Trade and Multinationals: The Effect of Economic Integration on Taxation and Tax Revenue*

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Abstract

The rising importance of multinationals in the world economy has been accompanied by a rise in trade between affiliates of multinationals located in different countries, and by profits being shifted to low tax countries. The effect of trade barriers on taxation, intra firm trade and profit shifting has largely been ignored by both the trade literature and the public finance literature. This paper analyzes how competition over shifty profits affect tax policy as trade barriers are lowered. The main results are: (i) A reduction in trade barriers unambiguously leads to higher tax revenue for low or intermediate levels of trade costs, and (ii) that the effect on equilibrium tax rates depends on the proportion of the corporate tax bases that is foreign owned and how far economic integration has proceeded.

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1 Introduction

A country that cuts its tax rate on capital typically ignores the resulting fall in tax revenue in other countries. The negative fiscal externality arising from competition among countries to attract scarce capital is known to lead to too low taxes, a reduction in tax revenue, underprovision of public goods, and lower welfare.[1] Despite these predictions, tax revenues on corporate income as proportion of GDP have remained stable or even gone up for some countries since the early 1960s. A few countries have even increased their corporate tax rates, although statutory tax rates for large samples of countries in general show a declining trend.[2]

The purpose of this paper is to provide an explanation of why; (i) corporate tax revenue has not fallen, and (ii) corporate tax rates in some countries have even risen despite increased economic integration and the predictions from the theoretical part of the tax competition literature that taxes and tax revenue should fall. We argue that the modeling of tax competition has overlooked some important stylized facts about globalization which, if taken into account, give a richer picture of the outcome of tax competition.

First, almost the entire literature neglects the impact of reductions in all sorts of barriers to trade (henceforth referred to as economic integration). Studies show that these barriers are significant and thus likely to be of importance for the tax setting behavior among countries. For example, Venables and Markusen (1998) estimate trade costs to be 10-15 percent of firms' marginal costs. Norman (1998) concludes that the trade pattern of market shares in European markets can be made consistent with profit maximizing firms only if the sum of natural and artificial barriers to trade is equivalent to tariffs of 30-60 percent, depending on the product.

[1] See Wilson (1999) for a survey of the tax competition literature.

[2] For empirical facts related to capital mobility and taxation see e.g., Devereaux, Griffith and Klemm (2002).

Second, the literature on tax competition has largely neglected the fact that the rise in FDI means that national tax bases have become more mobile internationally. Indeed, an important aspect of the global economy is the strong growth of foreign direct investment (FDI) throughout the world with surges in annual growth rates of 25 and 32 percent in the late 80s and 90s. The rising importance of multinationals has been accompanied by a rise in trade between affiliates of multinationals located in different countries to the extent that about 33 percent of world trade was intra-firm trade already in 1993 (Markusen (2002, ch1)). This development has implications for the modelling of tax competition. If globalization means that the share of foreign firms in the domestic economy rises and these foreign firms engage in profit shifting, the tax sensitivity of the corporate tax base increases.[3] As pointed out by Markusen (2002; ch 1.), a substantial part of intra-firm trade is in goods where arm's length prices are not easily established. This suggests that the cost to the firm of concealing transfer pricing is fairly low. The problem posed by profit shifting for the fiscal autonomy of countries therefore depends on the volume of trade, the level of trade costs, and the ease with which multinationals can shift profits.

The background provided above suggests that there is a need for a tax competition model that embeds trade, trade costs, and transfer pricing, in order to understand how economic integration affects tax revenue and tax rates. The purpose of this paper is to fill this gap.

The literature on tax competition in the presence of multinationals that is of relevance to this paper can be divided into two. The first set of papers studies *how transfer pricing affects tax policy*. Mansori and Weichenrieder (2001) and Raimondos-Møller and Scharf (2002) model transfer pricing regulations by two governments and investigate how transfer pricing affects equilibrium tax rates. Elitzur and Mintz (1996) discuss corporate tax competition under alternative transfer pricing rules when transfer pricing affects managerial incentives as well as the overall tax payment. Haufler and Schjelderup (2000) investigate the optimal taxation of corporate profits when governments can choose both the tax rate and the base of the corporate tax, and multinationals shift profits by transfer pricing.

[3]The empirical evidence on the importance of income shifting and transfer pricing related to multinationals is well documented (see e.g. Weichenrieder (1996) and Hines (1999)).

