at  $n = 1.67$ . To the left of this line, the difference is positive and the firm locates in the union despite intra-union tax competition. To the right of the

frontier, in Regime III, the firm locates in the outside country  $C$ . Finally, Regime IV shows the circumstances under which the firm would locate in country  $C$  in the absence of taxes, where the borderline between Regimes III and IV is determined by setting  $\lambda = 0$  in equation (10).

Figure 2 shows that, in comparison to the scenario without taxes and subsidies illustrated in Figure 1, the ability of the union to attract the investment under tax competition is unambiguously diminished. This is due to the lower tax (higher subsidy) that outside country  $C$  is prepared to offer. The enhanced attractiveness of country  $C$ , where it now succeeds in capturing the investment, is represented by the area shown as Regime III.

#### 4 Regional tax and subsidy coordination

We now consider the case where the union countries  $A$  and  $B$  coordinate their policies and jointly make a tax offer to the firm. This affects the results in two of the four regimes that we introduced in the previous section.

First, the coordinated tax policy will never result in a better offer than is needed to prevent the firm from locating in country  $C$ . As the two union countries are no longer competing with one another, neither will attempt to undercut the other's tax. Consequently, whenever country  $A$  attracts the firm, the equilibrium tax in this coordinated case is always  $t_A^* = \mu_C^\lambda$ . Therefore, a coordinated policy will lead to a smaller subsidy (indeed, potentially a positive tax) in Regime I, where we have established that  $t_A^* = \mu_{AB} < \mu_C^\lambda$  in the presence of tax competition between all countries. This tax increase will transfer some location rents from the firm to the treasury of country  $A$  and thus leads to a welfare gain of  $\Delta(u_A + u_B) = \mu_C^\lambda - \mu_{AB} > 0$  for the union as a whole. These benefits arise in the left-hand shaded area in Figure 3.

\*\*\*\*\* Figure 3 about here \*\*\*\*\*

The second important change occurs in Regime III. A regionally coordinated tax will take into account the combined benefits to both countries of the firm locating in the union rather than in country  $C$ . We maintain our convention that, if the firm invests in the union, it settles in country  $A$ . The maximum offer made under this coordinated policy is thus the sum of  $\mu_{AC}$  and the benefit to



country  $B$  of the firm locating in  $A$  rather than  $C$ . From the symmetry of the two union countries, this latter benefit is equal to  $\mu_{AC} - \mu_{AB}$ . The combined minimum tax for the union, denoted by  $\mu_U$ , is thus found by summing terms in (14) and (15):

$$\mu_U \equiv 2\mu_{AC} - \mu_{AB} = \frac{[2(\alpha - w) - \sigma](\tau - 2\sigma) + \tau(\sigma - \tau)}{8\beta}. \quad (20)$$

This tax will be lower than the best offer of country  $A$  if and only if country  $B$  benefits from having the firm locate in  $A$  rather than  $C$ . From (15), we know that this condition is met whenever intra-union trade costs are less than the costs of importing from country  $C$ .

Given this offer, the equilibrium condition for the firm to locate in the union is  $\mu_C^\lambda - \mu_U > 0$ . Computing this difference from (17) and (20), we determine the frontier  $n_{UC}(\tau)$  along which the firm would be indifferent between locating within or outside the union, given each nation's best offer:

$$n_{UC}(\tau) = \frac{(2\sigma - \tau)[2(\alpha - w) - \sigma] - \tau(\sigma - \tau)}{\sigma[2(\alpha - w) - \sigma]}. \quad (21)$$

Comparison of (21) with (11), the expression for the frontier without taxes and subsidies, reveals that the loci are identical. In other words, the combined tax offer of the union members exactly offsets the benefits to the firm of country  $C$ 's best offer. Hence, the firm once again trades off the relatively greater size of country  $C$ 's market against the lower level of intra-union trade costs.

