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# Corporate tax regime and international allocation of ownership<sup>1</sup>

by

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## **Abstract**

This paper analyzes a two-country model with an international investor considering acquisitions of already existing target firms in a high-tax country and a low-tax country. The investor is able to shift profits from one location to another for tax saving purposes. Two systems of corporate taxation are compared, a system with separate accounting and a system with tax base consolidation and formula apportionment. It is shown that, under separate accounting, the number of acquisitions is inefficiently high in both the high tax and the low tax country. If a tax on acquisitions is available the high tax country will levy a positive acquisitions tax rate whereas the low tax country has no interest in doing so. Under formula apportionment, the number of acquisitions is inefficiently high in the low tax country and inefficiently low in the high tax country. The reason is that the firm has an incentive to inflate its stocks in the low tax country to reduce its effective tax rate. Now, the low tax country has an incentive to unilaterally decrease the number of acquisitions within its borders.

**JEL Codes:** H25, F23

**Keywords:** Corporate Taxation, Separate Accounting, Formula Apportionment

# 1 Introduction

Increasing cross-border business activity within the European Union (EU) has increased the pressure to reform the system of corporate taxation. So far, corporate taxes are levied and collected at the national level according to individual national rules. The diversity of tax rates and rules give rise to, firstly, substantial compliance cost for firms which are active in more than one member state and, secondly, to tax arbitrage opportunities. Accounting techniques enable firms to shift taxable profits from one location to another and, thus, help saving taxes if locations are subject to different (effective) tax rates. In order to mitigate compliance cost and curb profit shifting, the EU has proposed a system of formula apportionment where profits are consolidated within a multinational firm and then attributed to the different locations according to some formula (based on sales, capital or labor).

As the literature has shown, replacing a system with separate accounting (SA) by formula apportionment (FA) effectively means replacing one set of distortions by another. In this paper, we focus of a type of distortion which has so far been neglected in the context of a comparison between SA and FA regimes: the allocation of ownership. We present a two country model in which multinational firms acquire target firms. Acquisitions have a real economic effect taking the form of a change in cash-flow (synergy). We derive the type and the size of tax-induced distortions of the incentive to sell or acquire existing firms.

Our results are the following. As a benchmark, the allocation of ownership is efficient if there are no profit shifting opportunities and if residence based taxes are ruled out. If profit shifting opportunities are introduced, the number of acquisitions is inefficiently high in both the high tax and the low tax country, i.e. the marginal synergy is negative. This distortion is larger in the high tax country than in the low tax country. In other words, the marginal buyer is less capable of running the firm than the original owner, and profits decrease after the acquisition. Because the acquisition is associated with increased profit shifting opportunities, the transaction nevertheless takes place. As a consequence, the marginal acquisition destroys wealth. In the tax competition equilibrium, tax rates are inefficiently low. If a tax on acquisitions is available the high tax country will levy a positive acquisitions tax rate whereas the low tax country has no interest in reducing

the number of acquisitions (although its number is inefficiently high from a global perspective).

Under formula apportionment, the picture changes. Now, the number of acquisitions is inefficiently high in the low tax country and inefficiently low in the high tax country. The reason is that the firm has an incentive to inflate its stocks in the low tax country to reduce its effective tax rate. While, under separate accounting, the high tax country has an incentive to unilaterally decrease the acquisitions of the multinational investor, the low tax country does want to do so under formula apportionment.

What follows from a tax policy perspective? Firstly, our paper rationalizes the notion of welfare decreasing foreign direct investment. Under separate accounting, the multinational investor acquires firms although the related synergy is negative, because the transaction is “subsidized” by profit shifting opportunities. The idea of bad foreign investment exists in the public debate for a long time but is surprisingly rarely commented from a scholarly point of view. The reason may be that this effect does not show up in models with greenfield investment.<sup>1</sup> The existence of welfare-decreasing acquisitions is, of course, not a sufficient justification for taxing (or forbidding) acquisitions by foreign investors. Our paper simply demonstrates that not all investment from outside the country is equally desirable. Secondly, our paper sheds some light on the potential welfare consequences of a switch to a system of formula apportionment. According to our results, the high tax country may see its incoming investment decrease but, since there is overinvestment under separate accounting, a welfare comparison is elusive. However, it is interesting that, in our model, the low tax country wants to reduce the number of acquisitions under formula apportionment whereas, under separate accounting, it has no incentive to do so.

