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Transfer Pricing and Enforcement Policy in Oligopolistic Markets

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Abstract

We set up a symmetric two-country model with two multinationals competing on the quantities and possibly manipulating their transfer prices. Governments choose both the corporate profit tax rate and the level of enforcement of the "arm's length" principle. We show that stronger enforcement increases equilibrium tax rates. We also find that a larger international ownership of multinationals leads to a "race to the top" in both policies between the two countries, while trade liberalization initially implies a "race to the bottom". But as trade becomes free enough, a further decrease in trade costs raises equilibrium tax rates and enforcement policies.

Keywords: Multinational Enterprises; Transfer Pricing; Tax Competition; Enforcement Policy; Economic Integration.

JEL Classification: F02; F15; F23; H87.

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1 Introduction

Nowadays a large share of international trade occurs within multinational enterprises (hereafter MNEs) and manipulation of the transfer prices they use for their internal transactions can shift a huge amount of taxable profits between countries. In fact, the empirical evidence almost unambiguously suggests that MNEs are able to reduce their worldwide tax payments by shifting profits from highly taxed to more lightly taxed jurisdictions.[1] Most of the empirical work has been concerned with profit shifting from the United States to low-tax countries or tax havens and it has relied mainly on statistical relationships between country tax rates and affiliate profitabilities or tax liabilities. Clausing (2003) is a notable exception in that she analyzes U.S. data on intrafirm transfer prices to understand in what direction and to what extent these prices differ from those charged in outside markets due to tax rate differentials. Her estimates indicate that a tax rate 1 percent lower in the country of destination (origin) is associated with intrafirm export (import) prices 1.8 percent lower (2 percent higher) relative to non-intrafirm goods.[2]

Present international tax rules attempt to moderate, at least to some extent, these tax arbitrage activities through the principle that transactions within MNEs should be valued at their "arm's length" price, i.e. the price that would be paid by unrelated parties for similar transactions (OECD, 1995). The same concern can be found in the U.S. regulations on transfer pricing, whose main objectives are to *"ensure that taxpayers clearly reflect income attributable to controlled transactions, and to prevent the avoidance of taxes with respect to such transactions"* (U.S. Department of the Treasury, 1994, p.34990). However, even if tax authorities of OECD countries are usually supposed to follow the standard guidelines for transfer pricing, Bartelsman and Beetsma (2003) show that profit shifting opportunities for MNEs do exist among OECD countries (including the U.S.) as well, and they provide evidence that the degree of enforcement of the "arm's length" principle differs among countries. Table 1 summarizes the information about transfer pricing (TP) enforcement policies for the countries involved in their empirical analysis.[3]

The purpose of this paper is to think about international taxation of MNEs and enforcement of the "arm's length" principle. These issues look increasingly important in a world where economic integration proceeds at a very rapid pace and the relevance of MNEs is undoubtedly rising.[4] Our work is essentially related to the literature which studies transfer pricing and tax competition in the presence of MNEs. For instance, Elitzur and Mintz (1996) model the trade-off

[1] See Hines (1997, 1999) for comprehensive surveys of the empirical literature about tax-motivated transfer pricing and profit shifting by MNEs.

[2] See, e.g., Jenkins and Wright (1975), Grubert and Mutti (1991), Harris et al. (1993), Grubert, Goodspeed and Swenson (1993), Hines and Rice (1994).

[3] Most countries have *explicit TP* rules, while a smaller group of countries uses *formal TP documentation* rules, meaning that tax authorities simply recommend taxpayers to maintain written documentation to confirm that the amounts charged in intrafirm transactions are consistent with the "arm's length" principle. And yet an even smaller set of countries imposes *TP specific penalties*. Numbers indicate month and year of introduction of different TP related policies.

[4] Note that about 33 percent of world trade was intrafirm already in 1993 (Markusen, 2002).

Table 1: Formal enforcement of transfer pricing rules by country

Country	Explicit TP rules	Formal TP documentation rules	TP specific penalties
Australia	07/83	09/95	07/83
Austria	-	-	-
Belgium	07/99	07/99	-
Canada	-	01/99	01/99
Denmark	01/99	01/99	-
Finland	01/31	-	-
France	09/85	04/96	04/96
Germany	02/83	-	-
Italy	12/86	-	-
Japan	04/86	-	-
Netherlands	-	-	-
Portugal	-	-	-
Spain	01/96	-	-
Sweden	-	-	-
United Kingdom	07/99	07/99	07/99
United States	01/28	01/94	01/94

Source: Ernst & Young (2000), cited in Bartelsman and Beetsma (2003, p.2230) and Peralta et al. (2003, p.3).

for a MNE between the minimization of its worldwide tax payments and the incentives provided to the managing partner of the foreign subsidiary, finding that corporate tax rates are too high from a global perspective. Haufler and Schjelderup (2000) develop a tax competition model with investment and transfer pricing decisions by a MNE operating in two small countries, and they show that the optimal policy is to accept some distortions of the investment decision (i.e. an incomplete deduction for the cost of capital) in order to reduce the incentive to shift profits out of the country. Mansori and Weichenrieder (2001) and Raimondos-Møller and Scharf (2002) study competition in transfer pricing regulations between two governments. In both models, the non-cooperative outcome implies an excessive taxation of the MNE, resulting from a partial double taxation of its profits. However, none of these papers explicitly accounts for the impact that the degree of enforcement of the "arm's length" principle may have on the corporate profit tax rate set by the government, nor they analyze the effects of economic integration on the two policy instruments and on the product market equilibrium.

In such a sense, the analysis that we carry out in the present paper is closer to Kind, Midelfart Knarvik, and Schjelderup (2001, 2002, 2004), and also relies on the contribution by Peralta, Wauthy, and van Ypersele (2003). In particular, Kind et al. (2002) study the effects of economic integration on equilibrium taxes by developing a symmetric two-country model

in the presence of two MNEs, whose location is given, and where the corporate tax base is partly foreign owned. The MNEs compete on quantities in the two markets and are assumed to incur some costs in order to conceal transfer price manipulation. These costs are reflected by an *exogenous* parameter and they are *tax-deductible*, in the sense that tax authorities may not even know that they are related to transfer pricing. In their model, trade liberalization reduces equilibrium taxes if the MNEs are owned by residents of a third country, but increases them if the MNEs are owned by home-country residents. Furthermore, increased international ownership implies higher equilibrium tax rates. Differently, Peralta et al. (2003) set up a model where two *almost* symmetric countries compete both for the location of a single MNE and for the taxation of its profits. The MNE acts as a monopolist in each market and is required to follow the "arm's length" principle. The two governments can decide between being strict or lenient on this requirement: such an "enforcement policy" is costless and essentially determined by government's reputation. As a result, transfer price manipulation implies a *non tax-deductible* cost for the MNE, and each government faces a trade-off between the benefit of attracting the MNE and the fiscal cost of hosting it, since the same tax rate must apply to domestic firms as well. They show that a country can optimally decide not to enforce the transfer pricing rule in order to attract the MNE, while setting high profit taxes on domestic firms. The other country, in turn, does not enjoy the benefits from the location of the MNE, but taxes its profits.

In our paper we set up a symmetric two-country model with trade costs and international ownership. We focus on the transfer pricing decisions by two MNEs operating in oligopolistic markets characterized by Cournot competition and we abstract from their location choices. We endow the government of each country with two policy instruments: the corporate profit tax rate and the transfer pricing enforcement policy. The latter identifies the government's efforts in forcing the MNE to adhere to the "arm's length" principle. The choice of such a policy is *endogenous*, reflecting government's attitude toward MNEs. This implies that transfer price manipulation is costly and that these costs are *non tax-deductible* by the MNEs. To account for the possible interaction between the two policies and to analyze the effects of increased economic integration on both of them, we consider a three-stage game where governments choose first the level of enforcement of the "arm's length" principle and then the corporate profit tax rate. In the last stage, the headquarters of the MNEs set transfer prices to their foreign subsidiaries and compete on quantities in the two markets. In such a setting, we show that, as governments increase the level of enforcement to discourage transfer pricing, equilibrium tax rates increase as well. Moreover, we find that increased economic integration may lead to higher equilibrium tax rates and enforcement policies. Namely, a higher international ownership of the MNEs leads to a "race to the top" in both policies between the two countries. On the contrary, when the two MNEs are not fully owned by domestic residents, trade liberalization initially implies a "race to the bottom". Then, as trade becomes free enough, a further decrease in trade costs increases both corporate profit tax rates and enforcement policies.

The rest of the paper is organized as follows. In Section 2, we outline the model. Section 3 illustrates the transfer pricing and quantity decisions by the MNEs when faced with the two policy instruments. In Sections 4 and 5, we derive the symmetric equilibrium tax rate and

transfer pricing enforcement policy levels. Furthermore, we analyze and discuss the effects of increased economic integration on the two policy instruments. In Section 6, we summarize our main results and conclude.

2 The model

We consider a partial equilibrium model with two countries, i and j, which are identical in all respects, and two identical horizontally integrated MNEs. The location choices of the MNEs are exogenously given and such that multinational enterprise MNE_i (resp., MNE_j) has headquarters in country i (j) and a foreign subsidiary in country j (i).

The production process within each MNE is divided into production of intermediate and final goods implying, respectively, marginal costs c^I and c^F. Without loss of generality, we postulate that all intermediates are produced at the headquarters and final production takes place locally, meaning that part of the production of intermediates is further processed by the parent company and then sold in the domestic market, while the rest is exported to the foreign subsidiary for final processing and sale abroad. Furthermore, we normalize to zero both marginal production costs so that $c^I = c^F = 0$. In our setting, the marginal cost of the exporting parent company, c^I, plays the role of the "arm's length" price which the OECD recommends for the pricing of intrafirm transactions. As shall become clear below, the key to our argument is that while both countries are supposed to follow the "arm's length" principle, they can endogenously choose the corresponding level of enforcement.

