

Tax Competition – Greenfield Investment versus Mergers and Acquisitions

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Abstract

In this paper, we analyze tax competition in a model where investor firms have the choice between two types of investment, greenfield investment and mergers and acquisitions. We show that the coexistence of these two types of investment intensifies tax competition in comparison to the case where there is only greenfield investment. If a specific tax on acquisitions is available, this result changes. Then, tax competition is mitigated compared to the pure greenfield case. The existence of an acquisition tax may even lead to corporate overtaxation.

JEL Code: H25, F23.

Keywords: corporate taxation, mergers and acquisitions, tax competition.

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1 Introduction

The increasing mobility of capital and the growing importance of multinational firms have given rise to an intensive political and academic debate on tax competition and the effects of taxes on cross-border capital flows. A large theoretical and empirical literature has emerged which has significantly improved our understanding of this issue. A characteristic of this literature is that it focuses almost entirely on greenfield investment. Building a new plant, however, is not the only way to realize an investment project. As an alternative, the investor may purchase an existing firm.

Empirically, mergers and acquisitions (m&a) play an important role. Figure 1 displays the total volume of all m&a transactions worldwide and in Europe (left ordinate) over time. Mergers and acquisitions come in waves with a peak of more than three trillion US dollars in 2000 and falling to only one trillion in 2002. The ordinate on the right depicts the fraction of national m&a, i.e. transactions where acquirer and vendor are within the same borders, and the sum of national and intraregional m&a. In contrast to the high volatility in volumes, these fractions stay virtually constant over time.

What is the difference between greenfield investment and mergers and acquisitions from a tax policy perspective? In standard models of tax competition¹, investment is modelled as a redistribution of net savings across countries. However, as recently pointed out by Desai and Hines (2004), m&a do not imply a relocation of corporate capital but rather a change in ownership and control rights. Clearly, firms which consider a new investment project often have the choice between different types of investment, including the acquisition of an existing firm or a greenfield investment. It is the purpose of this paper to analyse the implications of this choice for the welfare effects of tax competition. How would we expect mergers and acquisitions to affect tax competition? Intuitively, one could argue that acquisitions are less tax sensitive than greenfield investment because taxes are likely to be capitalized in the purchase price of immobile assets. This might suggest that the existence of m&a investment mitigates tax competition.

¹Standard references are Musgrave (1969) Feldstein and Hartman (1979), Wilson (1986), Zodrow and Mieszkowski (1986), Bond and Samuelson (1989), Bucovetsky and Wilson (1991).

In this paper, we develop a simple theoretical framework which allows to explore how the coexistence of m&a and greenfield investment affects corporate tax competition. We assume that investor firms considering a new project firstly screen the market for existing firms which are suitable as acquisition targets. If they do not find an adequate existing firm, they build a new plant (greenfield investment). We thus consider a setting where greenfield and m&a investments are substitutes. In such a framework, taxes may distort both the decision on the overall number of projects and the choice to realize these projects as greenfield investments or on the basis of acquisitions.