In Figure 3, we see that the locus under regional tax coordination has swung back to re-establish the frontier that existed in the absence of tax incentives (as shown in Figure 1). By coordinating their taxes, the union thus recaptures the investment that had fallen into Region III. In this scenario the additional location rent to the union, relative to the case of intra-union tax competition, lies in the difference between the amount that must be offered to the firm to induce it to invest in the union, and the maximum coordinated subsidy that the union is willing to offer, i.e.,  $\Delta(u_A + u_B) = \mu_C^\lambda - \mu_U > 0$ .

In between these two cases of welfare-improving regional tax coordination (in which the equilibrium tax moves in opposite directions in each case), lies Regime II where tax coordination has

no effect. This is the unshaded area in-between the two shaded sections in Figure 3. Here the union will attract the firm even if all countries compete against each other, and the binding constraint on the host country's tax level stems from the best offer made by the outside country.

## 5 Discussion and extensions

Consider, first of all, how our results compare with previous findings on regional tax coordination in a three-country setting (Konrad and Schjelderup, 1999; Huizinga and Nielsen, 2000; Sørensen, 2000 and 2004). A result common to these earlier papers and our analysis is that tax coordination is collectively beneficial for the region that undertakes the agreement. However, in the previous literature, welfare-improving regional tax coordination always leads to an *increase* in the rates of capital taxation. In our model this is only one of two possible scenarios, and tax coordination may also involve a *reduction* in the tax offered to a monopolistic firm.

This latter policy can yield welfare gains because all of the benefits from attracting FDI to a region are internalised under regional tax coordination, including those of countries that do not host the firm. Such spillovers on neighbouring countries in the region are not captured by standard settings of capital tax competition, where capital earns a normal rate of return. They do, however, arise in our model from the combination of profit-making firms and differential costs for trade within the union and between the union and the outside world.

The previous literature also typically finds that the countries outside the union benefit from the regional increase in tax rates (see Konrad and Schjelderup, 1999; Sørensen, 2004). As a consequence, models of tax competition in competitive capital markets predict that regions should share a common interest in collectively raising capital taxes, at least if they are sufficiently similar in size and other characteristics. This scenario raises the question as to why we do not observe more intensive efforts at *worldwide* tax coordination. In contrast, our setting introduces potentially conflicting interests between the union and the outside country. In particular, a coordinated tax reduction in the union will harm the outside country by redirecting FDI towards the integrating region.

In the present model, saving trade costs is the motive underlying governments' attempts to attract internationally mobile firms. It should be emphasised that, while the resulting fall in consumer prices is both an intuitively appealing and analytically convenient example of a positive effect on the host economy, there are other candidates that could be incorporated in a model. This incentive to attract FDI might be enhanced by, for example, technological linkages that exist between the production of the monopolistic firm and the producers of other goods in the host country of the investment (see Haaland and Wooton, 1999; Kind *et al.*, 2000; and Baldwin and Krugman, 2004). Hence, the basic argument derived from our analysis is not confined to the case where all firms produce final consumer goods, but can equally be applied to tax competition for a firm producing specialised intermediate inputs.

Other channels as to how FDI might benefit the host country have been discussed in the recent trade literature. For example, FDI can increase the productivity of domestic firms, or lead to increased competition in the intermediate goods sector (Markusen and Venables, 1999). The empirical evidence that FDI increases the productivity of indigenous firms is relatively weak however (Görg and Greenaway, 2002). In contrast, there is some indication that FDI causes additional market entry by indigenous firms (Görg and Strobl, 2003).

One of the core features of our model is that FDI in one country exerts a positive spillover on the population of the other country in the region. Again, this spillover is modelled here as savings in transportation costs, and hence a reduction in the consumer price level of the neighbouring country. Alternatively, increased competition in the host country of the investment (as discussed above) may benefit consumers in the neighbouring country through a reduction in *producer* prices, which spill over to other countries in the region when markets are integrated and cross-border shopping by consumers takes place. A still different mechanism may arise from wage rigidities in the host countries, which imply that each additional job created by FDI is associated with a positive rent for workers (Haaparanta, 1996). These increased rents are partly transmitted to other countries in the union through worker mobility (Ludema and Wooton, 2000) or commuting. These settings could yield

results for the effects of regional tax coordination qualitatively similar to those from our specification with trade costs, strengthening the benefits from cooperation.