The foreign subsidiary of, say, MNE_i is charged a transfer price, q_i, for each unit of the intermediate good that it buys from its headquarters. Since $c^I = 0$ by assumption, the transfer price is higher (lower) than the "arm's length" price if $q_i > 0$ ($q_i < 0$). The subsidiary also has to pay a per-unit trade cost, $\tau \geq 0$, which may reflect different types of barriers to international trade (e.g., transport costs and differing product standards), but does not include any kind of revenue generating tariffs imposed by the two governments.

The products of the MNEs are *perfect substitutes* in demand in both markets. That is, the two MNEs produce homogeneous goods and face the same inverse demand function

$$p_i = 1 - x_{ii} - x_{ji}, \tag{1}$$

where p_i is the price to consumers in country i, while x_{ii} and x_{ji} denote MNE_i's home sales and MNE_j's exports to country i respectively.

We let π_{ii} and π_{ij} denote before-tax profits for MNE_i's parent company and foreign subsidiary, where the first subscript indicates the headquarters' location and the second the country where profits are derived. Given our specifications, domestic and foreign before-tax profits for MNE_i can be expressed as

$$\pi_{ii} = p_i x_{ii} + q_i x_{ij}, \tag{2}$$

$$\pi_{ij} = (p_j - \tau - q_i) x_{ij}. \tag{3}$$

We assume that international corporate taxation follows the "source" principle, meaning that each country imposes a tax on the profits generated within its borders.[5] Furthermore, we postulate that tax authorities cannot directly observe the production cost of the parent company, so that the transfer price may be manipulated in response to international tax differentials to shift profits from one country to the other.

To limit this profit shifting incentive and to formalize the evidence by Bartelsman and Beetsma (2003), we argue that governments are concerned about transfer pricing. For this reason, the government of, say, country i chooses a level of enforcement, δ_i, of the "arm's length" principle and requires MNE_i to charge a transfer price equal to the marginal production cost of the exporting parent company.[6] To implement such an enforcement level, country i's government has to incur a cost $C_i(\delta_i) = \frac{d}{2}\delta_i^2,\ d > 0$, since it needs to allocate resources to control MNE_i's transfer pricing behavior. Furthermore, MNE_i needs to hire financial experts (e.g., lawyers and accountants) to show that the transfer price charged to its foreign subsidiary is consistent with the "arm's length" principle. As a result, transfer price manipulation entails some non-tax deductible costs for MNE_i.[7] These costs are increasing in the difference between q_i and c^I, in the level of enforcement chosen by the government, and in the amount of intrafirm exports. Namely, we let the "manipulation cost" function take the following form

$$MC_i\left(\delta_i, q_i - c^I, x_{ij}\right) = \delta_i q_i^2 x_{ij},$$

so that overinvoicing and underinvoicing of the transfer price are equally expensive for MNE_i. Note that if MNE_i charges a transfer price $q_i = c^I = 0$, its manipulation costs are equal to zero. Consequently, MNE_i's objective function can be written as

$$\Pi_i = (1 - t_i)\pi_{ii} + (1 - t_j)\pi_{ij} - \delta_i q_i^2 x_{ij}, \tag{4}$$

where t_i and t_j denote the corporate profit tax rate imposed by country i and country j respectively.

Turning to the objective function of the government, we denote by $\alpha \in [0, 1]$ the share of each MNE that is owned by domestic residents, while the residual $(1 - \alpha)$ is owned by residents

[5] This assumption is consistent with the actual behavior of most OECD countries. Indeed, the "source" country typically has a first right to tax the profits of all firms operating within its borders. Then, some "residence" countries exempt the foreign profits of their subsidiaries from domestic tax, in which case the "source" principle applies directly. Alternatively, "residence" countries can use the tax credit method of double taxation relief. Even in this case, the "source" principle often effectively remains in operation because foreign profits are taxed only upon repatriation, which can be deferred by the MNE. See, e.g., Keen (1993).

[6] Following Kant (1988), the endogenous choice of the enforcement policy can be interpreted as a change in government's attitude toward MNEs, e.g. due to a change in the government in either country or to a study and policy review by an existing government.

[7] The non tax-deductibility assumption is in line with Peralta et al. (2003). Instead, Kind et al. (2002) treat such "concealment costs" as tax-deductible.

of a third country, so that welfare in country i can be expressed as[8]

$$W_i = CS_i + T_i + \alpha\Pi_i - C_i(\delta_i),$$

where $CS_i = \frac{1}{2}(x_{ii} + x_{ji})^2$ represents consumer surplus and tax revenue is given by $T_i = t_i(\pi_{ii} + \pi_{ji})$. To show the different effects on welfare of the two policies and of the MNEs' ownership structure, the objective function can be rearranged as follows

$$W_i = CS_i + \underbrace{\alpha\left(\pi_{ii} + \pi_{ij}\right)}_{(I)} - \underbrace{\alpha t_j \pi_{ij}}_{(II)} + \underbrace{t_i\pi_{ji} + (1-\alpha)\, t_i\pi_{ii}}_{(III)} - \underbrace{\left(\alpha\delta_i q_i^2 x_{ij} + \frac{d}{2}\delta_i^2\right)}_{(IV)} \tag{5}$$

where

(I) the *profit ownership* effect shows that welfare is increasing in MNE_i's before-tax profits and in the share of these profits accruing to domestic residents;

(II) the *foreign tax exporting* effect indicates that country j has the ability to tax foreign profits of MNE_i (by taxing its subsidiary), thereby reducing the amount available to country i residents; this effect decreases welfare and is stronger the larger is the share of MNE_i owned by domestic residents;

(III) the *home tax exporting* effect increases welfare, since country i is able to shift the burden of taxation onto foreigners by taxing both MNE_j's foreign subsidiary and the share of MNE_i's parent company profits which accrue to third-country residents;

(IV) the *enforcement policy* effect shows that the costs in terms of welfare of such a policy are increasing in the share of MNE_i owned by domestic residents.

Given this scenario, we study a three-stage game characterized by the following order of moves:

- at the first stage, the two governments simultaneously set their level of enforcement of the "arm's length" principle, $\delta_i,\ \delta_j \in [0, \infty)$;
- at the second stage, the two governments simultaneously choose their corporate profit tax rates, $t_i,\ t_j \in [0, 1]$;
- at the third stage, the headquarters of the MNEs set the transfer prices to their foreign subsidiaries and compete on the quantities in the two markets.

This timing is consistent with the model by Kind et al. (2002), where δ is an exogenous parameter which reflects how costly is for MNEs to manipulate the transfer price. In their paper, the two countries simultaneously choose their tax rates, given δ, and at the final stage Cournot competition between the two MNEs takes place. The same timing characterizes the

[8] The parameter α can also be interpreted as the weight that each government puts on profits when it maximizes national welfare. If, say, $\alpha < 1$ and the MNEs in both countries are fully owned by domestic residents, the government values consumer surplus, tax revenue and the cost of the enforcement policy more than producer surplus.

model by Peralta et al. (2003) as well, where the sequence of decisions described above implies that country i's enforcement policy, δ_i, is essentially determined by government's reputation. Hence, it can be considered as a long-term policy variable.[9]

3 Transfer pricing and quantity decisions

We solve our three-stage game by backward induction. In the third stage, MNE_i maximizes its objective function (4) with respect to its home sales, exports and transfer price (x_{ii}, x_{ij} and q_i), taking the quantities supplied and the transfer price charged by MNE_j, the tax rates and the enforcement policies of both countries as given. Evidently, MNE_j's maximization problem is symmetric.

3.1 Equilibrium transfer price and profit shifting incentive

Using equations (1), (2) and (3), the equilibrium transfer price can be found by differentiating (4) with respect to q_i, which gives

$$q_i\left(t_i, t_j, \delta_i\right) = \frac{t_j - t_i}{2\delta_i}. \tag{6}$$

Note that the equilibrium transfer price only depends upon the tax rates set by the two governments and the enforcement policy of the domestic country.

Equation (6) illustrates the *profit shifting* incentive to manipulate the transfer price. If, say, $t_i > t_j$, MNE_i is induced to underinvoice its exports ($q_i < 0$) and shift profits to country j. Similarly, an incentive for overinvoicing ($q_i > 0$) and profit shifting into country i arises when $t_i < t_j$. Nevertheless, this profit shifting incentive is limited by country i's enforcement policy, δ_i. Intuitively, this policy should act in the same direction as the tax policy. Indeed, if country i is the high-tax country, MNE_i is induced to charge a negative transfer price, thereby shifting profits into country j. Hence, country i should set a higher enforcement level (as opposed to the case where it is the low-tax country) to keep as low as possible the negative effect which transfer pricing may have on the profits declared by MNE_i's parent company. On the contrary, if both countries levy the same corporate profit tax rate ($t_i = t_j$), no profit shifting motive exists and MNE_i optimally sets its transfer price equal to the "arm's length" price, i.e. $q_i^* = c^I = 0$.[10]

To further investigate the previous argument, we derive the effects on the equilibrium transfer price of a marginal change in tax rates and in country i's enforcement policy

$$\frac{\partial q_i}{\partial t_i} = -\frac{\partial q_i}{\partial t_j} = -\frac{1}{2\delta_i} < 0, \tag{7}$$

$$\frac{\partial q_i}{\partial \delta_i} = \frac{t_i - t_j}{2\delta_i^2}. \tag{8}$$

[9] We must also stress that the choice of an alternative timing where, before deciding on their enforcement policies, the two governments set tax rates, would make the model intractable and we would not obtain clear-cut results for the equilibrium values of the two policy instruments.

[10] Here and in what follows, we denote by an asterisk the value of the variables corresponding to the case of symmetric tax rates ($t_i = t_j$).