The literature comparing different regimes of corporate taxation like separate accounting and formula apportionment essentially compare two states of second-best worlds. In other words, whether or not an economy is better off with one of the two regimes depends on whether profit shifting is more of a problem than

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<sup>1</sup>To be precise, in the standard model of international capital investment, the efficiency loss due to a misallocation of capital caused by profit shifting is born by all capital owners and not just the residents of the country under consideration.

investment distortions caused by formula apportionment. The importance of international income shifting is documented by a growing empirical literature, see e.g. Huizinga & Laeven (2008). It is almost consensus among empirical public finance scholars that profit shifting is associated with large revenue losses for high-tax countries, increased incentives for all countries to lower their statutory corporate tax rates and, finally, with substantial efficiency cost in the form of tax advice, concealment effort etc. Implementing an FA system can abolish these undesired side effects of source-based taxation, see McLure (1980), Mintz (1999) and Devereux (2004).<sup>2</sup>

Next to these empirical approaches, there is a large and still growing body of theoretical literature on the incentive effects imposed by an FA system. Usually, these studies assume that profit shifting takes place in already existing firms<sup>3</sup> or in multinational firms with a given number of affiliates which can adjust their capital stocks.<sup>4</sup> In contrast, this paper considers tax policy under separate accounting and formula apportionment when firms determine the number of affiliates and may acquire new ones or sell existing ones. Our approach is related to and complements empirical estimates by Hines (2009) who measures how the attribution of profits under formula apportionment would deviate from the empirically observable attribution of profits. From this “misattribution” of profits under formula apportionment, he induces inefficient incentives for acquisition or divestiture.

The analysis of tax effects on mergers and acquisition is a rather neglected issue - at least compared to the wealth of studies analyzing tax effects on the use and employment of mobile capital (which is often labelled greenfield investment). In an early contribution, Devereux (1990) points out that tax distortions to ownership may be important if capital productivity depends on ownership. Becker & Fuest (2009) consider the efficiency properties of source and residence based taxation in a model where investment takes the form of mergers and acquisitions. It is shown

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<sup>2</sup>Empirical estimations of how an FA system would affect the tax revenues of EU member countries are provided by Fuest, Hemmelgarn & Ramb (2007) and by Devereux & Loretz (2008). In both studies, the authors find that the FA system would lead to a substantial redistribution of tax revenues among the member states.

<sup>3</sup>See McLure (1980), Mintz (1999), Mintz & Smart (2004) and Nielsen, Raimondos-Møller & Schjelderup (2003).

<sup>4</sup>See Gordon & Wilson (1986), Pethig & Wagener (2007), Eggert & Schjelderup (2003) Nielsen, Raimondos-Møller & Schjelderup (2004), Sørensen (2004) and Riedel & Runkel (2007).

that source based taxation is efficient from a global point of view if residence based taxes are ruled out. They do not consider profit shifting, though, nor analyze a system with formula apportionment <sup>5</sup>

The remainder of this paper is organized as follows. Section 2 describes the model and derives the results. Section 3 discusses some extensions and policy implications and concludes.

## 2 The model

Consider a world with two countries,  $a$  and  $b$ . In each country, there is a representative household receiving utility from the consumption of a single homogeneous good. This good is available at all quantities at a price of unity. Thus, utility of the household in country  $i \in \{a, b\}$  is a direct function of income  $Y_i$ :  $U_i = U_i(Y_i)$ . For simplicity, we will assume that  $U_i = Y_i$ .

The representative household in  $i$  owns  $m_i$  existing and immobile firms operating in country  $i$ . We refer to these firms as *national* firms, as opposed to *multinational* firms which will be introduced below. The after tax profit earned by each national firm is given by  $\pi_i(1 - t_i)$ , where  $t_i$  is the corporate income tax in country  $i$ . Next to corporate taxes governments are allowed to levy a special transaction tax  $\mu_i$  on acquisitions.