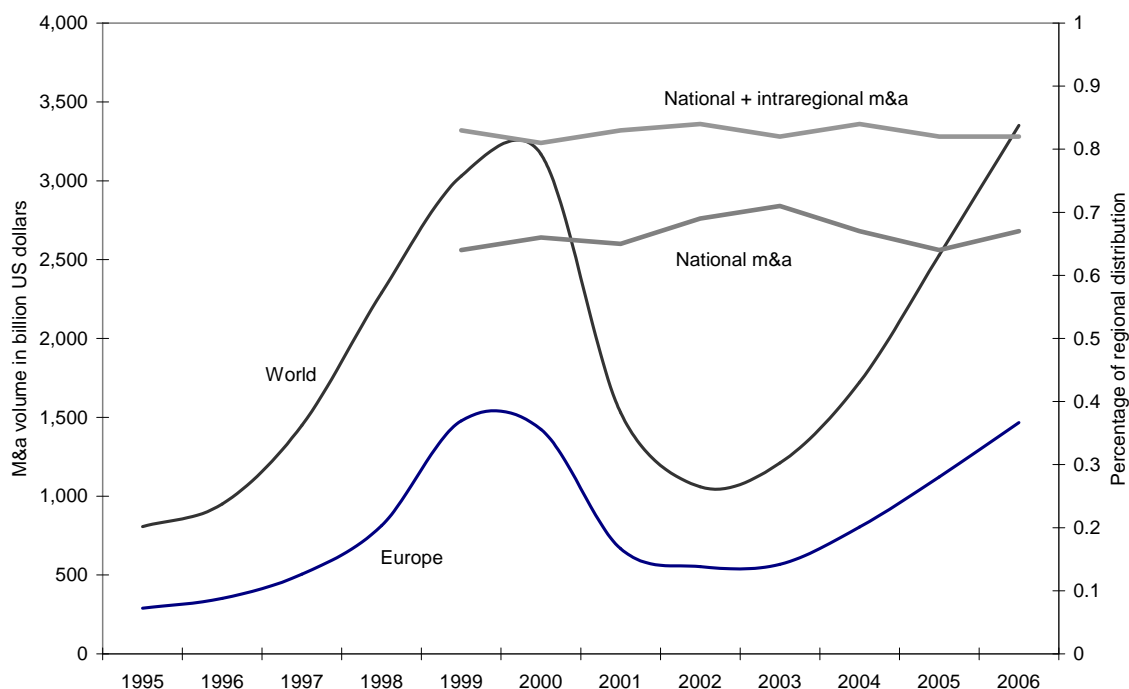


Figure 1: M&a volume worldwide (data source: Thompson Financial)

Our results do not confirm the view that the existence of mergers and acquisitions investment mitigates tax competition. To the contrary, in the baseline version of our model, we show that tax competition is intensified. The reason is that, due to the existence of m&a investment, greenfield investment becomes more tax sensitive. If a country increases its taxes, it does not only lose marginal greenfield investment projects, but intra-marginal greenfield projects are replaced

by acquisitions of existing firms. This reduces the number of 'new' projects in the country and, as a consequence, total tax revenue. Put differently, the introduction of m&a into the standard tax competition model generates a second fiscal externality which points in the same direction as the one known from the standard model. An interesting implication of this result is that high-tax countries are predicted to have more m&a projects than low-tax countries. But this is not to their advantage because, at the margin, greenfield projects generate more tax revenue than m&a projects.

Things are different, though, if one takes into account that tax policy may discriminate between m&a and greenfield projects. In this case, corporate tax competition is mitigated due to the existence of acquisition taxes. We demonstrate that there may even be equilibria where corporate taxes become too high in the sense that a coordinated increase of corporate tax rates reduces welfare. Furthermore, there is a potential for welfare enhancing coordination of the tax treatment of acquisitions. This also sheds light on attempts by the European Union to coordinate the tax treatment of cross-border m&a.²

In this paper, we focus on domestic m&a transactions in the presence of an international market for portfolio capital. We do so in order to relate our analysis as closely as possible to the standard literature on (harmful) tax competition and the underprovision of public goods, see the literature cited in footnote 1. Accounting for international transactions, i.e. cross-border greenfield and m&a projects, complicates the analysis by raising issues like repatriation tax schemes, foreign firm ownership effects, competition between domestic and foreign investors etc. These are all important aspects of international taxation, but including them would complicate our analysis without changing the main insights. We discuss some of these issues in the extensions section (3.2). Moreover, although cross-border transactions are more often debated, the bulk of transactions still takes place within national borders, as figure 1 shows. Our analysis demonstrates that such transactions are important for international tax competition, as well.

In the public finance literature, Devereux (1990) is one of the first to shift

²EC level coordination is mainly concerned about discrimination of border crossing relative to national transactions whereas our argument for coordination also applies to purely national transactions.