Equation (7) shows that, as long as $\delta_i > 0$, a marginal increase in t_i induces MNE_i to lower its transfer price and shift profits out of country i. But the reduction in q_i turns out to be lower the larger is the level of δ_i. On the contrary, a marginal increase in t_j determines an increase in q_i and MNE_i is willing to shift profits into country i. But the rise in q_i turns out to be larger the lower is the level of δ_i. Both situations suggest that the enforcement policy of country i should work in the same direction as its tax policy in order to keep more profits within its borders.

Equation (8) confirms the last statement. If country i is the low-tax country, MNE_i is induced to overinvoice its exports to country j. Since $\partial q_i/\partial \delta_i < 0$, a marginal increase in δ_i decreases q_i and MNE_i can shift a lower amount of profits into country i. Hence, δ_i should be as low as possible. On the other hand, if country i is the high-tax country, MNE_i is induced to underinvoice its exports to country j. In this case, $\partial q_i/\partial \delta_i > 0$ and country i should set δ_i as high as possible because the higher δ_i, the closer to the "arm's length" price (i.e. to zero) the transfer price q_i is, and the smaller the amount of profits that MNE_i is willing to declare in country j.

3.2 Equilibrium home sales and exports

Differentiating (4) with respect to x_{ii} and x_{ij}, we get the following first-order conditions

$$\frac{\partial \Pi_i}{\partial x_{ii}} = 1 - 2x_{ii} - x_{ji} = 0, \tag{9}$$

$$\frac{\partial \Pi_i}{\partial x_{ij}} = (1-t_i)q_i + (1-t_j)(1 - 2x_{ij} - x_{jj} - \tau - q_i) - \delta_i q_i^2 = 0, \tag{10}$$

which, together with the symmetric expressions for MNE_j, implicitly define the *best response* functions of the two MNEs to a change in the quantities supplied on the two markets. Note that quantities are *strategic substitutes* ($\partial x_{ii}/\partial x_{ji} < 0$ and $\partial x_{jj}/\partial x_{ij} < 0$).

Solving (9) and (10) simultaneously for the two MNEs and using the equilibrium transfer price (6), we obtain equilibrium home sales and exports by MNE_i and MNE_j

$$\textit{home sales} \quad : \quad x_{ii} = \frac{1+\tau}{3} - \frac{(t_j - t_i)^2}{12\delta_j(1-t_i)}, \; x_{jj} = \frac{1+\tau}{3} - \frac{(t_j - t_i)^2}{12\delta_i(1-t_j)}, \tag{11}$$

$$\textit{exports} \quad : \quad \underbrace{x_{ij} = \frac{1-2\tau}{3} + \frac{(t_j - t_i)^2}{6\delta_i(1-t_j)}}_{MNE_i}, \; \underbrace{x_{ji} = \frac{1-2\tau}{3} + \frac{(t_j - t_i)^2}{6\delta_j(1-t_i)}}_{MNE_j}. \tag{12}$$

Note that, in the case of symmetric corporate profit tax rates ($t_i = t_j$), equilibrium quantities reduce to

$$x_{ii}^* = x_{jj}^* = \frac{1+\tau}{3}, \quad x_{ij}^* = x_{ji}^* = \frac{1-2\tau}{3}, \tag{13}$$

and since the two MNEs are induced to set the same transfer price $q_i^* = q_j^* = 0$, their symmetric equilibrium before-tax profits are given by

$$\pi_{ii}^* = \pi_{jj}^* = \frac{(1+\tau)^2}{9}, \quad \pi_{ij}^* = \pi_{ji}^* = \frac{(1-2\tau)^2}{9}. \tag{14}$$

Equation (13) suggests that sufficiently high trade costs, i.e. $\tau \geq \frac{1}{2}$, would lead to negative exports for both MNEs. Thus, in order to have international trade in our model, we need to

assume that $\tau \in \left[0, \frac{1}{2}\right)$. Furthermore, differentiation of (11) and (12) shows that a decrease in trade costs reduces domestic sales and simultaneously increases exports by the two MNEs, thereby inducing more competition in both markets.

3.2.1 Export incentive and enforcement policy

According to the equilibrium quantities expressions, (11) and (12), home sales by the two MNEs are affected by the enforcement policy of the foreign country, while they are independent of the domestic enforcement policy. On the contrary, exports only depend upon the latter. Namely, differentiating (11) and (12) with respect to δ_i, we find that, as long as $t_i \neq t_j$

$$\underbrace{\frac{\partial x_{ii}}{\partial \delta_i} = \frac{\partial x_{ji}}{\partial \delta_i} = 0,}_{Country\ i's\ market} \quad \underbrace{\frac{\partial x_{ij}}{\partial \delta_i} < 0, \frac{\partial x_{jj}}{\partial \delta_i} > 0,}_{Country\ j's\ market}$$

which imply that a marginal increase in δ_i has no impact on home sales by MNE_i, but leads to a decrease in its exports to country j. At the same time, it induces MNE_j to increase its home sales in country j, leaving unaffected its exports to country i. In other words, country i's enforcement policy affects the quantities sold in country j's market through its negative impact on exports by MNE_i.

To account for this observation, we need to put forward the *export* incentive faced by MNE_i. Substituting for the equilibrium transfer price (6), the first-order condition (10) can be rewritten as

$$\frac{\partial \Pi_i}{\partial x_{ij}} = (1 - t_i)\left(\frac{t_j - t_i}{2\delta_i}\right) + (1 - t_j)\left[1 - 2x_{ij} - x_{jj} - \tau - \left(\frac{t_j - t_i}{2\delta_i}\right)\right] - \frac{(t_j - t_i)^2}{4\delta_i}. \qquad (15)$$

If, regardless of a tax rate differential ($t_i \neq t_j$), MNE_i does not manipulate the transfer price and sets $q_i^* = 0$, (10) implies that $1 - 2x_{ij} - x_{jj} - \tau = 0$. Inserting the last expression into (15), we obtain

$$\frac{\partial \Pi_i}{\partial x_{ij}} = \frac{(t_j - t_i)^2}{4\delta_i} > 0.$$

Since it is optimal for MNE_i to increase its exports until the marginal profit goes down to zero, we can argue that MNE_i will export more when there is room for manipulating the transfer price (i.e., $t_i \neq t_j$) than in the case of symmetric tax rates.

Such an export incentive turns out to be decreasing in the level of country i's enforcement policy as well as the profit shifting incentive defined above. This is precisely the reason why, even in the presence of a tax rate differential, an increase in δ_i induces MNE_i to decrease its exports to country j. Finally, consider what happens in country j's market. Since the two competing MNEs set their quantities simultaneously, MNE_j cannot observe MNE_i's actual behavior before setting its own quantity. It can, however, anticipate such a behavior by observing the enforcement policy level which country i has previously chosen. Hence, if δ_i increases, MNE_j can anticipate that MNE_i will reduce its exports to country j and, since quantities are strategic substitutes, its optimal response will be to increase its home sales.

3.2.2 Strategic effect of corporate profit tax rates

In order to investigate how a change in country i's tax rate affects home sales and exports by the two MNEs, we derive the following expressions

$$\frac{\partial x_{ii}}{\partial t_i} = \frac{(t_j - t_i)(2 - t_i - t_j)}{12\delta_j (1 - t_i)^2} \quad , \quad \frac{\partial x_{ij}}{\partial t_i} = \frac{t_i - t_j}{3\delta_i (1 - t_j)}, \tag{16}$$

$$\underbrace{\frac{\partial x_{ji}}{\partial t_i} = \frac{(t_i - t_j)(2 - t_i - t_j)}{6\delta_j (1 - t_i)^2}}_{Country\ i's\ market} \quad , \quad \underbrace{\frac{\partial x_{jj}}{\partial t_i} = \frac{t_j - t_i}{6\delta_i (1 - t_j)}}_{Country\ j's\ market}. \tag{17}$$

It is clear that, as long as $\delta_i, \delta_j > 0$ and $t_i, t_j \neq 1$, their sign only depends upon the difference between t_i and t_j. In particular, if $t_i = t_j$, home sales and exports by the two MNEs are independent of the actual tax rates. Thus, a marginal increase in one of the tax rates starting from a symmetric equilibrium will not have any effect on supplied quantities. This will prove a useful property when deriving the equilibrium tax rate at the second stage.

Suppose now that $t_i \neq t_j$. We observe from (16) that, as long as $t_i < t_j$, a marginal increase in country i's tax rate induces MNE_i to increase its home sales and reduce its exports to country j. Furthermore, (17) suggests that MNE_j will respond to such a marginal increase in t_i by raising its home sales and decreasing its exports to country i. To account for these effects, we must recall that the two MNEs compete on the quantities knowing the tax rates which the two countries have previously set and that quantities are strategic substitutes. That is, we need to consider the *strategic effect* of tax rates on supplied quantities. When $t_i < t_j$, MNE_i is willing to overinvoice its exports and shift profits to country i, where the parent company resides. But a marginal increase in t_i will lower both the gain from manipulating the transfer price (profit shifting incentive) and the marginal profit of exports (export incentive), so that it will be optimal for MNE_i to decrease its exports to country j and increase its home sales. Given that tax rates are set before quantity competition, MNE_j can anticipate MNE_i's choice and, since quantities are strategic substitutes, its optimal response will be to increase its home sales and decrease its exports to country i.

On the contrary, if $t_i > t_j$, a marginal increase in country i's tax rate will have the opposite effects on supplied quantities. MNE_i will be induced to decrease its home sales and increase its exports to country j, while MNE_j will reduce its home sales and increase its exports to country i. In this case, we know that MNE_i is willing to underinvoice its exports and shift profits to country j, where the foreign subsidiary resides. Hence, a marginal increase in t_i will increase even further its profit shifting and export incentives, so that MNE_i will behave more aggressively in country j and less aggressively in country i. As before, since MNE_j can anticipate MNE_i's behavior by observing tax rates, its best response will be to lower its home sales and raise its exports to country i.[11]

[11] When $t_i > t_j$ ($t_i < t_j$), we can reach the same conclusion by using the argument that a marginal increase in t_i will have a positive (negative) impact on MNE_j's profit shifting and export incentives.