Finally, Smart and Mintz (2001) study corporate income taxation when firms operating in multiple jurisdictions can shift income by using financial planning strategies. Most of these papers embed trade explicitly, but none of them incorporates the effect of trade costs on the outcome of their analysis. The second set of papers *ignores both transfer pricing and trade costs, but examines how the structure of ownership* affects tax policy in the presence of multinationals. A benchmark result in this literature is that increased foreign ownership of the tax base leads to higher equilibrium taxes.[4]

The purpose of this paper is to bridge the gap between the two strands of literature by developing a model of tax competition in the presence of multinationals and profit shifting, where the corporate tax base is partly foreign owned and the tax base endogenously determined by the tax rates set by each government. *Moreover, we aim to answer the one major question that has so far been left unresolved*: How does economic integration affect tax revenue and taxes?[5] To answer this question we use a two-country model with trade costs, where each country is host to a multinational firm (henceforth MNC) producing a single consumer good. The two MNCs serve their home markets, but also export goods to their foreign affiliates unless trade costs are too high. Each government sets taxes so as to maximize national welfare, taking into consideration the strategic choices of the multinationals and their ability to shift profits. We demonstrate that for low and intermediate levels of trade costs, economic integration increases the corporate tax revenue, but has an ambiguous effect on tax rates depending on the ownership structure of the corporate tax base. Economic integration reduces the corporate tax rate if MNCs are owned by residents of a foreign country, while it increases equilibrium taxes if MNCs are owned by home country residents.[6]

The paper is organized as follows. Section 2 presents the modelling framework and explores the impact of economic integration on equilibrium tax rates and tax revenues,

[4]See Huizinga and Nielsen (1997) and Olsen and Osmundsen (2001) in a setting of asymmetric information.

[5]In this paper we will take the location of the multinational as given. A complementary question is how economic integration may affect the localization pattern of multinational corporations. See e.g., Neary (2002) for an analysis.

[6]*Home country* refers to the country where the MNC's parent company is located.

while section 3 concludes.

2 The model

We employ a model that has two identical countries, A and B, and two identical multinational companies.[7] Multinational company MNC_i has headquarters with production facilities in country i and an affiliate in country j $(i \neq j)$. Domestic and foreign profits before tax for MNC_i are equal to π_{ii} and π_{ij}, respectively, where the first subscript indicates where the headquarters are located and the second where profits are derived. Aggregate profit before tax for MNC_i is $\pi_i = \pi_{ii} + \pi_{ij}$ $(i, j = A, B,\ i \neq j)$.

The MNCs produce homogenous goods, and face the inverse demand curve

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

where p_i is the price in country i, and x_{ii} and x_{ji} denote quantities supplied by the domestic and foreign MNC, respectively. The production process is split into production of intermediates and final goods. The former incurs a marginal cost c, while the latter incurs a marginal cost d. We shall assume that all intermediates are produced at the headquarters, while final production takes place locally. This implies that part of the production of intermediates in country i is further processed in country i and the rest is exported to the affiliate in country j for final processing there.

The affiliate of each MNC is charged a transfer price g_i for intermediates that it buys from its parent. The transfer price is potentially an instrument the MNCs can use to shift profit from one country to the other in order to save taxes. In line with most of the literature on transfer pricing we make the realistic assumption that it is costly to conceal deviations in the transfer price from the true cost of production. More

[7] In some industries the long-run localization pattern of multinational companies may partly be determined by tax incentives (e.g. for export-oriented MNCs) and partly by access to specific factors of production. Our focus, however, is on MNCs where the foreign subsidiaries are primarily set up to serve local markets, and we therefore treat the number of MNCs and affiliates in each country as exogenous.

specifically, we assume that the concealment cost function is strictly convex, and equal to $C_i = \delta(g_i - c)^2 x_{ij}$, where $\delta > 0$, so that it is equally expensive to manipulate the transfer price above or below marginal costs. This assumption can be interpreted as costs that need to be incurred in order to conceal the true price of the product, for example by hiring of lawyers or accountants (see, e.g., Haufler and Schjelderup, 2000).[8].

In addition to the transfer price, the foreign affiliate pays a trade cost $\tau \geq 0$ for each unit it receives from its headquarters. We emphasize that trade costs in our setting should be interpreted as a synthetic measure of a wide range of barriers to trade including transport costs, costs of frontier formalities, and differing product standards. We do not consider income generating tariffs, as these are typically of limited importance in the trade between industrialized countries.

Profit before taxes by the parent firm located in country i is $\pi_{ii} = (p_i - c - d)\, x_{ii} + (g_i - c)\, x_{ij} - \delta\, (g_i - c)^2\, x_{ij}$, while the profit level of the foreign plant equals $\pi_{ij} = (p_j - \tau - d - g_i)x_{ij}$. In order to leave the notation as simple as possible in the continuation, but without loss of generality for the analysis to come[9], we normalize marginal costs so that $c = d = 0$. Hence, we rewrite profits as

$$\pi_{ii} = p_i x_{ii} + g_i x_{ij} - \delta g_i^2 x_{ij} \quad \text{and} \quad \pi_{ij} = (p_j - \tau - g_i)x_{ij} \tag{2}$$

Total profits for MNC_i before taxes are $\pi_i = p_i x_{ii} - \delta g_i^2 x_{ij} + (p_j - \tau)x_{ij}$, which makes it clear that in the absence of a profit shifting motive, the optimal transfer price is equal to marginal production costs (i.e., $g_i = 0$).