Next to the national sectors, there is a sector of multinational firms. The number of multinationals is normalized to unity. The representative multinational firm is owned by both households. The household in  $i$  holds a share of  $\theta_i$  of the multinational's stock with  $0 \leq \theta_a + \theta_b \leq 1$ . The multinational considers acquisitions of firms in the domestic and the foreign country.<sup>6</sup>

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<sup>5</sup>Desai & Hines (2004) and Becker & Fuest (forthcoming) discuss the argument that the optimal foreign tax system for capital flows taking the form of m&a is exemption rather than the tax credit system. Haufler & Schulte (2007) consider tax incentives in a model where m&a can take place within and across borders. They show that ownership patterns are highly important for the welfare implications of tax policy choices. Becker & Fuest (2007) analyse tax competition in a model where m&a and greenfield investment are alternative modes of entry and show that the existence of m&a investment intensifies tax competition. Empirical evidence for tax effects on m&a is provided in Swenson (1994), Auerbach & Slemrod (1997) and Huizinga & Voget (forthcoming) and for non-tax aspects of m&a activity in Andrade, Mitchell & Stafford (2001).

<sup>6</sup>We assume that the acquisition targets are only domestic or foreign national firms. We thus abstract from the possibility that a change in firm ownership occurs between multinational firms.

If an existing national firm is acquired, the change of ownership is not accompanied by a relocation of real capital. However, the ownership change does have a real economic effect. It increases the cash flow of the target firm in  $i$  by  $\Delta_i$ . The multinational draws  $\Delta_a$  and  $\Delta_b$  from uniform distributions over the intervals  $[\Delta_a^-, \Delta_a^+]$  and  $[\Delta_b^-, \Delta_b^+]$ , respectively. The distribution functions are denoted by  $\Omega_a(\Delta_a)$  and  $\Omega_b(\Delta_b)$ . This increase in profitability is the driving force for changes in ownership in our model. It may be interpreted as the result of cost savings due to superior technology or an increase in output value due to access to a brand name or better distribution systems. Note that the synergies are location specific, i.e. there is a range of potential synergies in  $a$  and in  $b$  with two unrelated from each other. This assumption might be justified by the existence of locational search cost for suitable target firms, location specific productivity advantages etc.

As extensively discussed in Becker & Fuest (forthcoming), a key question is whether these ownership skills are a public good within the firm, so that the firm can make acquisitions in all cases where it has an ownership advantage, or whether the number of acquisitions is limited. In the following, we will assume that the number of feasible acquisitions is only limited by the synergy generated and not by some exogenously given restriction. The latter is discussed in section 3.

For the tax treatment of acquisitions, we assume that the revenue from selling firms is untaxed and investors cannot deduct acquisition costs from the corporate tax base. This may be interpreted as a highly stylised way of modelling acquisitions in the form of share deals, as opposed to asset deals. We thus abstract from many complexities associated with the tax consequences of mergers and acquisitions including taxation of unrealized capital gains, the use of loss carryforwards and other specific tax law provisions of the national tax systems, some of which are surveyed in Huizinga & Voget (forthcoming). We discuss the potential impact of these tax provisions in section 3.

## 2.1 Investment behavior in the absence of profit shifting

The multinational firm maximizes its market value. Considering the acquisition of a target firm  $j$  in  $i$ , the multinational firm weighs the future proceeds given by the old profits plus the synergy against the purchase price  $P_{ij}$  of the firm. In the



absence of profit shifting, the investor firm will acquire the firm  $j$  if

$$(\pi_i + \Delta_{ji})(1 - t_i) - P_{ji} - \mu_i \geq 0 \quad (1)$$

How is the acquisition price  $P_{ij}$  determined? The price crucially depends on the market conditions and the nature of the synergy. Assume, for instance, that the synergy is generated by market specific knowledge of the target firm which is worth more if the multinational investor can use it. Then, multinational investors may bid for the target firm and the whole surplus is received by the seller. A contrary example is that the multinational firm just needs a distribution network in the market where the target firms are located. Each target firm could provide this service. In this case, the acquirer would keep the whole surplus. We allow for these cases by generally assuming that both parties, seller and acquirer, get a fraction  $0 \leq \gamma, 1 - \gamma \leq 1$  of the surplus. Assume that the seller gets  $1 - \gamma$  of the surplus where the surplus is given by  $(\pi_i + \Delta_{ji})(1 - t_i) - \mu_i - \pi_i(1 - t_i)$ . The purchase price is therefore given by  $P_{ij} = \left( \pi_i + (1 - \gamma) \left( \Delta_{ji} - \frac{\mu_i}{1 - t_i} \right) \right) (1 - t_i)$ . For simplicity, we will assume that  $\gamma$  is identical for all firms and both countries. It follows that the investor firm will buy the target firm  $j$  if

$$\gamma(\Delta_{ji}(1 - t_i) + \mu_i) \geq 0 \quad (2)$$

from which follows that the cut-off level in synergy is given by  $\Delta_{ji}^u = 0$ . We may state as a benchmark result