4 Tax competition

At the second stage, each government sets its corporate profit tax rate in order to maximize national welfare, taking the tax rate of the other country and both enforcement policies as given. Clearly, the welfare maximization problem of the two countries is symmetric. In particular, country i's government maximizes its welfare function (5) with respect to t_i, taking country j's tax rate (t_j), as well as δ_i and δ_j, as given. The corresponding first-order condition is given by

$$\begin{aligned}\frac{\partial W_i}{\partial t_i} &= \frac{\partial CS_i}{\partial t_i} + \alpha\left(\frac{\partial \pi_{ii}}{\partial t_i} + \frac{\partial \pi_{ij}}{\partial t_i}\right) - \alpha t_j \frac{\partial \pi_{ij}}{\partial t_i} + \pi_{ji} + t_i \frac{\partial \pi_{ji}}{\partial t_i} + (1-\alpha)\pi_{ii} \\ &+ (1-\alpha) t_i \frac{\partial \pi_{ii}}{\partial t_i} - \alpha\left(\delta_i q_i^2 \frac{\partial x_{ij}}{\partial t_i} + 2\delta_i q_i x_{ij} \frac{\partial q_i}{\partial t_i}\right) = 0,\end{aligned}$$

and we can easily show that the total effect of country i's tax rate on national welfare can be decomposed into three different effects

$$\begin{aligned}\frac{\partial W_i}{\partial t_i} &= \underbrace{\pi_{ji} + (1-\alpha)\pi_{ii}}_{Direct} + \underbrace{\left[(1-\alpha) t_i + \alpha(t_j - 2\delta_i q_i)\right] x_{ij} \frac{\partial q_i}{\partial t_i} - t_i x_{ji} \frac{\partial q_j}{\partial t_i}}_{TP} \\ &+ \left\{x_{ii} + (1-t_i) x_{ji} + (1 - 2x_{ii} - x_{ji})\left[\alpha + (1-\alpha) t_i\right]\right\} \frac{\partial x_{ii}}{\partial t_i} \\ &+ \left[\alpha(1-t_j)(1 - 2x_{ij} - x_{jj} - \tau) + (1-\alpha) q_i t_i + \alpha q_i (t_j - \delta_i q_i)\right] \frac{\partial x_{ij}}{\partial t_i} \\ &+ \left[x_{ji} + (1-\alpha)(1-t_i) x_{ii} + t_i (1 - 2x_{ji} - x_{ii} - \tau - q_j)\right] \frac{\partial x_{ji}}{\partial t_i} \\ &- \alpha(1-t_j) x_{ij} \frac{\partial x_{jj}}{\partial t_i} = 0, \end{aligned} \tag{18}$$

where *Direct* and TP denote, respectively, the *direct* effect on tax revenue (for constant transfer price and supplied quantities) and the *profit shifting* effect through transfer pricing, while the remaining terms represent the *strategic* effect of t_i on supplied quantities.

In *any* symmetric equilibrium in tax rates ($t_i = t_j$), we know from equation (6) that the two MNEs optimally do not manipulate the transfer price by setting $q_i^* = q_j^* = 0$. Moreover, home sales and exports are independent of the actual tax rates. This means that the strategic effect on supplied quantities is equal to zero so that country i's tax rate affects national welfare only through the other two effects.[12] Hence, imposing symmetry on the first-order condition and defining $t^* \equiv t_i = t_j$ in any symmetric equilibrium in tax rates, (18) reduces to

$$\frac{\partial W_i}{\partial t_i} = \underbrace{\pi_{ji}^* + (1-\alpha)\pi_{ii}^*}_{Direct} + \underbrace{t^*\left(x_{ij}^* \frac{\partial q_i}{\partial t_i} - x_{ji}^* \frac{\partial q_j}{\partial t_i}\right)}_{TP} = 0, \tag{19}$$

and we can substitute for (7), (13), (14) and $\partial q_j / \partial t_i = 1/2\delta_j$ to derive the symmetric equilibrium tax rate.

[12] Alternatively, it can be shown that a marginal change in the tax rates from a symmetric equilibrium will not affect consumer surplus, the profit ownership effect (I) and the enforcement policy effect (IV).

Proposition 1 *The symmetric equilibrium tax rate is given by*

$$t^*(\delta_i, \delta_j, \alpha, \tau) = \frac{2\delta_i\delta_j\left[5\tau^2 - 2\tau + 2 - \alpha(1+\tau)^2\right]}{3(\delta_i + \delta_j)(1-2\tau)}, \tag{20}$$

and turns out to be positive as long as $\delta_i, \delta_j > 0$. *It depends on the level of enforcement of the "arm's length" principle by the two countries (*δ_i *and* δ_j*), on the ownership structure of the MNEs (*α*) and on trade costs (*τ*).*

Proof See Appendix A1. □

The symmetric solution to the government's maximization problem allows us to analyze the effects that enforcement policies may have on corporate profit tax rates. Differentiating (20) with respect to δ_i and δ_j, we obtain

$$\frac{\partial t^*}{\partial \delta_i} > 0, \ \frac{\partial t^*}{\partial \delta_j} > 0,$$

so that we can state

Proposition 2 *An increase in the level of enforcement of the "arm's length" principle by one of the two countries (or by both of them) increases the symmetric equilibrium tax rate.*

Proof See Appendix A1. □

Consequently, if we believe that OECD countries have generally become more concerned about profit shifting opportunities for MNEs due to the substantial growth in foreign direct investments and intrafirm trade which has characterized the last two decades (Markusen, 2002), our model suggests that, as governments allocate more and more resources to control the transfer pricing behavior of MNEs, equilibrium tax rates will increase as well.

4.1 Effects of economic integration

In our framework "economic integration" may be interpreted either as *trade liberalization* or as an increasing *international ownership* of the two MNEs. While the former is represented by a decrease in trade costs, τ, the latter is captured by a decrease in the share of the domestic MNE which is owned by domestic residents, α, and by a corresponding increase in the ownership by foreigners.

We first consider the effect on t^* of a change in the ownership structure of the MNEs. Differentiating (20) with respect to α, we find that

$$\frac{\partial t^*}{\partial \alpha} < 0,$$

which allows us to state

Proposition 3 *An increase in the share of international ownership of the MNEs, i.e. a lower* α*, increases the symmetric equilibrium tax rate.*

Proof See Appendix A1. □

Intuitively, the higher is the share of the domestic *MNE* which is owned by residents of a third country, the stronger is the incentive for the government to raise the tax rate, thereby shifting more of the tax burden onto foreigners.[13]

We now analyze the effects of trade liberalization on t^*. To begin, we discuss the two extreme cases where MNE_i is fully owned either by domestic residents ($\alpha = 1$) or by residents of a third country ($\alpha = 0$).

With **full domestic ownership** ($\alpha = 1$), evaluating the first order-condition (19) at the symmetric equilibrium in tax rates gives

$$\frac{\partial W_i}{\partial t_i} = \underbrace{\pi^*_{ji}}_{Direct} + \underbrace{t^* \left(x^*_{ij} \frac{\partial q_i}{\partial t_i} - x^*_{ji} \frac{\partial q_j}{\partial t_i} \right)}_{TP} = 0.$$

The *direct* effect on welfare of an increase in t_i is positive, since a higher tax rate (for constant transfer price) allows country i to tax more heavily the profits of MNE_j's foreign subsidiary, π^*_{ji}. On the contrary, the *profit shifting* effect through transfer pricing has a negative impact on country i's welfare: on the one hand, a higher t_i leads MNE_i to decrease the transfer price charged to its subsidiary in country j ($\partial q_i / \partial t_i < 0$), thus increasing the profits of the latter and allowing country j to export more of its tax burden to country i's residents; on the other hand, a higher t_i induces MNE_j to increase the transfer price for its subsidiary in country i ($\partial q_j / \partial t_i > 0$), thereby decreasing the subsidiary profits and reducing the scope for country i to tax foreigners.

Substituting for the symmetric equilibrium values of before-tax profits and exports, and using (7), we obtain

$$\frac{\partial W_i}{\partial t_i} = \underbrace{\frac{(1-2\tau)^2}{9}}_{Direct} - \underbrace{t^* \frac{(\delta_i + \delta_j)(1-2\tau)}{6\delta_i \delta_j}}_{TP} = 0. \tag{21}$$

The first term in (21) represents the positive effect on welfare of raising t_i when trade costs τ decrease: trade liberalization increases the profits of MNE_j's subsidiary (*tax base expansion*), so that more of the domestic tax burden can be exported to foreigners. At the same time, there is a negative effect which corresponds to the second term in (21): a decrease in trade costs (for constant enforcement policies) leads to more profit shifting through transfer pricing (*tax base loss*).