We assume that the countries use separate accounting as foundation for their corporate tax system, i.e. each country imposes a tax on the profits generated within its borders. The aim of this tax code is to identify the precise receipts and expenditures attributable to the corporation's activities in each jurisdiction. Although repatriated profits in principle are taxed in the country of residence, there is general agreement that due to deferral

[8]Alternatively, the costs may represent an increased probability of detection by the tax authorities as modeled by Kant (1988)

[9]A proof of this is obtainable from the authors upon request.

possibilities and limited tax credit rules, the source principle of taxation is effectively in operation in most OECD countries (Keen, 1993, and Tanzi and Bovenberg, 1990). Taking this into account, global after tax profits of a multinational firm with headquarters in country i are

$$\Pi_i = (1 - t_i)\pi_{ii} + (1 - t_j)\pi_{ij}. \tag{3}$$

We consider a game with two stages. In the first stage the two countries simultaneously set their tax rates, t_A and t_B, as to maximize national welfare. In the second stage the headquarters set the transfer prices to their foreign affiliates, and compete á-lá Cournot in the two segmented end-user markets.

Stage 2: In the second stage, the multinational firm with its parent company in country i maximizes (3) with respect to x_{ii}, x_{ij} and g_i, taking the quantities supplied by the other multinational firm (i.e., MNC_j) and the tax rates as given. Using equations (1) and (2) in (3), and differentiating with respect to g_i yields

$$g_i = \frac{t_j - t_i}{2\delta(1 - t_i)}, \tag{4}$$

which shows that MNC_i wants to underinvoice its exports ($g_i < 0$) if $t_i > t_j$, and thus shift profits to the low tax country j. Similarly, an incentive to overinvoice ($g_i > 0$) arises when $t_i < t_j$ and profits are shifted to country i. If it is prohibitively costly to manipulate the transfer price ($\delta \to \infty$), or if $t_i = t_j$ - in which case no profit shifting motive exists - it follows from (4) that the transfer price is set equal to marginal cost (i.e., $g_i = 0$).

Differentiating (3) with respect to x_{ii} and x_{ij} we obtain the first order conditions for x_{ii} and x_{ij}. Solving this simultaneously for the two MNCs and using (4), we have:

$$\begin{aligned} x_{ii} &= \frac{\alpha + \tau}{3} - \frac{1}{12}\frac{(t_i - t_j)^2}{\beta\delta\,(1 - t_i)\,(1 - t_j)}, \\ x_{ij} &= \frac{\alpha - 2\tau}{3} + \frac{1}{6}\frac{(t_i - t_j)^2}{\beta\delta\,(1 - t_i)\,(1 - t_j)}. \end{aligned} \tag{5}$$

From (5) it is seen that the last term in the expression for both x_{ii} and x_{ij} is positive or zero. It is zero if it is prohibitively expensive to manipulate the transfer prices ($\delta \to \infty$)

or if $t_i = t_j$. Hence, the multinational exports more if it can manipulate the transfer price than if it cannot.

Equation (5) also shows that a decrease in trade costs (τ) increases exports and thus intensifies import competition.[10] All else equal, economic integration thus reduces domestic profit (π_{ii}) and increases export income (π_{ij}). The total effect of reduced trade costs on global profit before taxes is therefore uncertain. However, a standard result in trade theory is that there is a U-shaped relationship between global profit and trade costs, as shown in Figure 1. To see the intuition for this result, note first that the direct effect of lower trade costs is that the cost level of the firms decreases. All else equal, economic integration will therefore lead to higher profit. This is the reason why the profit curve is downward-sloping to the left of τ' in Figure 1.[11] However, economic integration also implies that import competition increases. This has a negative effect on the firms' profitability, and it is well known from international economics that this effect dominates if trade costs are initially high (because the firms then make almost all of their profit domestically). This explains why the profit curve is upward-sloping to the right of τ'.