the focus from capital to ownership allocation. He does not refer explicitly to mergers and acquisitions but points out that tax distortions to ownership may be important if capital productivity depends on ownership. The paper introduces the concept of “capital ownership neutrality” as a property of international tax systems which avoid distortions in ownership. Gordon and Bovenberg (1996) also consider tax policy in a model where investors may acquire existing firms. But they concentrate on problems of asymmetric information, and a change in ownership does not affect the productivity of existing firms. Fuest and Huber (2004) analyze tax policy in a model where firms may be sold to foreign investors, but they focus on the integration of personal and corporate income taxes and do not discuss tax competition. Moreover, Desai and Hines (2004), as mentioned above, argue that capital flows in the form of M&A are likely to have implications for tax policy which differ from the implications of the standard capital mobility model. Their main point is that US taxation of foreign source income is likely to distort ownership patterns and to put US firms at a disadvantage when competing for foreign acquisitions. They propose to exempt foreign source income from domestic taxation.³ In Becker and Fuest (2007b), we analyze this argument and show that exemption is an appropriate policy choice when ownership advantage is a public good within the firm, but is dominated in welfare terms by a cross-border cash-flow tax system. Haufler and Schulte (2007) consider tax incentives in a model where mergers and acquisitions can take place within and across borders. They show that ownership patterns are highly important for the welfare implications of tax policy choices.

There is also a growing literature dealing with the impact of globalisation on mergers and acquisitions, see e.g. Neary (2007). This literature analyses mergers of firms operating in imperfectly competitive markets. In this paper, we deliberately abstract from imperfect competition and the question of how m&a investment affects market structures and trade patterns, mainly because we want to keep our approach as close as possible to standard models of tax competition. Nevertheless, we will discuss this issue further in the extensions section (3.3).

Apart from this, the present paper is related to two strands of literature.

³See also Desai and Hines (2003) and the debate between Grubert (2005) and Desai and Hines (2005).

Firstly, there are some recent theoretical papers on merger policy, e.g. Haufler and Nielsen (forthcoming), as well as on M&A and trade policy, e.g. Huck and Konrad (2004). Empirical evidence on M&A is reported in Andrade, Mitchell and Stafford (2001). A second strand of literature deals with capital mobility and tax competition.⁴ There is a broad empirical literature on the impact of taxes on investment and capital flows, which is surveyed by Hines (1999) and Devereux (2007). However, virtually all studies treat investment flows as if they were green-field projects.

Combining these two literatures raises the question of how taxation affects M&A activity. As Auerbach and Slemrod (1997) and Kaplan (1989) suggest, taxes may be of crucial importance for M&A investment. There are some papers discussing the impact of the U.S. tax reform on acquisitions of US firms by foreign investors. Here, the main idea is that the effective increase in the tax burden caused by the 1986 tax reform induced investors located in countries with foreign tax credit regimes to take over U.S. firms because the higher US taxes were credited against home country taxes (Scholes and Wolfson (1990), Collins, Kemsley and Shackelford (1995)). Swenson (1994) applies the same argument to US inbound foreign direct investment and finds robust evidence supporting the hypothesis. In a recent paper, Huizinga and Voget (2006) study the empirical impact of international taxation schemes on M&A activity.

The remainder of the paper is set up as follows. In section 2, we present the model and the main results. In section 3, we consider some extensions. Section 4 discusses some policy implications and concludes.

2 The model

In this section, we describe the setup of the model and derive a benchmark result which is based on greenfield investment. Then, we introduce the opportunity for investor firms to acquire existing firms.

⁴For a recent survey see e.g. Fuest, Huber and Mintz (2005).

2.1 The setup

The world consists of n identical open economies. Each country is populated by a representative household which lives for two periods. The utility function of the representative domestic household of country i is given by $U(C_1, C_2, G) = u(C_1) + C_2 + h(G)$,⁵ where C_1 and C_2 are consumption levels in the first and the second period and G is a public consumption good provided by the government in period 2. For notational convenience, we omit the country index unless misunderstandings may arise. The functions $u(C_1)$ and $h(G)$ are strictly concave, with $u' > 0$, $u'' < 0$ and $h' > 0$, $h'' \leq 0$. In period 1, the household has an endowment of E units of a numeraire good. This numeraire good may be transformed into the private consumption good and the public consumption good on a one to one basis. Households may borrow or lend in the international capital market at the interest rate r . There are no residence based taxes on capital income.