It is then straightforward to derive the symmetric equilibrium tax rate in the case of full domestic ownership

$$t^*(\delta_i, \delta_j, 1, \tau) = \frac{2\delta_i \delta_j (1-2\tau)}{3(\delta_i + \delta_j)},$$

[13] This result is consistent with Huizinga and Nielsen (1997) who show that if economic integration means that a larger part of the corporate tax falls on foreigners, an incentive for "tax exportation" arises leading to a higher corporate tax rate. Their model, however, does not consider transfer pricing by MNEs.

and to show that trade liberalization will *increase* t^*, meaning that the positive direct effect on tax revenue dominates the negative profit shifting effect.[14]

With **full third-country ownership** ($\alpha = 0$), evaluating the first order-condition (19) at the symmetric equilibrium in tax rates gives

$$\frac{\partial W_i}{\partial t_i} = \underbrace{\pi^*_{ji} + \pi^*_{ii}}_{Direct} + \underbrace{t^* \left(x^*_{ij} \frac{\partial q_i}{\partial t_i} - x^*_{ji} \frac{\partial q_j}{\partial t_i} \right)}_{TP} = 0.$$

As before, country i faces a trade-off between the incentive to shift taxes onto foreigners and a potential loss of tax revenue due to profit shifting through transfer pricing. In this case, the direct effect consists of the equilibrium profits of both MNE_j's subsidiary and MNE_i's parent company, which entirely accrue to foreigners. Although we could argue that country i should set t_i as high as possible (i.e. equal to 1), such a tax rate cannot be optimal since it would induce both MNEs to manipulate their transfer prices and shift profits out of the country. Using equations (7), (13) and (14), the first-order condition becomes

$$\frac{\partial W_i}{\partial t_i} = \underbrace{\frac{(1-2\tau)^2}{9} + \frac{(1+\tau)^2}{9}}_{Direct} - \underbrace{t^* \frac{(\delta_i + \delta_j)(1-2\tau)}{6\delta_i \delta_j}}_{TP} = 0.$$

As in the case of full domestic ownership, if t_i increases, trade liberalization leads to a larger amount of profit shifting through transfer pricing (*tax base loss*). Here, however, the impact of trade liberalization on the direct effect turns out to be positive just for low values of trade costs.[15] The intuition behind this result is straightforward. Consider what happens when there is no international trade (i.e. $\tau = \frac{1}{2}$): MNE_j does not export to country i, so that its subsidiary earns no profits, while MNE_i's parent company can earn monopoly profits. Then, as τ decreases, MNE_j will eventually enter country i's market and its subsidiary will start earning positive profits. At the same time, MNE_i's parent company profits will reduce. Since MNE_i's monopoly profits are gradually replaced by lower total duopoly profits, the tax base for country i's government shrinks (*tax base contraction*). Indeed, even if total duopoly profits rise again for lower values of τ, they will never reach the monopoly profits level in the absence of international trade.

Therefore, if the two MNEs are fully owned by third-country residents, the symmetric equilibrium tax rate is given by

$$t^*(\delta_i, \delta_j, 0, \tau) = \frac{2\delta_i \delta_j \left(5\tau^2 - 2\tau + 2\right)}{3(\delta_i + \delta_j)(1-2\tau)},$$

[14] Ludema and Wooton (2000) obtain a similar result in that economic integration, in terms of lower trade costs, may lead to higher equilibrium tax rates. Specifically, they use an economic geography model to study how tax competition may affect the location of manufacturing workers. Such a result is confirmed also by Baldwin and Krugman (2004), who show that, by introducing agglomeration externalities into a standard tax competition model, greater economic integration may determine a "race to the top" in tax rates.

[15] See Appendix A1.

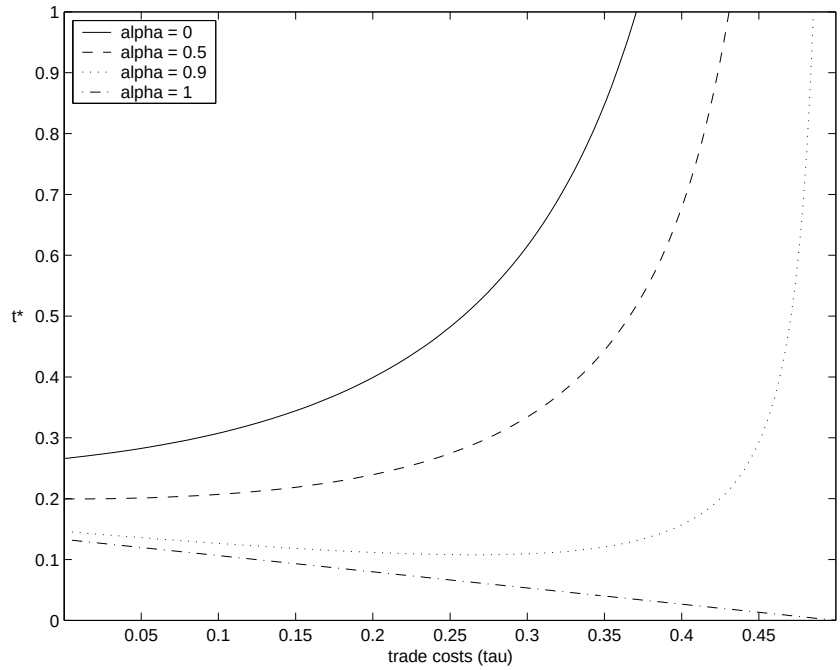

Figure 1: Effects of τ on t^* for $\delta_i = \delta_j$ and different values of α

and trade liberalization will *decrease* t^*, meaning that the direct effect on tax revenue is not positive enough to override the negative profit shifting effect.

To account for the relationship between t^* and τ for values of $\alpha \in (0, 1)$, we differentiate (20) with respect to τ and get the following expression

$$\frac{\partial t^*}{\partial \tau} = \frac{4\delta_i\delta_j \left[1 + 5\tau - 5\tau^2 - \alpha\left(1+\tau\right)\left(2-\tau\right)\right]}{3\left(\delta_i + \delta_j\right)\left(1-2\tau\right)^2},$$

whose sign only depends on the term in square brackets. In particular, for $\alpha \in \left(0, \frac{1}{2}\right]$, the symmetric equilibrium tax rate monotonically decreases as a result of trade liberalization, meaning that the negative transfer pricing effect is stronger than the direct effect. On the contrary, for $\alpha \in \left(\frac{1}{2}, 1\right)$, we find a non-monotonic relationship between t^* and τ: for high values of trade costs, trade liberalization leads to a decrease in t^*; but when trade costs become low enough, the tax base expansion overrides the tax base loss, so that a further decrease in τ increases t^*.

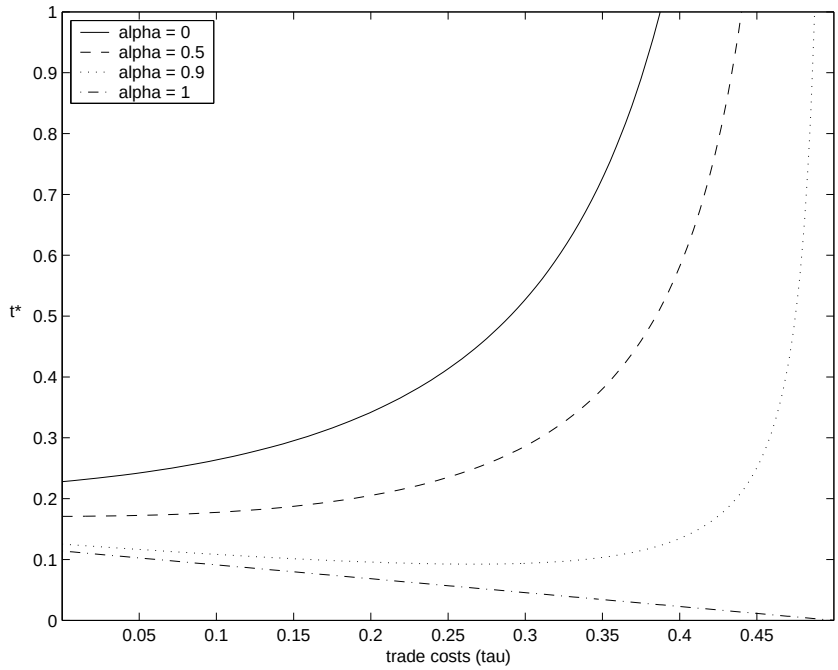

Figure 2: Effects of τ on t^* for $\delta_i \neq \delta_j$ and different values of α

In the following Proposition, we summarize our findings about the effects of trade liberalization on the symmetric equilibrium tax rate.

Proposition 4 *The effects of trade liberalization on the symmetric equilibrium tax rate depend on the ownership structure of the two MNEs.*
(i) If both MNEs are fully owned by domestic residents ($\alpha = 1$), a decrease in trade costs increases t^*.
(i) If both MNEs are fully owned by third-country residents ($\alpha = 0$), a decrease in trade costs decreases t^*.
(iii) If the ownership structure of both MNEs is such that $\alpha \in \left(0, \frac{1}{2}\right]$, that is third-country residents hold the majority of shares, a decrease in trade costs decreases t^*.
(iv) If the ownership structure of both MNEs is such that $\alpha \in \left(\frac{1}{2}, 1\right)$, that is domestic residents hold the majority of shares, a decrease in trade costs increases t^* when trade costs are sufficiently low, i.e. for $\tau \in [0, \hat{\tau}]$. Otherwise, i.e. for $\tau \in \left(\hat{\tau}, \frac{1}{2}\right)$, a decrease in trade costs decreases t^*.

Proof See Appendix A1. □

Figures 1 and 2 illustrate the relationship between trade costs and the symmetric equilibrium tax rate for different values of α in the case where the two countries choose the same level of enforcement ($\delta_i = \delta_j = 0.4$) and in the case of asymmetric enforcement policies ($\delta_i = 0.4,\ \delta_j = 0.3$), respectively. First of all, note that a higher level of enforcement by one of the two countries increases t^* for any value of α: in fact, all the values of t^* in Figure 1 ($\delta_j = 0.4$) are higher

than the corresponding values in Figure 2 ($\delta_j = 0.3$). Moreover, the level of t^* increases with the share of the two MNEs which is owned by residents of a third country. It is also evident that the effects of trade liberalization on t^* depend on the ownership structure of the MNEs. The upward-sloping curves for $\alpha = 0$ and $\alpha = 0.5$ show that t^* decreases with τ when foreigners hold the majority or the whole of shares in the two MNEs, while the downward-sloping curve for $\alpha = 1$ depicts the negative relationship between the two variables when the two MNEs are entirely owned by domestic residents. To conclude, notice the non-monotonic relationship between t^* and τ when $\alpha = 0.9$. In the neighborhood of $\tau = 1/2$, if a small share of both MNEs is owned by residents of a third country, any positive tax rate represents a pure tax on foreigners and t^* should be set as high as possible. Indeed, the benefit of a high tax rate dominates the loss of tax base, since profit shifting is negligible. Anyway, as τ decreases, the tax base becomes more sensitive to tax changes as the scope for transfer pricing increases, so that it is optimal to decrease t^*. Finally, when τ becomes sufficiently low, t^* slightly increases again because the tax base expansion turns out to be more important for the government than the tax base loss due to transfer pricing.