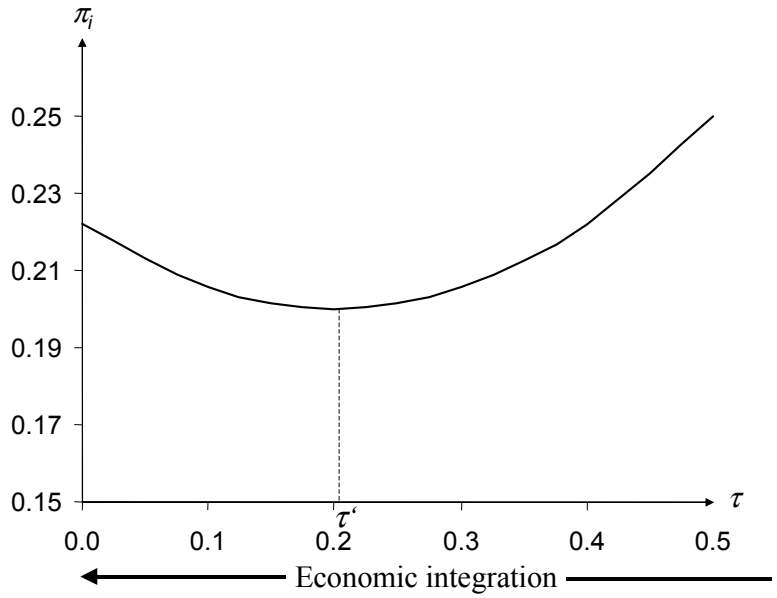

Figure 1: *Global profit and economic integration.*

[10]Notice that there will be no trade if $\tau \geq \alpha/2$.

[11]In Figure 1 we have assumed that $\alpha = \beta = 1$ and $t_i = t_j$.

Stage 1: At the first stage each government sets its tax rate in order to maximize national welfare, taking the taxes of the other country as given. National welfare is a function of consumer surplus, profits that accrue to domestic residents and public good provision. Assume that a share $s \in [0,1]$ of each multinational is owned by domestic residents, while a share $(1-s)$ is owned by residents of a third country. Welfare in country i is given by

$$W_i = CS_i + G\left(T_i\right) + s\Pi_i, \tag{6}$$

where $CS_i = \frac{1}{2}\left(1-p_i\right)\left(x_{ii}+x_{ji}\right)$ is consumer surplus in country i and $G(T_i)$ is a public good which is financed by tax revenue, $T_i = t_i(\pi_{ii}+\pi_{ji})$. We assume that $G^{'} > 0$ and $G^{''} < 0$.

The government in country i maximizes (6) with respect to t_i, taking t_j as given. A symmetric equilibrium is characterized by $t_A = t_B \equiv t^*$ (* will be used to denote equilibrium values). Instead of mechanically solving $\partial W_i/\partial t_i = 0$ simultaneously for the two countries, it is instructive to derive the equilibrium tax rate t^* by characterizing the symmetric equilibrium. From equation (5) we find that $\partial x^*_{ii}/\partial t_i\big|_{t_i=t_j} = \partial x^*_{ji}/\partial t_i\big|_{t_i=t_j} = 0$, which means that a small change in the tax rates from the symmetric equilibrium does not have any effect on supplied quantities or consumer surplus. Consequently, a marginal increase in t_i affects welfare in country i only through its impact on the second and third terms of (6) . The equilibrium is thus characterized by

$$0 = \frac{\partial W^*_i}{\partial t_i} = \underbrace{G'\frac{\partial T^*_i}{\partial t_i}}_{\text{Tax revenue effect}} + \underbrace{s\frac{\partial \Pi^*_i}{\partial t_i}}_{\text{Profit ownership effect}} \tag{7}$$

where $G' \equiv \partial G^*/\partial T_i$.

The differential $\partial T^*_i/\partial t_i$ shows the change in tax revenue in country i due to a marginal increase in t_i. The first term in (7) is therefore labelled the *tax revenue effect*. The second term is labelled the *profit-ownership effect*, and shows how a marginal increase in t_i affects the domestic residents' profit income from multinational i $(s\Pi_i)$. The higher the value of s the more of the profits of MNC_i is owned by residents of country i. All else equal, therefore, this term is more important in the welfare function the higher the value of s.

To examine the impact of economic integration on tax rates and tax revenues, in other words the impact of economic integration on the governments' welfare maximization problem (cf. equation (7)) it is useful to first consider the special case where the multinationals are fully owned by residents of a third country.

The multinationals are owned by third country residents ($s = 0$) With $s = 0$ the profit ownership effect vanishes. Thus, equation (7) implies that each country sets its tax rate so as to maximize domestic tax revenue only, and solving $\partial T_i^* / \partial t_i = 0$ we find

$$\frac{t^*}{1 - t^*} = \delta \frac{2\alpha^2 - 2\alpha\tau + 5\tau^2}{3(\alpha - 2\tau)}, \tag{8}$$

where the ratio $t^*/(1 - t^*)$ is monotonically increasing in t^*.