**Proposition 1 *Benchmark result.*** *If profit shifting opportunities are absent,  $\mu_i = 0$  and profits are determined according to separate accounting, corporate income taxes do not distort the allocation of ownership across locations and firms.*

**Proof.** Follows directly from (2). ■

The above proposition is not novel (see e.g. Becker & Fuest, 2009). The reason is that, in this model, source based corporate income taxes are perfectly capitalized in share prices. From a different perspective, source based taxes ensure capital import neutrality.

It is this benchmark against which Hines (2009) evaluates the allocative properties of a system with formula apportionment. However, this neglects why formula

apportionment is to be introduced in the first place. At least in the context of the EU, formula apportionment is designed to get rid of profit shifting opportunities for large multinational firms. But profit shifting opportunities may themselves cause distortions in the pattern of ownership and investment. This is to be analyzed in the next section.

## 2.2 Separate accounting

The above described model is now extended by the opportunity for the multinational firm to shift profits across borders. In each acquired firm in country  $i$ , the investor may shift  $s_i$  at a convex cost of  $C(s_i)$ . Of course, the firm has to account for the fact that within the firm net shifting is zero:

$$n_a s_a + n_b s_b = 0 \quad (3)$$

where  $n_a$  and  $n_b$  are the firm number in countries  $a$  and  $b$ , respectively, defined as  $n_a = \int_{\Delta_a^u}^{\Delta_a^+} d\Delta_a$  and  $n_b = \int_{\Delta_b^u}^{\Delta_b^+} d\Delta_b$ .

The multinational's after-tax profits are given by

$$\begin{aligned} \Pi = & \int_{\Delta_a^u}^{\Delta_a^+} [(1 - t_a)(\pi_a + \Delta_a + s_a) - C_a(s_a) - P_a - \mu_a] d\Delta_a \\ & + \int_{\Delta_b^u}^{\Delta_b^+} [(1 - t_b)(\pi_b + \Delta_b + s_b) - C_b(s_b) - P_b - \mu_b] d\Delta_b \end{aligned} \quad (4)$$

subject to (3).

Assume that the sellers get a fraction of  $1 - \gamma$  of the surplus. The surplus of acquiring firm  $j$  in  $i$  is given by  $(1 - t_i)(\Delta_{ij} + s_i) - C_i(s_i) + \lambda s_i$ . Then, the price is given by

$$P_i = (1 - t_i) \pi_i + (1 - \gamma) ((1 - t_i)(\Delta_{ij} + s_i) - C_i(s_i) + \lambda s_i) \quad (5)$$

for  $i \in \{a, b\}$  where  $\lambda$  is the Lagrangian shadow price (due to profit shifting) of increasing the number of firms in  $i$ . The Lagrangian is then given by

$$L = \Pi + \lambda [n_a s_a + n_b s_b] \quad (6)$$

The investor firm chooses  $\Delta_a^u$ ,  $\Delta_b^u$ ,  $s_a$  and  $s_b$  according to  $\frac{\partial L}{\partial \Delta_a^u} = 0$ ,  $\frac{\partial L}{\partial \Delta_b^u} = 0$ ,  $\frac{\partial L}{\partial s_a} = 0$ ,  $\frac{\partial L}{\partial s_b} = 0$  and  $\frac{\partial L}{\partial \lambda} = 0$ .

Consider first the level of profit-maximizing profit shifting. The appendix shows that

$$s_i = -\frac{t_i - t_{-i}}{\beta} \frac{n_{-i}}{N} \quad \text{for } i = a, b \quad (7)$$

with  $N = n_a + n_b$ . If  $t_a > t_b$ , profits are shifted out of the high-tax country  $a$  and into the low-tax country  $b$ .