We now discuss the likely effects on the results of relaxing some of the underlying assumptions of our model. We have excluded the profits of the firm by assuming that they accrue to the residents of a (fourth) country not explicitly considered in the analysis. More generally, let countries  $A$  and  $B$  both own a share  $\delta$  of the firm's profits while country  $C$  owns a share  $\varepsilon$ , where  $2\delta + \varepsilon \leq 1$ . Then, profit income of  $\delta\pi_i$  has to be added to the welfare expressions of the union countries  $A$  and  $B$  in (12), where  $\pi_i$  are the firm's net profits in location  $i$  [see (7)]. Equalising country  $A$ 's welfare in the different situations leads to adjusted best offers to the firm

$$\mu_{AB}^+ = \frac{-\tau[2(\alpha - w) - \tau]}{8\beta} - \delta(\pi_A - \pi_B),$$

$$\mu_{AC}^+ = \frac{-\sigma[2(\alpha - w) - \sigma]}{8\beta} - \delta(\pi_A - \pi_C),$$

and equivalently for country  $B$ . Similarly the adjusted best offer of country  $C$  is

$$\mu_C^+ = \frac{-n\sigma[2(\alpha - w) - \sigma]}{8\beta} - n\varepsilon(\pi_C - \pi_A).$$

In contrast to the benchmark model, the best offers of each country now depend on the equilibrium profits of the firm in alternative locations. Importantly, however, the equilibrium tax rate set by the country that “wins” the competition is always chosen so as to leave the firm indifferent to the offer made by the closest competitor. Hence  $\pi_A = \pi_B$  is always fulfilled when intra-union competition is binding whereas  $\pi_A = \pi_C$  is fulfilled when competition between the union and the outside country  $C$  is binding. The additional terms incorporating the profit differential thus cancel from the above expressions, and the locus of all regimes is unchanged from the benchmark analysis.

Incorporating local ownership of the firm does, however, affect the magnitude of the gains from tax coordination. In Regime I, where the firm has a strong incentive to settle in the region, tax coordination enables the union countries to collectively increase taxes and extract more rents from the firm. Tax revenue increases by  $\mu_C^{\lambda} - \mu_{AB} > 0$  and reduces the firm's profits by the same amount. The reduction in the firm's profits affects welfare in each of countries  $A$  and  $B$  by the local ownership

share  $\delta$ . Hence the welfare gain to the union from tax coordination is still positive in this regime,  $\Delta(u_A + u_B) = (1 - 2\delta)(\mu_C^\lambda - \mu_{AB}) > 0$ , but it is lower than in the benchmark case where all profit income accrues to foreigners.

In Regime III, the firm locates in  $C$  in the absence of coordination. The gain to the union from having the firm is  $\mu_U$ , but to attract it from country  $C$  requires only  $\mu_C^\lambda < \mu_U$ . The firm's profits are affected by the additional location rent in the union,  $\lambda > 0$ , and by the change in the tax rate. The total change in the firm's profits is  $(\lambda - \mu_C^\lambda) - (\lambda - \mu_{AC}) = \mu_{AC} - \mu_C^\lambda > 0$ . Hence, the union's total welfare change from coordination is  $\Delta(u_A + u_B) = \mu_C^\lambda - \mu_U + 2\delta(\mu_{AC} - \mu_C^\lambda) > 0$ . The gains to the union from policy coordination are thus increased, relative to the benchmark case, as the additional profits now partly accrue to domestic residents.

The benefits of regional tax coordination will also be affected if lump-sum taxes and subsidies are ruled out and distortionary taxes are the governments' marginal source of finance. Other things equal, this will put a premium on taxes raised from the firm and therefore increase the gains from a coordinated tax increase (Regime I). The reverse is also true, as this modification imposes an extra cost on subsidies paid out to the firm, and hence reduces the gains from a coordinated tax reduction (Regime III). Note that these departures from our results work in the opposite direction to the previous extension of incorporating profit income accruing to residents of the union. Therefore, on the basis of these two simplifications alone, a setting where lump-sum taxes exist and all profit income accrues to non-residents may be seen as a simple benchmark that does not systematically bias our results in any particular direction.