From equation (8) it follows that $t^* = 1$ if trade costs are prohibitively high ($\tau = \alpha/2$), reflecting the fact that in absence of trade the MNCs cannot use the transfer price to shift profit internationally. It is, therefore, optimal for each country to confiscate the whole profit, since the MNCs are owned by foreigners.

Trade occurs if $\tau < \alpha/2$, and the countries will then compete for shifty profit. Other things equal this puts a downward pressure on tax rates, and with complete integration ($\tau = 0$) we have $t^* = 2\alpha\delta/(2\alpha\delta + 3) < 1$.[12] More generally, we find that

$$\frac{\partial}{\partial \tau}\left(\frac{t^*}{1 - t^*}\right) = 2\delta \frac{\alpha^2 + 5\tau(\alpha - \tau)}{3(\alpha - 2\tau)^2} > 0, \tag{9}$$

which means that t^* is monotonically increasing in τ. We may state:

Lemma 1. *The tax revenue effect indicates that the equilibrium tax rate (t^*) is increasing in τ.*

Lemma 1 is consistent with the view that economic integration ($d\tau < 0$) makes corporate tax bases more tax sensitive, which in turn forces the countries to reduce their tax

[12] Assuming $\delta < \infty$.

rates. However, this does not mean that tax *revenue* falls. On the contrary, economic integration implies that tax revenue increases if the initial level of trade costs is sufficiently low. Specifically, in the neighborhood of $\tau = 0$ we can use equations (5), (7) and (8) to obtain

$$\left.\frac{\partial T^*}{\partial \tau}\right|_{\tau=0} = -\frac{8\delta^2\alpha^3}{9\beta\left(3+2\delta\alpha\right)^2} < 0. \tag{10}$$

To see the intuition for equation (10), recall from Figure 1 that global corporate profit before tax is a U-shaped function of τ. In particular, economic integration increases the profit level of the firms if trade costs are low. Thereby the tax base in each country is enlarged and this gives rise to higher tax revenue.

So far we have assumed that each multinational is owned by residents of a third country. In order to asses the generality of our results, we next consider the case where home country residents own a share of the domestic multinational firm (i.e., $s > 0$).

The multinationals are partly owned by domestic residents ($s > 0$) To find the relationship between taxes and trade costs when $s > 0$ it is convenient to derive the expression for the term $\partial\Pi_i^*/\partial t_i$ in equation (7). Using (3) we have[13]

$$\frac{\partial \Pi_i^*}{\partial t_i} = -\pi_{ii}^* = -\frac{\left(\alpha+\tau\right)^2}{9\beta} < 0. \tag{11}$$

Equation (11) measures the loss in profit for the domestic multinational subsequent to an increase in t_i, and allows us to rewrite first-order condition (7) as

$$0 = \frac{\partial W_i^*}{\partial t_i} = -s\frac{\left(\alpha+\tau\right)^2}{9\beta} + G'\frac{\partial T_i^*}{\partial t_i}. \tag{12}$$

The second term on the right hand side of (12) is the tax revenue effect, which is discussed in Lemma 1. Our attention here is on the profit ownership effect (first term), which is negative. Thus, when $s > 0$, the government sets a tax rate which is lower than the one that maximizes tax revenue. Note that the absolute value of the profit ownership effect

[13]Formally, $\partial\Pi_i^*/\partial t_i = -\pi_{ii}^* + (1-t^*)\left(\partial\pi_{ii}^*/\partial t_i + \partial\pi_{ij}^*/\partial t_i\right)$, where the last bracket equals zero since the net effect of profit shifting is zero: $\partial\pi_{ii}^*/\partial t_i = -\partial\pi_{ij}^*/\partial t_i = -\left(\alpha-2\tau\right)/\left[6\beta\delta\left(1-t\right)\right] < 0$.

is increasing in τ, suggesting, ceteris paribus, that the equilibrium tax rate is lower the *higher* the level of trade costs:

Lemma 2: *When $s > 0$, the profit-ownership effect indicates that the equilibrium tax rate (t^*) is decreasing in τ.*

The reason why the profit ownership effect suggests that the tax rate is decreasing in τ, is that the domestic multinational makes a higher profit at home the higher the level of trade costs (reflecting weaker import competition). If the firm is partly owned by domestic residents, the government therefore has smaller incentives to set a high tax rate the larger the value of τ. Moreover, for $s > 0$ it is generally not optimal to set the tax rate equal to 100% when trade is prohibitively expensive, because a high tax rate reduces private income in each country. Indeed, for $s = 1$ it is optimal to set the tax rate such that the marginal utility of private income is equal to the marginal utility of the public good.[14]

Solving (12) we find

$$\frac{t^*}{1-t^*} = \frac{1}{3}\frac{2\alpha^2 - 2\alpha\tau + 5\tau^2}{\alpha - 2\tau}\delta - \frac{1}{3}\delta\frac{(\alpha+\tau)^2}{\alpha-2\tau}\frac{s}{G'}, \tag{13}$$

which is an implicit expression for t^*, since G' is also a function of the tax rate.