Households are also endowed with m existing, immobile firms. We refer to these firms as target firms, as opposed to investor firms which will be introduced below. Target firms are endowed with immobile capital goods from investment in previous periods. They do not consider new investment opportunities, but they may be sold to investor firms. If a target firm is not sold to an investor firm, it yields an after tax profit $\pi(1 - \tau)$ in period 2, where τ is the corporate tax rate. Thus, under their initial owners, all target firms are assumed to yield the same profits. However, we assume that they differ in their suitability as acquisition targets. This will be explained in greater detail below.

Next to the target firms, there is a large number of investor firms. For notational convenience, we normalize their number to unity. The representative investor firm is also owned by the domestic household.⁶ The investor firm considers a set of investment projects in its country of residence. In the second period, each project j yields a project-specific pre-tax return denoted by Δ_j . Δ is assumed to be uniformly distributed over the interval $[\Delta^-, \Delta^+]$. The distribution function is

⁵We use this quasilinear utility function because it eliminates income effects on savings which would complicate the analysis without adding further insights.

⁶Thus, there is no cross-border investment in the strict sense. However, in the absence of repatriation taxes, the results derived in this model carry over to the case of cross-border investment, but get more complex due to the incentive to tax profits accruing to foreign owners, as will be discussed in section 3.

denoted by $\Omega(\Delta)$. The cost of investment in period 1 cannot be deducted from the corporate tax base in period 2. Thus, the after tax cash flow generated by project j in period 2 is given by $\Delta_j(1 - \tau)$. These projects may be carried out as greenfield investments or as acquisitions, which means that the level of Δ_j does not depend on the type of transaction. The cost of investment may differ, though. If a project is carried out as a greenfield investment, it requires the investment of one unit of the numeraire good in period 1. If the project is carried out on the basis of an acquisition, rather than a greenfield investment, the investor firm has to acquire an existing target firm in period 1.

We will proceed as follows. As a first step, we assume that all projects are greenfield investment projects. In a second step, we introduce the opportunity to acquire existing firms and thus allow for greenfield and m&a investment to coexist.

2.2 Greenfield investment

Assume that all projects are carried out as greenfield investments. In this case, the investor firm will carry out all investment projects whose return exceeds a critical value Δ^c . The firm will choose this critical value so as to maximize its market value V^{gf} , which is given by

$$(1 + r) \left[V^{gf} + \int_{\Delta^c}^{\Delta^+} d\Delta \right] = \int_{\Delta^c}^{\Delta^+} \Delta (1 - \tau) d\Delta \quad (1)$$

The superscript gf denotes the pure greenfield case. Maximizing V^{gf} over the cutoff value Δ^c yields the result that, not surprisingly, investment is decreasing in the interest rate and the corporate tax rate:

$$\Delta^c = \frac{1 + r}{1 - \tau} \quad (2)$$

In the first period, the household finances greenfield investment of the domestic investor firm. In addition, the household may borrow ($S > 0$) or lend ($S < 0$) in the international credit market. The household's budget constraint is

$$C_1^{gf} = E - S - \int_{\Delta^c}^{\Delta^+} d\Delta \quad (3)$$

In the second period, the household receives income from savings, profit income from ongoing firms and profit income from the investor firm. The budget constraint is given by

$$C_2^{gf} = S(1+r) + m\pi(1-\tau) + \int_{\Delta^c}^{\Delta^+} \Delta(1-\tau) d\Delta \quad (4)$$

Optimal savings of the domestic households imply

$$u'(C_1) = 1+r \quad (5)$$

The budget constraint of the government is

$$G^{gf} = \tau \left[m\pi + \int_{\Delta^c}^{\Delta^+} \Delta d\Delta \right] \quad (6)$$

Consider next the determination of the interest rate in the international capital market. Capital market equilibrium implies

$$\sum_{i=1}^n S^i = 0 \quad (7)$$

Equations (5) and (7) determine S^i , $\forall i = 1, \dots, n$, and r , for given values of τ^i . Straightforward comparative static analysis yields

$$\frac{dr}{d\tau^d} = \frac{\partial \Delta^{dc}}{\partial \tau^d} \frac{1}{\Gamma} < 0 \quad (8)$$

where $\Gamma = \sum \left[\frac{1}{u^{i''}(C_1^i)} - \frac{1}{(1-\tau^i)} \right] < 0$, i.e. an increase in the tax rate in country d leads to a decline in the interest rate.⁷