5 Enforcement policy competition

At the first stage, each government sets its level of enforcement of the "arm's length" principle in order to maximize national welfare, taking the enforcement policy of the other country as given. Substituting for the symmetric equilibrium values of transfer price, home sales, exports, before-tax profits and corporate profit tax rate, which we have obtained in the previous two stages, the government's objective function (5) can be rewritten as

$$W_i^* = CS_i^* + \underbrace{\alpha\left(\pi_{ii}^* + \pi_{ij}^*\right)}_{(I)} - \underbrace{\alpha t^* \pi_{ij}^*}_{(II)} + \underbrace{t^* \pi_{ji}^* + (1-\alpha)\, t^* \pi_{ii}^*}_{(III)} - \underbrace{\left(\alpha \delta_i q_i^{*2} x_{ij}^* + \frac{d}{2}\delta_i^2\right)}_{(IV)},$$

which, using equations (13), (14) and (20), reduces to

$$W_i^* = \frac{1}{18}(2-\tau)^2 + \frac{\left(5\tau^2 - 2\tau + 2\right)\left[\alpha + (1-\alpha)\, t^*\right]}{9} - \frac{d}{2}\delta_i^2,$$

so that the first-order condition for the government's maximization problem is given by

$$\frac{\partial W_i^*}{\partial \delta_i} = \underbrace{\frac{(1-\alpha)\left(5\tau^2 - 2\tau + 2\right)}{9}\frac{\partial t^*}{\partial \delta_i}}_{Indirect} - \underbrace{d\delta_i}_{Implementation} = 0.$$

When choosing the level of its transfer pricing enforcement policy, country i must balance the positive impact on national welfare of increasing δ_i, which is captured by the *indirect* effect through the level of the symmetric equilibrium tax rate ($\partial t^*/\partial \delta_i > 0$), against a negative and direct effect, which is reflected by the marginal cost of implementing δ_i itself (*Implementation*).

Note that the negative effect does not vary with trade costs τ nor the ownership structure parameter α. Instead, the positive effect of increasing δ_i turns out to be increasing in trade costs τ, in the case of full third-country ownership ($\alpha = 0$), and decreasing in domestic ownership α,

$\forall \tau \in \left[0, \frac{1}{2}\right)$.[16] Hence, if the share of domestic ownership in the MNEs decreases, the benefits in terms of national welfare to enforce the "arm's length" principle increase.

By solving the first-order conditions simultaneously for the two countries, we show that there exists a symmetric equilibrium in transfer pricing enforcement policies, $\delta^* \equiv \delta_i = \delta_j$, which can be characterized as follows

Proposition 5 *There exists a symmetric equilibrium level of enforcement of the "arm's length" principle*

$$\delta^*(\alpha, \tau) = \frac{(1-\alpha)\left(5\tau^2 - 2\tau + 2\right)\left[5\tau^2 - 2\tau + 2 - \alpha(1+\tau)^2\right]}{54d(1-2\tau)},$$

which depends on the ownership structure of the MNEs (α) and on trade costs (τ), and turns out to be nonnegative for all possible values of α and τ.

Proof See Appendix A2. □

We can immediately observe that $\delta^*(1, \tau) = 0$, while $\delta^*(\alpha, \tau) > 0, \ \forall \alpha \in [0, 1)$, so that we can state

Proposition 6 *If the two MNEs are fully owned by domestic residents ($\alpha = 1$), the two countries will find it optimal not to enforce the "arm's length" principle. Otherwise, both countries will optimally choose a positive level of enforcement.*

The intuition for this result is simple. In the case of full domestic ownership of the MNEs, each country would incur the maximal costs in terms of national welfare to enforce the "arm's length" principle. Indeed, any positive level of enforcement would just have a negative impact on welfare due to its marginal implementation cost. On the contrary, when a minimal share of the MNEs is owned by foreigners, the enforcement policy has a positive impact on national welfare, since it allows both countries to increase their corporate profit tax rates and partly shift the burden of taxation onto foreigners.

In particular, when the two MNEs are fully owned by residents of a third country ($\alpha = 0$), the equilibrium level of enforcement by the two countries is

$$\delta^*(0, \tau) = \frac{\left(5\tau^2 - 2\tau + 2\right)^2}{54d(1-2\tau)} > 0,$$

and we find that $\delta^*(0, \tau)$ *decreases* with trade liberalization, since a decrease in trade costs reduces the positive impact on national welfare of increasing the level of enforcement.

To see how the ownership structure parameter affects the equilibrium enforcement policy, we derive the following expression

$$\frac{\partial \delta^*}{\partial \alpha} = -\frac{\left(5\tau^2 - 2\tau + 2\right)\left[5\tau^2 - 2\tau + 2 + \left(1+\tau^2\right)(1-2\alpha)\right]}{54d(1-2\tau)},$$

which turns out to be negative for all admissible values of α and τ. The positive effect on national welfare of increasing δ_i is decreasing in α, while its marginal implementation cost is

[16] See Appendix A2.

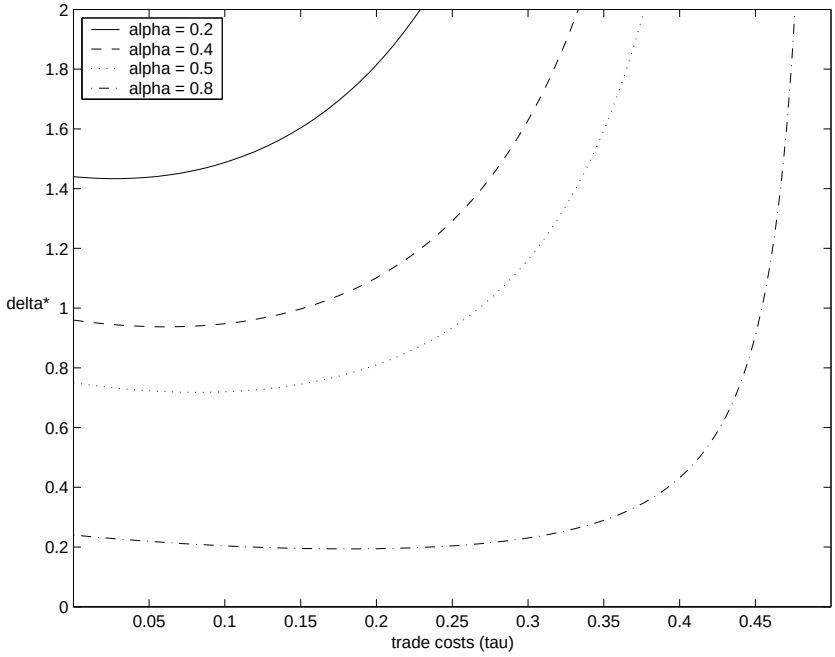

Figure 3: Effects of τ on δ^* for different values of α

independent of such a parameter. Hence, an increased economic integration in terms of a larger international ownership of the two MNEs *increases* the equilibrium level of enforcement. This indirectly confirms our previous result that, with full domestic ownership ($\alpha = 1$), the two countries optimally decide not to enforce the "arm's length" principle.

Figure 3 illustrates the relationship between trade costs and the equilibrium enforcement policy for values of $\alpha \in (0,1)$ and $d = 1/27$. Trade liberalization initially leads to a decrease in δ^*, but when trade costs become sufficiently low, a further decrease in τ will increase δ^*. Such a non-monotonic relationship between δ^* and τ is similar to the impact of trade liberalization on t^* when domestic residents hold the majority of shares in the two MNEs, i.e. $\alpha \in \left(\frac{1}{2}, 1\right)$. When trade becomes free enough and depending on the ownership structure of the MNEs, the two countries optimally decide to increase the level of enforcement of the "arm's length" principle. Namely, we find a threshold value, $\hat{\alpha}(\tau)$, for the ownership structure parameter, α, which depends on trade costs and above which trade liberalization increases δ^*.

To conclude, our findings about the effects of increased economic integration on the equilibrium level of enforcement, δ^*, can be summarized as

Proposition 7 *An increase in the share of international ownership of the two MNEs, i.e. a lower α, increases δ^*, for any level of trade costs. On the contrary, the effects of trade liberalization on δ^* depend on the ownership structure of the two MNEs.*
(i) If both MNEs are fully owned by third-country residents ($\alpha = 0$), a decrease in trade costs decreases δ^*.
(ii) If the ownership structure of both MNEs is such that $\alpha \in (0,1)$, that is the two MNEs are

not fully owned by third-country nor domestic residents, there exists a threshold value, $\hat{\alpha}(\tau)$, for α, above which trade liberalization increases δ^*. Instead, for $\alpha < \hat{\alpha}(\tau)$, trade liberalization decreases δ^*.

Proof See Appendix A2. □

6 Concluding remarks

In this paper we have examined and discussed the outcome of a three-stage game where the governments of two symmetric countries set corporate profit tax rates and choose the level of enforcement of the "arm's length" principle to maximize national welfare, taking into account the strategic choices of two MNEs competing on the quantities in the two markets. Our purposes have been to study how enforcement policies affect the tax competition game and to understand in what direction economic integration, described as a reduction in trade costs and/or a larger international ownership of MNEs, influences the symmetric equilibrium levels of the two policy instruments.