The first term on the right-hand side of (13) corresponds to the tax revenue effect and it suggests that t^* is increasing in τ, while the second term corresponds to the profit ownership effect, and indicates that t^* is decreasing in τ. In general we cannot say which of these effects dominates, but economic integration (lower trade costs) is more likely to reduce the equilibrium tax rate the smaller the value of s (the weaker is the profit ownership effect).[15] From equation (13) we further see that the equilibrium tax rate is

[14]The first-order condition for the optimal tax rate when trade costs are prohibitively high is derived by solving (12) for $\tau = \alpha/2$. We then find that the tax rate is implicitly given by the condition $G' = s$. The first-order condition holds provided that $G' = s$ defines a tax rate $t^* \leq 1.0$. Otherwise, the optimal tax rate is $t^* = 1.0$ (as is the case when $s = 0$).

[15]Consider the simple example where $G_i(T_i) = T_i$, which means that $G' = 1$. We then find $\frac{\partial t}{\partial \tau} = 6\delta\frac{\alpha^2+5\alpha\tau-5\tau^2}{(3\alpha-6\tau+2\delta\alpha^2-2\delta\alpha\tau+5\delta\tau^2)^2} > 0$ for $s = 0$ and $\frac{\partial t}{\partial \tau} = -6\frac{\delta}{(\delta\alpha-2\delta\tau+3)^2} < 0$ for $s = 1$.

increasing in G', all else equal. The reason for this is that the countries have stronger incentives to increase the tax rates the higher the marginal utility of public goods. We can now state:

Proposition 1. *Other things equal, the equilibrium tax rate is increasing in the marginal utility of public funds and decreasing in the country's ownership in the domestic multinational. Economic integration is more likely to lead to a lower equilibrium tax rate the larger the share of the domestic multinational that is owned by foreigners.*

Figure 2 illustrates how the tax rate depends on the level of trade costs for two different ownership shares.[16] In the case where home country residents own half of the domestic multinational ($s = 1/2$) we see that economic integration reduces the equilibrium tax rate. This result is in line with the conventional wisdom from the tax competition literature (Zodrow and Mieszkowski 1986, Wilson 1986), and reflects the fact that the tax revenue effect dominates.

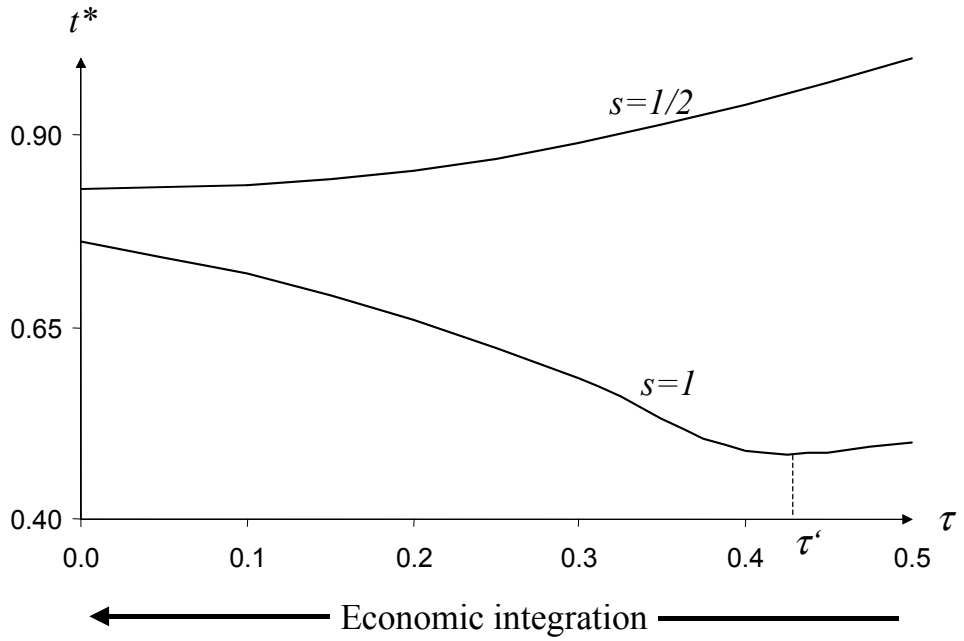

Figure 2: *Economic integration and tax rates.*

[16]See the Appendix for parameter values and the functional form of $G(T_i)$.