Another restriction of our model is that governments are given only a single tax/subsidy instrument that can be employed vis-à-vis the firm. The interaction of endogenous tax and tariff policies towards multinational firms has long been analysed in the international trade literature (see Brander and Spencer, 1987). Haufler and Wooton (1999) consider tariffs as a second policy instrument, in addition to profit taxes, and show that the larger country can use its relatively high optimal tariff as an instrument to deter the firm from locating in another country. Hence, the larger

country will be able to increase its equilibrium profit tax in comparison to the case where the tariff instrument cannot be used. A related analysis is by Raff (2002), who shows in a three-country model that establishing a free trade agreement between two union countries may lead to falling external tariffs and reduced tax rates that the union countries can levy on the profits of multinational firms. Applying this line of argument to the present analysis indicates a further source of welfare gain from regional policy coordination. If the two union countries jointly set their external tariff, the common optimal tariff will be higher than that of each member state acting in isolation. This will allow the union to charge a higher tax from the multinational firm than in the benchmark case without tariffs.

Finally, our simple partial equilibrium model has only considered the location of a single firm in a particular industry. It is conceptually straightforward, however, to extend the discussion to a continuum of firms and industries. In such an extended setting the firms would typically differ with respect to the location rent ( $\lambda$ ) that they earn in the union vis-à-vis the outside country, leading to a locational equilibrium with a positive number of firms in each of Regimes I to III. A coordinated tax rise (or a coordinated subsidy reduction) in the union would then have to weigh the aggregate gains from increasing tax receipts from the firms in Regime I against the losses in consumer surplus resulting from the outflow of firms in Regime II. While such a model would be far more complex than the one presented here, our fundamental argument that the direction of a welfare-increasing policy coordination measure is ambiguous should carry through to this more general setting.

## 6 Conclusions

In this paper we have argued that regional tax and subsidy coordination, in a setting with a monopolistic firm and an outside country, can lead to two types of welfare gains for the countries undertaking the agreement. First, for investments that would have taken place in the union in the absence of coordination, coordination allows an increase in equilibrium taxes, transferring location rents from the firm to the union countries. Second, by internalizing the benefits to all union members from the location of a foreign production plant, the union as a whole may be able to attract the firm by means of a lower tax (or higher subsidy), whereas non-cooperative policies of its members would have caused the firm to settle outside the region.

These results seem to strengthen the policy case for a regional coordination of both profit (corporation) taxes and location subsidies. But the analysis has also shown that the direction that a regionally coordinated policy reform should take is far from clear. Most of the policy discussion in the EU, as well as the results from previous research, suggest a coordinated *increase* in profit taxes (by means of a minimum corporate tax rate) as well as a coordinated reduction in location subsidies (by means of a strict enforcement of maximum subsidy levels). Yet the opposite conclusions are equally possible in a world where countries outside the region are not part of the agreement. Hence, the optimal coordinated policy for an integrated region such as the EU involves trading off changes in the location rents that can be reaped from existing firms with those associated with an increase or reduction in the number of firms that locate within the region.

Our analysis also holds some implications for the precise form that regional policy coordination should take. Throughout, we have considered only the welfare effects that regional tax coordination has on the union as a whole, leaving aside the issue of how these gains can be divided between individual member states. In situations where coordinated tax policy results in a lower tax, or higher subsidy, than the best offers of each individual country, the host country would need to receive side-payments from its union partner(s) in order to submit a bid that is sufficiently low to attract the firm to the region. The most straightforward way to overcome this coordination problem would be by means of centralizing corporation taxes and subsidy payments at the EU level. The analysis has also shown, however, that permitting bids by individual countries is a means of internalising the positive spillovers that each country perceives from the location of mobile firms. A centralised tax or subsidy policy at the EU level would eliminate this preference-revelation mechanism. Hence while this instrument could lead to an efficient distribution of firms between the EU and the rest of the world, it does not simultaneously guarantee an efficient distribution of firms between individual EU states.