In line with Kind et al. (2002), we find that increased international ownership of MNEs unambiguously leads to *higher* corporate profit tax rates. Huizinga and Nicodeme (2003) offer empirical support for such a theoretical result by suggesting that corporate tax burdens in Europe are positively related to foreign ownership shares at the country level. According to their estimates, an increase in foreign ownership by 1 percent would lead to an increase in the average corporate tax rate by between 0.5 and 1 percent. We further show that the effects of trade liberalization depend on the ownership structure of the MNEs.

- If the two MNEs are fully owned by residents of a third country, a decrease in trade costs *decreases* equilibrium tax rates.
- If the two MNEs are fully owned by domestic residents, a decrease in trade costs *increases* equilibrium tax rates.
- If the two MNEs are partly owned by foreigners and partly by domestic residents, with the latter holding the majority of shares, trade liberalization *increases* equilibrium tax rates when trade costs become sufficiently low.

Therefore, increased economic integration may lead either to a "race to the bottom" or to a "race to the top" in corporate profit tax rates between the two countries. While the former represents a good analogy with the standard results in the tax competition literature, the latter contrasts with the conventional conclusion that, due to tighter economic integration, tax competition between countries should imply a downward pressure on tax rates.[17]

Our model also predicts that, as governments increase the level of enforcement of the "arm's length" principle to control the transfer pricing behavior of MNEs and to avoid cross-country profit shifting, equilibrium tax rates *increase* as well. Moreover, we show that, when the two

[17] See, e.g., Wilson (1999) for a survey of the tax competition literature.

MNEs are not fully owned by domestic residents, increased economic integration may determine a "race to the top" in transfer pricing enforcement policies between the two countries. While an increase in the international ownership share of the MNEs monotonically *increases* the equilibrium level of enforcement, trade liberalization initially has an opposite effect on this policy. But as trade free becomes free enough, and depending on the ownership structure of the MNEs, a further decrease in trade costs will *increase* the equilibrium enforcement policy. Instead, when the two MNEs are fully owned by domestic residents, it is optimal for both countries not to enforce the "arm's length" principle. In such a case, indeed, any positive level of enforcement will uniquely have a negative impact on national welfare because of the marginal cost of implementing it.

To sum up, our results may be interpreted in the light of two different views of the economic integration process. On the one hand, if we look at increased economic integration just as a matter of internationalization of the ownership structure of MNEs, we prove that, for any given level of trade costs, both equilibrium tax rates and enforcement policies will increase. Each country's government, by allocating more resources to control transfer pricing, is able to increase its corporate profit tax rate. Moreover, as the share of foreign ownership in the domestic MNE gets larger, increasing its tax rate allows each country to shift more of the tax burden onto foreigners. Hence, such an internationalization phenomenon will lead to a "race to the top" in both policy instruments between countries.

On the other hand, if we consider economic integration only in terms of trade liberalization, we show that, starting from a high level of trade costs and as long as the two MNEs are not fully owned by domestic residents, a "race to the bottom" in tax rates and enforcement policies will take place between the two countries. Then, when trade becomes free enough, and depending on the ownership structure of the MNEs, a further decrease in trade costs may increase the level of both policy instruments again, since the tax base expansion may be more important for each country's government than the tax base loss due to transfer pricing.

7 Appendix

A1: Tax competition

Proof of Proposition 1

To show that the symmetric equilibrium tax rate $t^*(\delta_i, \delta_j, \alpha, \tau)$ is positive for all possible values of $\alpha \in [0,1]$ and $\tau \in \left[0, \frac{1}{2}\right)$ as long as $\delta_i, \delta_j > 0$, we need to check the sign of the following expression

$$f(\alpha, \tau) \equiv 5\tau^2 - 2\tau + 2 - \alpha(1+\tau)^2,$$

which is strictly decreasing in α, since $\partial f(\alpha, \tau)/\partial\alpha = -(1+\tau)^2 < 0, \forall\tau$. Then, we can restrict our attention to the maximum value which α can take, i.e. $\alpha = 1$, which gives

$$f(1, \tau) = (2\tau - 1)^2 > 0, \quad \forall\tau \in \left[0, \frac{1}{2}\right).$$

Therefore, since $f(1,\tau) > 0,\ \forall\tau$, and $f(\alpha,\tau)$ is strictly decreasing in α, we can conclude that $f(\alpha,\tau) > 0$ for all $\alpha \in [0,1]$, implying that $t^*(\delta_i,\delta_j,\alpha,\tau)$ is positive for all possible values of α and τ.

Proof of Proposition 2

The effects on t^* of a change in the level of enforcement of the "arm's length" principle by country i and country j are reflected by

$$\frac{\partial t^*}{\partial \delta_i} = \frac{2\delta_j^2\left[5\tau^2 - 2\tau + 2 - \alpha(1+\tau)^2\right]}{3(1-2\tau)(\delta_i+\delta_j)^2} > 0, \text{ as long as } \delta_j > 0,$$

and

$$\frac{\partial t^*}{\partial \delta_j} = \frac{2\delta_i^2\left[5\tau^2 - 2\tau + 2 - \alpha(1+\tau)^2\right]}{3(1-2\tau)(\delta_i+\delta_j)^2} > 0, \text{ as long as } \delta_i > 0,$$

which allow us to conclude that an increase in the enforcement policy by one of the two countries (or by both of them) will increase t^*.

Proof of Proposition 3

The effect on t^* of a change in the ownership structure of the MNEs is given by

$$\frac{\partial t^*}{\partial \alpha} = -\frac{2\delta_i\delta_j(1+\tau)^2}{3(1-2\tau)(\delta_i+\delta_j)} < 0, \text{ as long as } \delta_i,\delta_j > 0,$$

so that we can argue that a lower α will increase t^*.

Trade liberalization: *Direct* vs *TP* effect

In the case of full domestic ownership ($\alpha = 1$), the direct and the TP effects are given by

$$f(\tau) = \frac{(1-2\tau)^2}{9}$$

and

$$g(\tau) = -\frac{t^*(\delta_i+\delta_j)(1-2\tau)}{6\delta_i\delta_j},$$

respectively. Differentiating $f(\tau)$ with respect to τ, we find that

$$f'(\tau) > 0 \Leftrightarrow \tau > \frac{1}{2}.$$

Hence, $f'(\tau) < 0,\ \forall\tau \in \left[0,\frac{1}{2}\right)$, meaning that the impact of trade liberalization on the direct effect is positive. On the contrary, differentiating $g(\tau)$ with respect to τ, we find that $g'(\tau) < 0,\ \forall\tau \in \left[0,\frac{1}{2}\right)$, and this implies that the impact of trade liberalization on the TP effect is negative.

In the case of full third-country ownership ($\alpha = 0$), the TP effect and the impact on it of a decrease in trade costs are the same as above, while the direct effect is equal to

$$h(\tau) = \frac{(1-2\tau)^2}{9} + \frac{(1+\tau)^2}{9}.$$

Differentiating $h(\tau)$ with respect to τ, we find that

$$h^{'}(\tau) > 0 \Leftrightarrow \tau > \frac{1}{5}.$$

Furthermore, since $h^{''}(\tau) > 0$, we have that $h(\tau)$ is a strictly convex function which reaches its minimum value at $\tau = \frac{1}{5}$. Thus, trade liberalization has a non-monotonic impact on the direct effect. For $\tau \in \left[0, \frac{1}{5}\right)$, $h^{'}(\tau) < 0$, meaning that such an impact is positive just for sufficiently low values of trade costs. Instead, $h^{'}(\tau) > 0$ for $\tau \in \left(\frac{1}{5}, \frac{1}{2}\right)$, implying that for higher values of trade costs trade liberalization has a negative impact on the direct effect as well.

Proof of Proposition 4

(i) In the case of full domestic ownership ($\alpha = 1$), the effect of a change in trade costs on the symmetric equilibrium tax rate is captured by

$$\frac{\partial t^{*}(\delta_i, \delta_j, 1, \tau)}{\partial \tau} = -\frac{4\delta_i \delta_j}{3(\delta_i + \delta_j)} < 0,$$

which allows us to conclude that a decrease in τ increases t^{*}.

(ii) In the case of full third-country ownership ($\alpha = 0$), the effect of a change in trade costs on the symmetric equilibrium tax rate is given by

$$\frac{\partial t^{*}(\delta_i, \delta_j, 0, \tau)}{\partial \tau} = \frac{4\delta_i \delta_j \left(1 + 5\tau - 5\tau^2\right)}{3(\delta_i + \delta_j)(1 - 2\tau)^2} > 0,$$

implying that a decrease in τ decreases t^{*}.