For high levels of trade costs ($\tau > \tau'$), Figure 2 shows that economic integration implies that the equilibrium tax rate falls also for $s = 1$, because lower trade costs make the tax bases more tax sensitive. However, the profit ownership effect dominates for lower levels of trade costs and economic integration increases the equilibrium tax rate. This outcome fits empirical data showing that some countries have increased their corporate tax rates between the mid 1980s and the millennium.[17] Finland, for example, had a corporate tax rate of 25 percent in 1993, but has later increased it so that it in 2003 is 29 percent. Furthermore, the German business tax has increased steadily since the early 80s (See Kelders and Kotenburger, 2003).[18]

Above, we showed that economic integration leads to higher tax revenue in the neighborhood of $\tau = 0$ when the multinationals are fully owned by residents of a third country. This happens despite the fact that economic integration reduces the equilibrium tax rate when $s = 0$. If $s > 0$ the profit ownership effect implies that economic integration may actually lead to a higher tax rate, strengthening the tendency for economic integration to increase tax revenue. This is illustrated in Figure 3, which shows the relationship between trade costs and tax revenue. In the Appendix we offer a formal proof of the following result:

Proposition 2: *Economic integration in the neighborhood of* $\tau = 0$ *leads to higher equilibrium tax revenue.*

[17] E.g., Finland and Norway.

[18] Consistent with Proposition 1, we also see from Figure 2 that the equilibrium tax rate is lower the higher the value of s, suggesting that the ownership composition matters for the tax rate.

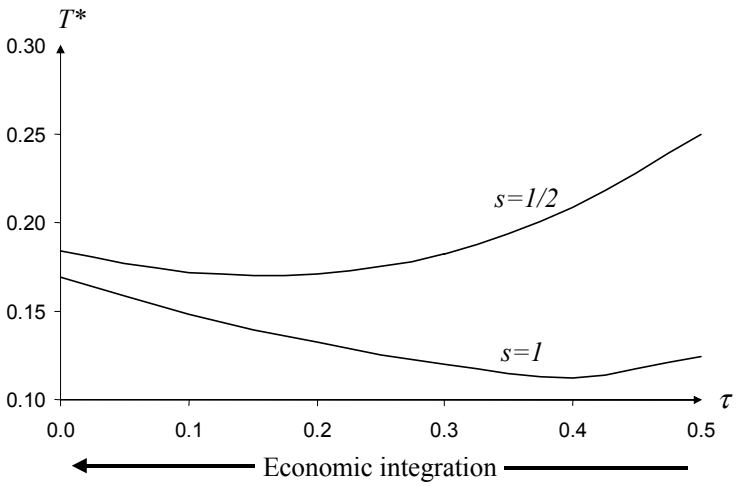

Figure 3: *Economic integration and tax revenue.*

Figure 3 shows that tax revenue may rise if economic integration has proceeded far and this seems to be in line with empirical data. Devereaux, Griffith and Klemm (2002), for example, find that tax revenue has remained broadly stable, but that it has increased for some countries (among them the U.K.).

It is important to note that trade barriers are neglected in the standard tax competition literature. Competition among countries to attract capital or shifty profits thus leads to too low taxes and falling tax revenue due to the fiscal externality arising in the tax equilibrium (see, e.g., Wilson (1999)). In contrast, we find that economic integration may mitigate the loss of tax revenue and even lead to higher tax rates (and an increase in welfare). This is almost the opposite view on tax competition than in the standard literature.

3 Concluding remarks

In this paper we have investigated how a reduction of trade costs, inclusive of communication costs and other barriers to trade, affects equilibrium tax rates in an economy where multinationals engage in profit shifting. We have found two opposing forces that affect tax rates. The first is that economic integration makes the corporate tax base more mobile and thus tax more sensitive. All else equal, this suggests that the tax rates will

fall. The second effect pertains to the fact that economic integration allows foreign firms to capture a larger share of the domestic market. This effect indicates that taxes should rise, since there is an incentive to shift the burden of taxation onto foreigners. Which of these two effects dominates, depends on the level of economic integration and on the ownership structure of firms. However, independent of whether the equilibrium tax rate falls or increases, we have demonstrated that if trade costs are low, economic integration leads to higher tax revenue due to the gains from free trade.

Our results seem to fit with empirical studies Devereaux, Griffith and Klemm (2002) find that tax revenues on corporate income as proportion of GDP have remained stable or even increased for some countries since the early 1960s.[19] The stability of tax revenue seems to be in line with the tax base effect we have identified. For the same sample of countries they show that statutory tax rates have fallen, which is in line with our main scenario. There are however outlier countries where the statutory tax rate has risen. One such country is Finland, which has become significantly more integrated with the world economy after the collapse of the Soviet Union. This case fits with the alternative result on tax rates that we have presented.