The profit-maximizing cut-off level of synergy in country  $i$  is given by

$$\Delta_i^u = -\frac{(t_i - t_{-i})^2}{2\beta(1 - t_i)} \left(\frac{n_{-i}}{N}\right)^2 + \frac{\mu_i}{(1 - t_i)} \quad (8)$$

This implies that as long as  $t_a \neq t_b$  and  $\mu_i = 0$ , the marginal synergy is negative. The reason is that the opportunity to shift profits across borders for tax saving purposes is an effective subsidy to take over target firms. At the margin the subsidy is compensated by a negative synergy. We can therefore state

**Proposition 2** (*Separate accounting*). *In the absence of transaction taxes,  $\mu_i = 0$ , the number of acquired firms is inefficiently high in both countries (overinvestment). This distortion is larger in the high tax country.*

**Proof.** Follows from (8). ■

Here the model captures an idea that has been floating around in the public debate for a long time. A multinational firm acquires a domestic firm and destroys its values, i.e. decreases its profits. In our model, this happens because the acquisition has a greater value for the multinational than profits and synergy alone. In addition to these, it facilitates profit shifting in the whole firm.

How do taxes affect the profit-maximizing number of firms in the two countries. We state

**Proposition 3** (*Separate accounting*). *If transaction taxes are absent,  $\mu_i = 0$ ,*

*i) and if  $t_a > t_b$ , an increase in  $t_a$  increases the acquisitions in both countries,  $\frac{\partial \Delta_a^u}{\partial t_a}, \frac{\partial \Delta_b^u}{\partial t_a} < 0$  whereas an increase in  $t_b$  does the opposite,  $\frac{\partial \Delta_a^u}{\partial t_b}, \frac{\partial \Delta_b^u}{\partial t_b} > 0$ .*

*ii) a coordinated increase in  $t_a$  and  $t_b$  which leaves the tax gap  $t_a - t_b$  unaffected, decreases the number of acquisitions in both countries.*

**Proof.** See the appendix. ■

Now, consider the welfare effects of taxation. We assume that welfare is the weighted sum of the representative household's utility  $U_i = Y_i$  where  $Y_i = \theta_i \Pi + \int_{\Delta_i^-}^{\Delta_i^u} \pi_i (1 - t_i) d\Delta_i + \int_{\Delta_i^u}^{\Delta_i^+} P_i d\Delta_i$  and the tax revenue. We introduce a welfare weight  $\psi_i$  for private consumption in country  $i$ . If  $\psi_i = 0$ , the government is assumed to maximize tax revenue, if  $\psi_i = 1$  the government maximizes national income and if  $0 < \psi_i < 1$ , the case of public good provision is captured where the marginal preference for the public good (here equal to one) is larger than the marginal utility of private consumption:

$$W_i = \psi_i \left[ \theta_i \Pi_i + \int_{\Delta_i^-}^{\Delta_i^u} \pi_i (1 - t_i) d\Delta_i + \int_{\Delta_i^u}^{\Delta_i^+} P_i d\Delta_i \right] + \left[ t_i m_i \pi + \int_{\Delta_i^u}^{\Delta_i^+} (t_i (\Delta_i + s_i) + \mu_i) d\Delta_i \right] \quad (9)$$

The government in  $i$  sets its corporate tax rate  $t_i$  according to  $\frac{\partial W_i}{\partial t_i} = 0$  with

$$\begin{aligned} \frac{\partial W_i}{\partial t_i} = & \psi_i \left[ \theta_i \frac{\partial \Pi}{\partial t_i} - \int_{\Delta_i^-}^{\Delta_i^u} \pi_i d\Delta_i + \int_{\Delta_i^u}^{\Delta_i^+} \frac{\partial P_i}{\partial t_i} d\Delta_i \right] + \left[ m_i \pi + \int_{\Delta_i^u}^{\Delta_i^+} (\Delta_i + s_i) d\Delta_i \right] \\ & + \int_{\Delta_i^u}^{\Delta_i^+} t_i \frac{\partial s_i}{\partial t_i} d\Delta_i - [t_i (\Delta_i^u + s_i) + \mu_i] \frac{\partial \Delta_i^u}{\partial t_i} \end{aligned} \quad (10)$$

The first term on the right hand side depicts the negative effect of an increase in  $t_i$  on private income. The second effect captures the corresponding positive effect on tax revenues. A change in profit shifting will, of course, also affect tax revenues (third term). Finally, increasing  $t_i$  affects the number of acquired firms which has a marginal effect on corporate and transaction tax revenue (last term). Note that it follows from (7) and (8) that  $\Delta_a^u + s_a < 0$  and  $\Delta_b^u + s_b > 0$ .