Finally, the trade-off for regional policy coordination described in this paper holds for a scenario where only *either* a positive tax *or* a location subsidy can be used vis-à-vis the firm. In order to *simultaneously* increase the location rents from existing firms and attract new firms to the region, a richer set of instruments is needed. For example, a coordinated EU policy could consist of a firm-

specific location subsidy, which ensures that FDI with a positive net value to the union is indeed attracted, and a coordinated tax on corporate profits that avoids a mutual undercutting of individual EU states. This would require an intertemporal approach in which the effects of location subsidies for new firms and profit taxes for sunk investments can be clearly distinguished. This extension of our model, in which the optimal combination of tax and subsidy (competition) policies is derived for a union of countries that faces an outside competitor, is left for future work.



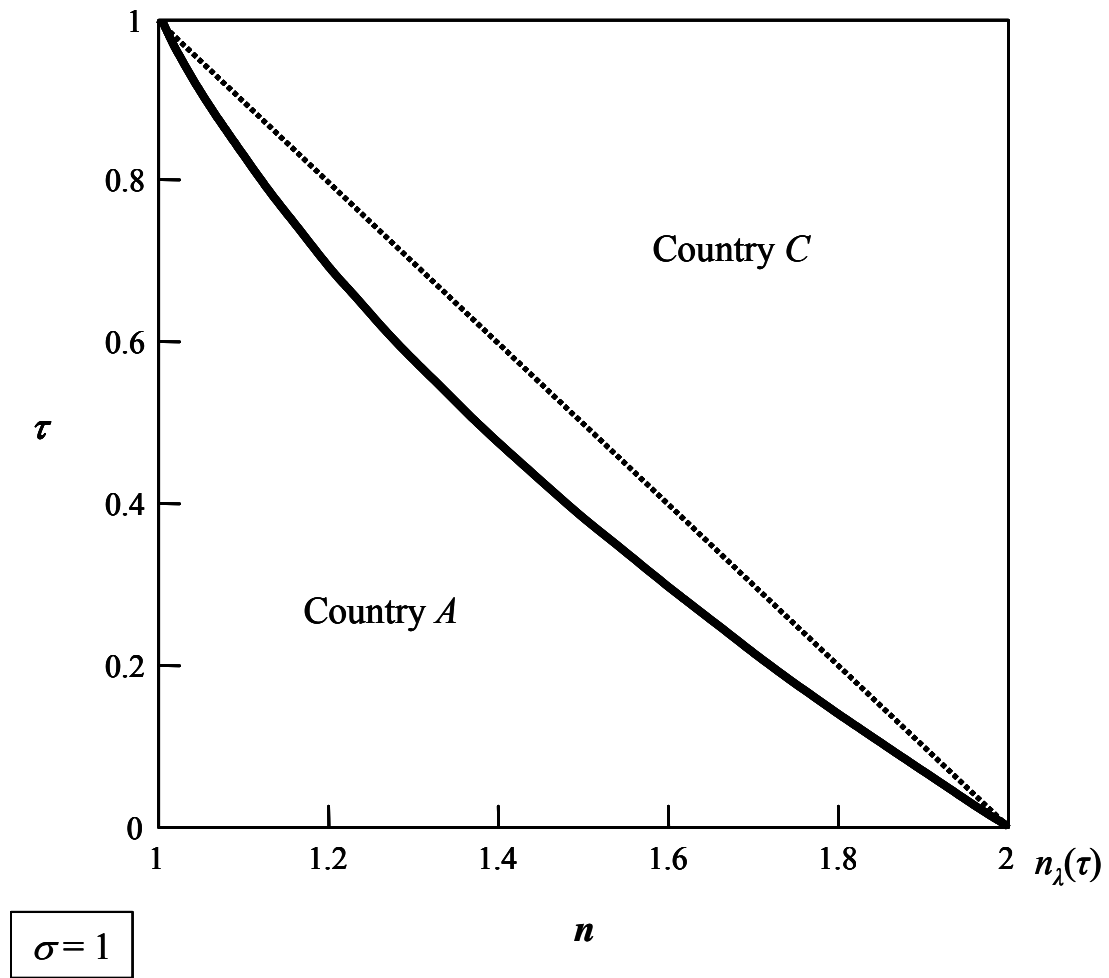
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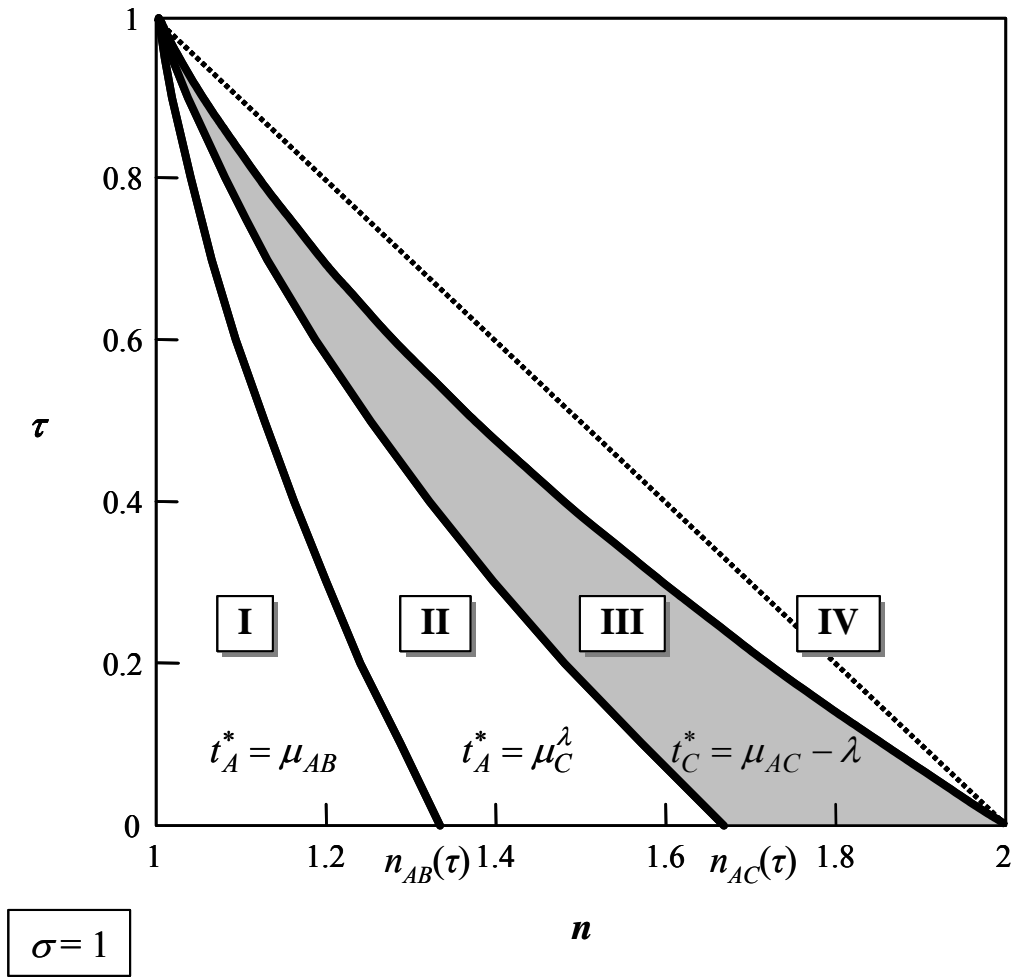
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**Figure 1. Location of firm in absence of tax/subsidy competition**



**Figure 2. Location of firm under tax/subsidy competition**



**Figure 3. Location of firm under tax/subsidy coordination**