2.3 Tax competition and tax coordination with greenfield investment

Under tax competition, the domestic government maximizes domestic welfare $W = u(C_1) + C_2 + h(G)$ subject to the constraints in (3)-(6) and takes the tax policy of

⁷Note that if $n \rightarrow \infty$, then $\Gamma \rightarrow -\infty$ and $\frac{dr}{d\tau^i} \rightarrow 0$.

the other countries as given. The first order condition for the optimal tax policy of the domestic country can be written as

$$\frac{\partial W}{\partial \tau} = (h' - 1) \left[m\pi + \int_{\Delta^c}^{\Delta^+} \Delta d\Delta \right] - h' \hat{\tau} \frac{\partial \Delta^c}{\partial \tau} \Delta^c + \frac{\partial W}{\partial r} \frac{\partial r}{\partial \tau} = 0 \quad (9)$$

where $\hat{\tau} = \arg \max_{\tau} W$ and

$$\frac{\partial W}{\partial r} = S - h' \hat{\tau} \Delta^c \frac{\partial \Delta^c}{\partial r} \quad (10)$$

with $\frac{\partial \Delta^c}{\partial r} = \frac{1}{1-\tau}$. The government faces a trade-off between raising tax revenue for public goods provision and distorting investment. In a symmetric equilibrium, with $S = 0$, an underprovision of public goods relative to a first best equilibrium occurs, i.e. $h' > 1$.⁸

How does a simultaneous change in all corporate tax rates, departing from the equilibrium without coordination, affect global welfare? The change in welfare of an individual country d can be formulated as

$$dW^d = \frac{\partial W^d}{\partial \tau_d} d\hat{\tau}_d + \sum_{i=1}^{n-1} \frac{\partial W^d}{\partial \tau_i} d\hat{\tau}_i. \quad (11)$$

The optimal tax policy under tax competition implies $\frac{\partial W^d}{\partial \tau_d} = 0$. A change in the tax rate of other countries, though, does affect welfare in country d because it affects the interest rate in the world capital market. Using (8), (10) and the symmetry property of the equilibrium under tax competition, the overall welfare effect can be written as

$$dW^d = \frac{\partial W^d}{\partial r} \sum_{i=1}^{n-1} \frac{\partial r^i}{\partial \tau_i} d\hat{\tau}_i = h' \frac{\hat{\tau}}{1 - \hat{\tau}} (\Delta^c)^2 \left(\frac{n-1}{n} \right) \frac{u''}{u'' - (1 - \hat{\tau})} d\hat{\tau} > 0 \quad (12)$$

which implies that a coordinated increase in the corporate tax rate increases

⁸The first order condition for the optimal tax rate can be written as $\frac{\partial W}{\partial \tau} = [h' - 1] \left[m\pi + \int_{\Delta^c}^{\Delta^+} \Delta d\Delta \right] - h' \hat{\tau} \frac{\partial \Delta^c}{\partial \tau} \Delta^c \left[1 + \frac{\partial \Delta^c}{\partial r} \frac{\partial r}{\partial \tau} \right] = 0$. Using the expressions derived above, this simplifies to $\frac{\partial W}{\partial \tau} = (h' - 1) \left[m\pi + \int_{\Delta^c}^{\Delta^+} \Delta d\Delta \right] - \left[1 - \frac{u''}{n[u'' - (1 - \tau)]} \right] h' \hat{\tau} \frac{\partial \Delta^c}{\partial \tau} \Delta^c = 0$, so that $h' > 1$.

welfare.

Proposition 1 *A coordinated increase in all corporate tax rates, departing from the equilibrium under tax competition, increases welfare.*

This result is well known from the literature on tax competition with greenfield investment. The undertaxation result occurs because corporate tax cuts give rise to negative fiscal externalities on other countries.⁹ It serves as a benchmark for the analysis of tax competition in the presence of mergers and acquisitions in the following section.