The question arises whether national tax policy is efficient from a global point of view or whether it has external effects on the neighbouring country's welfare. For this purpose, consider a marginal tax increase in the neighbour country (indexed

– $i$ ) on the country  $i$ 's welfare

$$\begin{aligned} \frac{\partial W_i}{\partial t_{-i}} &= -\psi_i \theta_i \int_{\Delta_i^u}^{\Delta_i^+} (\pi_{-i} + \Delta_{-i} + s_{-i}) d\Delta_i + t_i n_i \frac{\partial s_i}{\partial t_{-i}} \\ &\quad - [t_i (\Delta_i^u + s_i) + \mu_i] \frac{\partial \Delta_i^u}{\partial t_{-i}} \end{aligned} \quad (11)$$

which for  $\psi_i = 0$  and  $\mu_i = 0$  is reduced to  $\frac{\partial W_i}{\partial t_{-i}} = t_i \left[ \int_{\Delta_i^u}^{\Delta_i^+} \frac{\partial s_i}{\partial t_{-i}} d\Delta_i + (\Delta_i^u + s_i) \frac{\partial \Delta_i^u}{\partial t_{-i}} \right] > 0$ . Firstly, an increase in the other country's tax rate reduces profit shifting if  $t_i > t_{-i}$  and increases profit shifting otherwise. In both cases, country  $i$  sees its tax revenue increase. Secondly, an increase in  $t_{-i}$  decreases the number of acquisitions if  $i$  is the high tax country and increases it otherwise. Again, in both cases country  $i$  gains.

Now we turn to the optimal choice of the transaction tax  $\mu_i$ . Country  $i$  sets  $\mu_i$  according to  $\frac{\partial W_i}{\partial \mu_i} = 0$  with

$$\frac{\partial W_i}{\partial \mu_i} = -(\psi_i \theta_i - 1) n_i + \psi_i \int_{\Delta_i^u}^{\Delta_i^+} \frac{\partial P_i}{\partial \mu_i} d\Delta_i - (t_i (\Delta_i^u + s_i) + \mu_i) \frac{\partial \Delta_i^u}{\partial \mu_i} + n_i t_i \frac{\partial s_i}{\partial \mu_i} \quad (12)$$

With  $\psi_i = 0$  and  $\frac{\partial \Delta_i^u}{\partial \mu_i} > 0$ , we can state

**Proposition 4** *If  $t_a > t_b$ , country  $a$  levies a positive acquisition tax  $\mu_a > 0$ , whereas country  $b$  only chooses  $\mu_b > 0$  if the transaction cost revenue exceeds the associated efficiency loss.*

**Proof.** If  $t_a > t_b$ , we can show that  $\frac{\partial s_a}{\partial \mu_i} > 0$  and  $\frac{\partial s_b}{\partial \mu_i} < 0$ . Since  $\Delta_a^u + s_a < 0$  and  $\Delta_b^u + s_b > 0$ , it follows that  $\frac{\partial W_a}{\partial \mu_a} > 0$  at  $\mu_a = 0$ .  $\frac{\partial W_b}{\partial \mu_b}$  has an ambiguous sign; if, at  $\mu_b = 0$ ,  $\left| \frac{\partial \Delta_b^u}{\partial \mu_b} \right|, \left| \frac{\partial s_b}{\partial \mu_b} \right|$  are large, country  $b$  will choose  $\mu_b = 0$ . ■

How does the transaction tax affect the neighbouring country? For this purpose, consider a small increase in the transaction tax of the neighbouring country – $i$ . The effect of country  $i$ 's welfare is given by

$$\begin{aligned} \frac{\partial W_i}{\partial \mu_{-i}} &= -\psi_i \theta_i n_{-i} + \psi_i \int \frac{\partial P_i}{\partial \mu_{-i}} d\Delta_i + (t_i (\Delta_i^u + s_i) + \mu_i) \frac{\partial \Delta_i^u}{\partial \mu_{-i}} \\ &\quad + n_i t_i \frac{\partial s_i}{\partial \mu_{-i}} + \frac{\partial W_i}{\partial t_{-i}} \frac{\partial t_{-i}}{\partial \mu_{-i}} \end{aligned} \quad (13)$$

**Proposition 5** *At  $\psi_i = 0$ , an increase in  $\mu_a$  has a negative impact on country  $b$ 's welfare if tax rates remain unchanged and an ambiguous impact of tax rates are allowed to adjust.*

**Proof.** See the appendix. ■

## 2.3 Formula apportionment

We now assume that the profits of the representative multinational firm generated in the two countries are taxed on the basis of formula apportionment: Taxable profits will be consolidated (i.e. here: summed up) for both countries and then allocated to each country according to some formula.