Our study suggests that empirical research on tax rates and tax revenues should focus on how integrated countries are. A pattern of falling tax revenues are consistent with high barriers to trade, whilst higher revenues are consistent with a high degree of economic integration. A final comment to the empirical predictions of our model is this. If further economic integration implies lower barriers to trade, more foreign ownership of the domestic tax base, and a continuing strong presence of multinationals, then the new wave of tax reforms that is about to be initiated in many OECD countries may actually entail higher corporate tax rates and - despite this - lead to higher tax revenue.

4 Appendix

Proof of Proposition 2

[19]Devereaux, Griffith and Klemm (2002)

From equation (13) we find that the tax rate at $\tau = 0$ equals

$$t = \frac{\left(2G^{'} - s\right)\delta\alpha}{\left(2G^{'} - s\right)\delta\alpha + 3G^{'}} \tag{14}$$

In the symmetric equilibrium we have $T_1 = T_2 \equiv T$, with

$$T = t\frac{2\alpha^2 + 5\tau^2 - 2\alpha\tau}{9\beta} \tag{15}$$

Note from equations (13) and (15) that we have respectively $t = t(\tau, G^{'}(T_1(\tau))$ and $T = T(\tau, t(\tau))$, which implies

$$\frac{dt}{d\tau} = \frac{\partial t}{\partial \tau} + \frac{\partial t}{\partial G^{'}}G^{''}\frac{dT}{d\tau} \tag{16}$$

and

$$\frac{dT}{d\tau} = \frac{\partial T}{\partial \tau} + \frac{\partial T}{\partial t}\frac{dt}{d\tau}. \tag{17}$$

Solving (16 and (17) simultaneously we find

$$\frac{dT_1}{d\tau} = -\frac{\frac{\partial T_1}{\partial \tau} + \frac{\partial T_1}{\partial t}\frac{\partial t}{\partial \tau}}{-1 + \frac{\partial t}{\partial G^{'}}G^{''}\frac{\partial T_1}{\partial t}} \tag{18}$$

and

$$\frac{dt}{d\tau} = -\frac{\frac{\partial t}{\partial \tau} + \frac{\partial t}{\partial G^{'}}\frac{\partial T_1}{\partial \tau}G^{''}}{-1 + \frac{\partial t}{\partial G^{'}}\frac{\partial T_1}{\partial t}G^{''}}. \tag{19}$$

Using that

$$\left.\frac{\partial t}{\partial G^{'}}\right|_{\tau=0} = 3\delta s\frac{\alpha}{\left(-2G^{'}\delta\alpha + s\delta\alpha - 3G^{'}\right)^2} \tag{20}$$

$$\left.\frac{\partial t}{\partial \tau}\right|_{\tau=0} = -6\delta G^{'}\frac{2s - G^{'}}{\left(-2G^{'}\delta\alpha + s\delta\alpha - 3G^{'}\right)^2} \tag{21}$$

$$\left.\frac{\partial T_1}{\partial \tau}\right|_{\tau=0} = -\frac{2}{9}t\frac{\alpha}{\beta} \tag{22}$$

$$\left.\frac{\partial T_1}{\partial t}\right|_{\tau=0} = \frac{2}{9}\frac{\alpha^2}{\beta} \tag{23}$$

we find from (18) that

$$\frac{dT_1}{d\tau} = -2\delta\alpha^2 \frac{4G'\delta\alpha\left(G'-s\right)+s^2\delta\alpha+9sG'}{9\beta\left[\left(2G'-s\right)\delta\alpha+3G'\right]^2-6\alpha^3\delta sG''} \tag{24}$$

The denominator in (24) is always positive, since $G'' < 0$. Also the numerator is positive. To see this, note that a sufficient condition for the numerator $N \equiv 4G'\delta\alpha\left(G'-s\right) + s^2\delta\alpha + 9sG'$ to be increasing in G' is that $G' > s/2$ ($dN/dG' = 8\delta\alpha\left(G'-s/2\right)+9s$). This we know must be true for any positive tax rate from equation (14). Since we further find that the numerator is positive for $G' = s/2$, it follows that the numerator must be positive for all relevant values of G' and s. It thus follows that trade liberalization around $\tau = 0$ unambiguously leads to higher tax income:

$$\left.\frac{dT_1}{d\tau}\right|_{\tau=0} < 0$$

We likewise find

$$\left.\frac{dt}{d\tau}\right|_{\tau=0} = -6\delta\frac{9\beta\left(2s-G'\right)G'-s\alpha^3G''}{9\beta\left(\left(2G'-s\right)\delta\alpha+3G'\right)^2-6\alpha^3\delta sG''} \lesseqgtr 0$$

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