2.4 Adding mergers and acquisitions

We now allow firms to choose between acquisitions and greenfield investment as possible ways to realize their project. An acquisition is a substitute for a greenfield investment, but we assume that it is an imperfect substitute. Existing firms with ongoing production differ in their suitability as target firms. We model this as follows. If an investor firm decides to carry out a project on the basis of an acquisition of target firm g , rather than a greenfield investment, there is an output loss in period 2 denoted by k^g . The variable k^g is assumed to be uniformly distributed over the interval $[0, k^+]$. The distribution function is denoted by $\Phi(k)$. The underlying idea is that greenfield investment allows the investor firm to set up its factory and choose a labour force exactly as it suits its interests whereas existing firms will not exactly match the investor's needs.¹⁰

What are the tax implications of an acquisition? We assume that the proceeds from selling a firm are untaxed and that the acquiring firm cannot write off the purchase price. This comes close to the usual tax treatment of a share deal, as opposed to an asset deal. We will discuss the robustness of our results with respect to this assumption in the extensions section (3.1). In addition, there is a discriminatory tax on acquisitions which allows countries to tax greenfield investment and acquisitions investment differently. In real world tax systems, such

⁹The concept of fiscal externalities is explained in detail in Bucovetsky and Wilson (1991).

¹⁰Of course, it may also occur that existing firms have unique assets which make them more suitable than a newly created firm. It would be straightforward to include this case by allowing for a negative k .

a discrimination can be achieved by designing rules for the transfer of reserves, inter-company dividends, the depreciation of goodwill etc. We summarize this in a tax on acquisitions denoted by θ .

The acquisition price is determined as follows. Since some firms are more suitable as acquisitions targets than others, investor firms will also be willing to pay a higher price for them. However, the price a vendor may charge is limited by the fact that the investor firm may always choose a greenfield investment. In equilibrium, acquisition prices will be such that the representative investor firm is indifferent between the two options. This is the case if the price of firm g , $P(k^g)$, satisfies:

$$\frac{(\Delta_j - k^g)(1 - \tau) - \theta}{1 + r} - P(k^g) = \frac{\Delta_j(1 - \tau)}{1 + r} - 1 \quad (13)$$

which can be rearranged to

$$P(k^g) = 1 - \frac{k^g(1 - \tau) + \theta}{1 + r} \quad (14)$$

The initial owner of target firm g will sell the firm if the price is at least as high as the present value of the profit the firm will make if it is not sold.¹¹ This requires

$$P(k^g) - \frac{\pi(1 - \tau)}{1 + r} \geq 0 \quad (15)$$

It follows that the initial owners of all target firms characterized by a k^g satisfying $k^g \leq k^c$ will sell their firms, where k^c is given by

$$k^c = \frac{1 + r - \theta}{1 - \tau} - \pi \quad (16)$$

k^c thus characterizes the marginal acquisition, where the vendor is just indifferent between selling and not selling the firm. Acquisitions will only occur if $k^c > 0$. In the following, we will focus on equilibria where some acquisitions take place.¹² Note further that the tax system is neutral with respect to the number

¹¹The highest possible acquisition price is $P(0) = 1$ (if $\theta = 0$). This implies that the original investment cost to create the target firm, net of output generated in previous periods, must have been lower than 1.

¹²An equilibrium where no greenfield investment occurs is also possible, but will be neglected in the following.

of acquisitions if $\theta = \tau(1 + r)$, see (16). In the absence of an acquisitions tax, the corporate tax distorts the choice between acquisitions and greenfield investment in favour of acquisitions, i.e. k^c is higher than in the absence of corporate taxes.

Figure 2 illustrates the model. The first margin, which determines the overall number of investment projects, is defined by $\Delta^c = \frac{1+r}{1-\tau}$. For a given r , neither the initial profit level π nor the acquisition tax θ will affect the total number of investment projects carried out in the country under consideration. Note, though, that changes in all these parameters may affect the equilibrium interest rate r . The second margin is defined by (16) and determines the number of projects realized on the basis of acquisitions, which is given by $\int_{k^-}^{k^c} dk$.