The factors entering the formula usually include indicators of real economic activity such as the payroll, property or sales. In the following, we assume that the share allocated to each country depends on the capital stock invested in the two countries. Since each firm is endowed with one unit of capital, a fraction  $n_a/N$  of the consolidated tax base is taxed at the tax rate of country  $a$ ,  $t_a$ , and the complement,  $n_b/N$ , at  $t_b$ .

After-tax profits are therefore given by

$$\begin{aligned} \Pi = & \int_{\Delta_a^u}^{\Delta_a^+} [(1 - T) (\pi_a + \Delta_a) - P_a - \mu_a] d\Delta_a \\ & + \int_{\Delta_b^u}^{\Delta_b^+} [(1 - T) (\pi_b + \Delta_b) - P_b - \mu_b] d\Delta_b \end{aligned} \quad (14)$$

with  $T = \frac{n_a t_a + n_b t_b}{N}$ .

Again, the question arises how the purchase prices are determined. As in the preceding analysis of separate accounting, we assume that the seller in country  $i$  receives  $1 - \gamma$  of the surplus. The surplus is the difference between the after-tax income after and before the acquisition plus the effect on the effective tax rate  $T$ :  $(\pi_i + \Delta_{ij}) (1 - T) - \mu_i - \pi_i (1 - t_i) + \frac{\partial \Pi}{\partial T} \frac{\partial T}{\partial \Delta_{ij}}$ . The purchase price is then

$$P_i(\Delta_{ij}) = \pi_i (1 - t_i) + (1 - \gamma) \left[ (\pi_i + \Delta_i) (1 - T) - \mu_i - \pi_i (1 - t_i) + \frac{\partial \Pi}{\partial T} \frac{\partial T}{\partial \Delta_{ij}} \right] \quad (15)$$

Given (15), the first-order conditions derived from (14) are given by

$$\frac{\partial \Pi}{\partial \Delta_i^u} = -\gamma [(1 - T) (\pi_i + \Delta_i^u) - \mu_i - \pi_i (1 - t_i)] + \gamma \frac{\partial \Pi}{\partial T} \frac{\partial T}{\partial \Delta_i^u} = 0 \quad (16)$$

for  $i = a, b$  from which follows

$$\Delta_i^u = \frac{\mu_i + \frac{\partial \Pi}{\partial T} \frac{\partial T}{\partial \Delta_i^u} - \frac{n-i}{N} \pi_i (t_i - t_{-i})}{1 - T} \quad (17)$$

With  $t_a > t_b$ ,  $\frac{\partial \Pi}{\partial T} < 0$  and  $\frac{\partial T}{\partial \Delta_a^u} < 0 < \frac{\partial T}{\partial \Delta_b^u}$ , both expressions are ambiguous at first glance. However, as the appendix shows, we can state

**Proposition 6** *The number of acquisitions in the low-tax country is inefficiently high (overinvestment) and the number of acquisitions in the high tax country is inefficiently low (underinvestment), i.e.  $\Delta_a^u > 0$  and  $\Delta_b^u < 0$ .*

**Proof.** See appendix. ■

In contrast to the separate accounting case, the number of acquisitions is inefficiently low in the high tax country. Thus, the introduction of formula apportionment abolishes the case of multinational investors reducing the profitability of domestic firms for profit shifting purposes. However, a new distortion is introduced. Multinational investors hesitate to invest in the high tax country because this implies an increase in the firm specific tax rate  $T$ . Accordingly, they overinvest in the low tax country in order to reduce  $T$ . In equilibrium, there is overinvestment in the low-tax and underinvestment in the high-tax country.