(iii) and (iv) The sign of $\partial t^{*}/\partial \tau$ for values of $\alpha \in (0, 1)$ only depends on the sign of the following expression

$$g(\alpha, \tau) \equiv 1 + 5\tau - 5\tau^2 - \alpha(1 + \tau)(2 - \tau).$$

In particular, $g(\alpha, \tau) > 0$ for all values of τ satisfying

$$(5 - \alpha)\tau^2 - (5 - \alpha)\tau + 2\alpha - 1 < 0,$$

that is for all $\tau \in (\hat{\tau}, \tilde{\tau})$, where

$$\hat{\tau} = \frac{1}{2} - \frac{3\sqrt{(5 - \alpha)(1 - \alpha)}}{2(5 - \alpha)}$$

and

$$\tilde{\tau} = \frac{1}{2} + \frac{3\sqrt{(5 - \alpha)(1 - \alpha)}}{2(5 - \alpha)}.$$

Since $\alpha \in [0, 1]$, we can easily check that $\tilde{\tau} \geq \frac{1}{2}$. Moreover, $\hat{\tau} > 0$ as long as $\alpha > \frac{1}{2}$. Therefore, given our assumption about trade costs, we can conclude that

- for $\alpha \leq \frac{1}{2}$, $\hat{\tau} \leq 0$ and $\tilde{\tau} \geq \frac{1}{2}$, implying that $g(\alpha, \tau) > 0$ for all $\tau \in \left[0, \frac{1}{2}\right)$; this means that $\partial t^{*}/\partial \tau > 0$, i.e. trade liberalization leads to a decrease in the symmetric equilibrium tax rate;

- for $\alpha > \frac{1}{2}$, $\hat{\tau} > 0$ and $\tilde{\tau} \geq \frac{1}{2}$; this implies that $g(\alpha, \tau)$ and $\partial t^*/\partial \tau$ are positive for $\tau \in \left(\hat{\tau}, \frac{1}{2}\right)$, but they are negative for $\tau \in [0, \hat{\tau}]$; thus, if domestic residents hold the majority of shares in the MNEs, the relationship between τ and t^* is non-monotonic and trade liberalization increases the symmetric equilibrium tax rate for sufficiently low values of τ.

A2: Enforcement policy competition

Economic integration and the *Indirect* effect

The indirect effect on country i's national welfare of a change in the level of enforcement of the "arm's length" principle is given by

$$k(\alpha, \tau) = \frac{2\delta_j^2 (1-\alpha)\left(5\tau^2 - 2\tau + 2\right)\left[5\tau^2 - 2\tau + 2 - \alpha(1+\tau)^2\right]}{27(1-2\tau)(\delta_i + \delta_j)^2}.$$

To see how the ownership structure of the MNEs affects such an indirect effect, we derive the following expression

$$\frac{\partial k(\alpha, \tau)}{\partial \alpha} = -\frac{2\delta_j^2\left(5\tau^2 - 2\tau + 2\right)\left[5\tau^2 - 2\tau + 2 + (1-2\alpha)(1+\tau)^2\right]}{27(1-2\tau)(\delta_i + \delta_j)^2} < 0,$$

as long as $\delta_j > 0$. Hence, a decrease in the domestic ownership share of the MNEs increases the positive indirect effect, and thus the benefit in terms of national welfare to enforce the "arm's length" principle.

With full third-country ownership ($\alpha = 0$), the indirect effect reduces to

$$k(0, \tau) = \frac{2\delta_j^2\left(5\tau^2 - 2\tau + 2\right)^2}{27(1-2\tau)(\delta_i + \delta_j)^2},$$

and the impact on it of trade liberalization is captured by

$$\frac{\partial k(0, \tau)}{\partial \tau} = \frac{4\delta_j^2 \tau(4 - 5\tau)\left(5\tau^2 - 2\tau + 2\right)}{9(1-2\tau)^2(\delta_i + \delta_j)^2} > 0, \ \forall \tau \in \left[0, \frac{1}{2}\right).$$

Therefore, when the two MNEs are fully owned by third-country residents, a decrease in trade costs decreases the positive indirect effect on national welfare of the transfer pricing enforcement policy.

Existence of the symmetric equilibrium in enforcement policies

We first need to show that the objective function of country i (country j) identified in Section 5 is concave in δ_i (δ_j). This amounts to check the sign of the following second derivatives

$$\begin{aligned}
\frac{\partial^2 W_i^*}{\partial \delta_i^2} &= -\frac{4(1-\alpha)\left(5\tau^2 - 2\tau + 2\right)\left[5\tau^2 - 2\tau + 2 - \alpha(1+\tau)^2\right]\delta_j^2}{27(1-2\tau)(\delta_i + \delta_j)^3} - d, \\
\frac{\partial^2 W_j^*}{\partial \delta_j^2} &= -\frac{4(1-\alpha)\left(5\tau^2 - 2\tau + 2\right)\left[5\tau^2 - 2\tau + 2 - \alpha(1+\tau)^2\right]\delta_i^2}{27(1-2\tau)(\delta_i + \delta_j)^3} - d.
\end{aligned}$$

Since $d > 0$ by assumption and we have shown above that the term in square brackets, i.e. $f(\alpha, \tau)$, is always positive, both derivatives turn out to be negative for all possible values of $\delta_i,\ \delta_j,\ \alpha$ and τ. Hence, the objective function of country i (resp., country j) is concave in its own argument.

The first-order conditions for the maximization problem of the two governments are

$$\begin{cases} \frac{(1-\alpha)\left(5\tau^2-2\tau+2\right)}{9}\frac{\partial t^*}{\partial \delta_i} - d\delta_i = 0 \\ \\ \frac{(1-\alpha)\left(5\tau^2-2\tau+2\right)}{9}\frac{\partial t^*}{\partial \delta_j} - d\delta_j = 0 \end{cases}$$

Substituting for $\partial t^*/\partial \delta_i$ and $\partial t^*/\partial \delta_j$ and rearranging, we get the following system

$$\begin{cases} \frac{2(1-\alpha)\left(5\tau^2-2\tau+2\right)\left[5\tau^2-2\tau+2-\alpha(1+\tau)^2\right]}{27d(1-2\tau)(\delta_i+\delta_j)^2} = \frac{\delta_i}{\delta_j^2} \\ \\ \frac{2(1-\alpha)\left(5\tau^2-2\tau+2\right)\left[5\tau^2-2\tau+2-\alpha(1+\tau)^2\right]}{27d(1-2\tau)(\delta_i+\delta_j)^2} = \frac{\delta_j}{\delta_i^2} \end{cases}$$

which implies

$$\frac{\delta_i}{\delta_j^2} = \frac{\delta_j}{\delta_i^2},$$

so that

$$\delta_i^3 = \delta_j^3 \Longleftrightarrow \delta_i = \delta_j,$$

i.e. there exists a symmetric equilibrium $\delta^* \equiv \delta_i = \delta_j$ in transfer pricing enforcement policies.

Proof of Proposition 7

To prove the negative relationship between the ownership structure parameter α and the equilibrium level of enforcement of the "arm's length" principle, we need to show that the function

$$h(\alpha, \tau) \equiv 5\tau^2 - 2\tau + 2 + (1+\tau^2)(1-2\alpha)$$

is positive for all admissible values of α and τ. Since $\partial h(\alpha, \tau)/\partial \alpha = -2\tau^2 - 2 < 0, \forall \tau$, we have that $h(\alpha, \tau)$ is strictly decreasing in α. Then, we restrict our attention to the maximum value which α can take, i.e. $\alpha = 1$, which gives

$$h(1, \tau) = 4\tau^2 - 2\tau + 1 > 0, \quad \forall \tau \in \left[0, \frac{1}{2}\right).$$

Therefore, since $h(1, \tau) > 0,\ \forall \tau$, and $h(\alpha, \tau)$ is strictly decreasing in α, we can conclude that $h(\alpha, \tau) > 0$ for all $\alpha \in [0, 1]$, implying that $\partial \delta^*/\partial \alpha < 0$ for all possible values of α and τ.

With full third-country ownership ($\alpha = 0$), the effect on the equilibrium enforcement policy of a change in trade costs is captured by

$$\frac{\partial \delta^*(0, \tau)}{\partial \tau} = \frac{\tau(4 - 5\tau)\left(5\tau^2 - 2\tau + 2\right)}{9d(1-2\tau)^2} > 0,\ \forall \tau \in \left[0, \frac{1}{2}\right),$$

meaning that trade liberalization decreases $\delta^*(0, \tau)$.

To analyze the relationship between trade liberalization and the equilibrium level of enforcement for values of $\alpha \in (0,1)$, we need to check the sign of

$$\begin{aligned}\frac{\partial \delta^{*}(\alpha,\tau)}{\partial \tau} &= \frac{1-\alpha}{27d(1-2\tau)^{2}}\{(1-2\tau)(5\tau-1)\left[5\tau^{2}-2\tau+2-\alpha(1+\tau)^{2}\right] \\ &+ (1-2\tau)\left(5\tau^{2}-2\tau+2\right)[5\tau-1-\alpha(1+\tau)] \\ &+ \left(5\tau^{2}-2\tau+2\right)\left[5\tau^{2}-2\tau+2-\alpha(1+\tau)^{2}\right]\}.\end{aligned}$$

Since $(1-\alpha)/27d(1-2\tau)^{2} > 0$ for all values of $\alpha \in (0,1)$ and $\tau \in \left[0,\frac{1}{2}\right)$, we have that $\partial\delta^{*}(\alpha,\tau)/\partial\tau > 0$ as long as the term in braces turns out to be positive. Hence, we simply need to show that

$$\begin{aligned}l(\alpha,\tau) &\equiv \left[5\tau^{2}-2\tau+2-\alpha(1+\tau)^{2}\right]\left[(1-2\tau)(5\tau-1)+\left(5\tau^{2}-2\tau+2\right)\right] \\ &+ (1-2\tau)\left(5\tau^{2}-2\tau+2\right)[5\tau-1-\alpha(1+\tau)] > 0.\end{aligned}$$

The last inequality holds for all values of α such that

$$\alpha < \frac{\tau\left(5\tau^{2}-2\tau+2\right)(4-5\tau)}{(1+\tau)(1+3\tau^{2}-5\tau^{3})} \equiv \hat{\alpha}(\tau),$$

where $\hat{\alpha}(\tau)$ represents the threshold value above which trade liberalization leads to an increase in the equilibrium enforcement policy. Furthermore, note that $\partial\hat{\alpha}(\tau)/\partial\tau > 0$, $\forall\tau \in \left[0,\frac{1}{2}\right)$, meaning that as τ decreases, the threshold value for α decreases as well.

In other words, when trade costs become sufficiently low, trade liberalization may increase the equilibrium level of enforcement of the "arm's length" principle, depending on the ownership structure of the MNEs as measured by α.

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