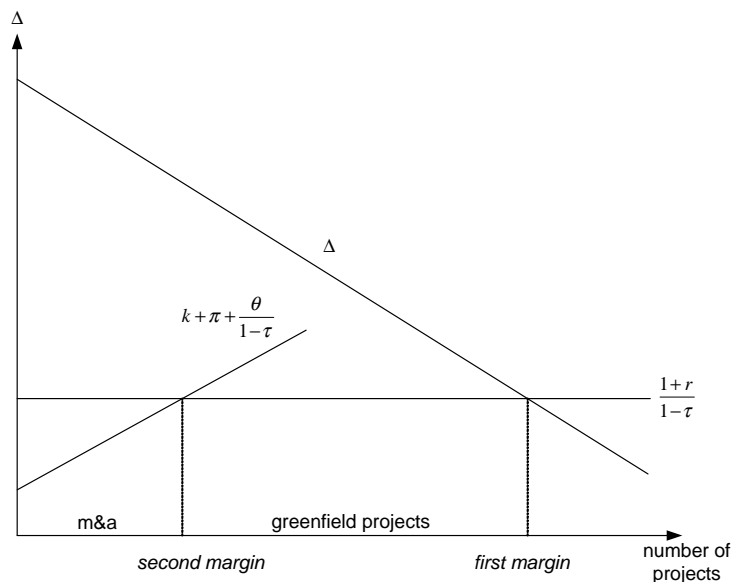


Figure 2: Two decision margins.

Not surprisingly, an increase in the acquisition tax θ reduces the number of acquisitions. In contrast, an increase in the corporate tax rate c.p. leads to an increase in the number of acquisitions:

$$\frac{\partial k^c}{\partial \tau} = \frac{1 + r - \theta}{(1 - \tau)^2} > 0 \quad (17)$$

The reason is that the higher corporate tax is capitalized in the purchase price for existing (immobile) firms whereas the price of new capital does not change

(given r). Thus, acquisitions become more attractive relative to greenfield investment. An increase in the interest rate also leads to more acquisitions and less greenfield investment. The reason is that a higher interest rate means that new capital becomes more expensive. This increases the incentives to use 'old' capital.

The value of the firm is now given by

$$\begin{aligned} & (1+r) \left[V + \int_{\Delta^c}^{\Delta^+} d\Delta + \int_0^{k^c} (P(k) - 1) dk \right] \\ &= \int_{\Delta^c}^{\Delta^+} \Delta (1-\tau) d\Delta - \int_0^{k^c} (\theta + (1-\tau)k) dk \end{aligned} \quad (18)$$

In period 1, expenditure for greenfield investment is equal to the overall number of projects which are carried out, $\int_{\Delta^c}^{\Delta^+} d\Delta$. For each acquisition, the firm has to pay the acquisition price $P(k)$, but it can reduce its expenditure on "new" capital by one unit. In period 2, the cash flow is reduced by the tax on acquisitions and the after-tax output loss $(1-\tau)k$.

Competition between investors drives up the prices of target firms so that investor firms are indifferent between acquisitions and greenfield investment. As a result, the equilibrium value of the investor firm does not depend on the mix between greenfield investment and acquisitions. Using $P(k^g) = \frac{1+r-k^g(1-\tau)-\theta}{1+r}$, the firm value equation boils down to

$$(1+r) \left[V + \int_{\Delta^c}^{\Delta^+} d\Delta \right] = \int_{\Delta^c}^{\Delta^+} \Delta (1-\tau) d\Delta. \quad (19)$$

This reflects that the surplus created by using existing firms rather than new capital fully accrues to the initial owners of the target firms. The maximization of V over the total number of projects Δ^c yields

$$\Delta^c = \frac{1+r}{1-\tau} \quad (20)$$

Thus, the marginal project is a greenfield project in the sense that the overall number of investment projects realized in the country under consideration is determined by the cost of greenfield investment. The mix between greenfield projects

and acquisitions depends on the availability of suitable target firms. More formally, the number of acquisitions is determined by (16). The remaining projects are realized as greenfield investments.