How do taxes affect the equilibrium number of acquisitions in both countries? To answer this question, it is important to understand the different tax effects. As becomes clear from equation (17), the number of acquisitions is efficient if  $\mu_i = 0$  and  $t_a = t_b$ . If  $t_a$  is slightly increased such that  $t_a > t_b$ , the firm starts investing strategically in order to manipulate the tax rate formula: Acquisitions are reduced in  $a$  and increased in  $b$ . This effect is partly set off by a second tax effect. If  $t_a > t_b$ , the multinational firm faces a firm specific tax rate of  $T$  with  $t_a > T > t_b$ . Ceteris paribus, it is then profitable for owners in  $a$  to sell their firms to the multinational investor while there is an incentive for owners in  $b$  to keep their firm (because their

tax rate is lower than the investor's one). As we show in the appendix, this latter effect is dominated by the former. We may state

**Proposition 7** *An increase in the tax rate  $t_a$  decreases the number of acquisitions in a and increases the number of acquisitions in b. Similarly, an increase in the tax rate  $t_b$  increases the number of acquisitions in a and decreases the number of acquisitions in b.*

**Proof.** See appendix. ■

Now, as in the preceding section, consider the welfare consequences of taxation. Welfare in country  $i$  is given by

$$\begin{aligned}
W_i = & \psi_i \left[ \theta_i \Pi_i + \int_{\Delta_i^-}^{\Delta_i^u} \pi (1 - t_i) d\Delta_i + \int_{\Delta_i^u}^{\Delta_i^+} P_i d\Delta_i \right] \\
& + \int_{\Delta_i^-}^{\Delta_i^u} t_i \pi d\Delta_i + t_i \frac{n_i}{N} B + \int_{\Delta_i^u}^{\Delta_i^+} \mu_i d\Delta_i
\end{aligned} \tag{18}$$

where  $B \equiv \int_{\Delta_i^u}^{\Delta_i^+} (\pi_i + \Delta_i) d\Delta_i + \int_{\Delta_{-i}^-}^{\Delta_{-i}^+} (\pi_{-i} + \Delta_{-i}) d\Delta_{-i}$  is the corporate tax base of the multinational firm.

The government in  $i$  maximizes  $W_i$  by setting the corporate tax rate according to  $\frac{\partial W_i}{\partial t_i} = 0$  with

$$\begin{aligned}
\frac{\partial W_i}{\partial t_i} = & -(\psi_i - 1) \int_{\Delta_i^-}^{\Delta_i^u} \pi d\Delta_i + \psi_i \left[ \theta_i \frac{\partial \Pi_i}{\partial t_i} + \int_{\Delta_i^u}^{\Delta_i^+} \frac{\partial P_i}{\partial t_i} d\Delta_i \right] \\
& + \left[ t_i \pi_i - t_i \frac{n_i}{N} \left( \pi_i + \Delta_i^u + \frac{n_{-i} B}{n_i N} \right) - \mu_i \right] \frac{\partial \Delta_i^u}{\partial t_i} - t_i \frac{n_i}{N} \left( \pi_{-i} + \Delta_{-i}^u - \frac{B}{N} \right) \frac{\partial \Delta_{-i}^u}{\partial t_i}
\end{aligned} \tag{19}$$

As before the question arises whether tax rates are efficient from a global point of view. For this purpose, consider the effect of a small increase in the other country's tax rate,  $t_{-i}$ , on country  $i$ 's welfare

$$\begin{aligned}
\frac{\partial W_i}{\partial t_{-i}} = & \psi_i \theta_i \frac{\partial \Pi_i}{\partial t_{-i}} + \left[ t_i \pi_i - t_i \frac{n_i}{N} \left( \pi_i + \Delta_i^u + \frac{n_{-i} B}{n_i N} \right) - \mu_i \right] \frac{\partial \Delta_i^u}{\partial t_{-i}} \\
& - t_i \frac{n_i}{N} \left( \pi_{-i} + \Delta_{-i}^u - \frac{B}{N} \right) \frac{\partial \Delta_{-i}^u}{\partial t_{-i}}
\end{aligned} \tag{20}$$



We can thus state

**Proposition 8** *An increase in the other country's tax rate,  $t_{-i}$ , increases national welfare.*

**Proof.** See appendix. ■

### 3 Discussion and conclusion

– to be added –

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## 4 Appendix

– *available upon request* –