Consider next the budget constraints of the private household and the government. The budget constraint of the domestic household in period 1 can be written as

$$C_1 = E - S - \left(\int_{\Delta^c}^{\Delta^+} d\Delta - \int_0^{k^c} dk \right) \quad (21)$$

Compared to the pure greenfield case, the household can reduce the expenditure for investment in period 1 by using 'old' rather than 'new' capital, i.e. by increasing the number of acquisitions. The second period budget constraint is given by

$$\begin{aligned} C_2 = & S(1+r) + \left(m - \int_0^{k^c} dk \right) \pi (1-\tau) \\ & + \int_{\Delta^c}^{\Delta^+} \Delta (1-\tau) d\Delta - \int_0^{k^c} (\theta + (1-\tau)k) dk \end{aligned} \quad (22)$$

Here, the the existence of acquisitions affects consumption opportunities as follows. The second term on the right hand side of (22) reflects that the household's income from ongoing firms is now smaller because some of them have been acquired by the investor firm. The third and the fourth terms represent the profits from new investment (based either on acquisitions or greenfield projects) net of acquisition taxes and the output losses due to k . The public sector budget constraint now becomes

$$G = \tau \left[\left(m - \int_0^{k^c} dk \right) \pi + \int_{\Delta^c}^{\Delta^+} \Delta d\Delta \right] + \int_0^{k^c} (\theta - \tau k) dk \quad (23)$$

Each additional acquisition increases tax revenue by the acquisition tax θ and reduces it through the output loss k and by decreasing the number of ongoing firms, so that tax revenue declines by $\tau(\pi + k^c)$, at the margin.

2.5 Capital market equilibrium

Given the functions $k_i^c = k_i^c(r, \tau_i, \theta_i)$ and $\Delta_i^c = \Delta_i^c(r, \tau_i)$, $i = 1 \dots n$, implied by (16) and (20), the capital market equilibrium is determined by the first order conditions for optimal savings $u^{i'} = 1 + r$, $i = 1 \dots n$, and the credit market equilibrium condition $\sum_i S^i = 0$. These $n + 1$ equations determine optimal savings S_i , $i = 1 \dots n$, and the interest rate r , for given values of the tax instruments τ_i and θ_i , $i = 1 \dots n$. Thus, the interest rate in the international capital market can be expressed as a function $r = r(\tau_1 \dots \tau_n, \theta_1 \dots \theta_n)$. Standard comparative static analysis yields

$$\frac{\partial r}{\partial \tau_i} = \left(\frac{\partial k_i^c}{\partial \tau_i} + \frac{\partial \Delta_i^c}{\partial \tau_i} \right) \frac{1}{\Gamma} < 0 \quad (24)$$

$$\frac{\partial r}{\partial \theta_i} = \frac{\partial k_i^c}{\partial \theta_i} \frac{1}{\Gamma} > 0 \quad (25)$$

where $\Gamma = \sum_{i=1}^n \left(\frac{1}{u^{i''}} - \frac{2}{(1-\tau_i)} \right) < 0$. Equation (24) shows that, as expected, an increase in the tax rate τ_i reduces the interest rate. An increase in θ_i , in contrast, increases the interest rate because it reduces the number of acquisitions while the overall number of projects carried out in country i remains constant. As a result, capital demand for greenfield investment in country i increases, and this drives up the interest rate.

2.6 Tax competition

Again, we assume that countries set their tax policy to maximize the welfare of the representative domestic household and take the tax policy of the other countries as given. In the presence of acquisitions, the first order condition for the optimal corporate tax rate is given by

$$\begin{aligned} \frac{\partial W}{\partial \tau} = & (h' - 1) \left[\left(m\pi - \int_{k^-}^{k^c} (\pi + k) dk \right) + \int_{\Delta^c}^{\Delta^+} \Delta d\Delta \right] \\ & - h' \left(\left(\hat{\tau} (\pi + k^c) - \hat{\theta} \right) \frac{\partial k^c}{\partial \tau} + \hat{\tau} \Delta^c \frac{\partial \Delta^c}{\partial \tau} \right) + \frac{\partial W}{\partial r} \frac{\partial r}{\partial \tau} \end{aligned} \quad (26)$$

where $\hat{\tau} = \arg \max_{\tau} W$ and $\hat{\theta} = \arg \max_{\theta} W$, as defined below. How does the coexistence of greenfield investment and acquisitions affect the optimal tax policy? An increase in the corporate tax raises revenue, as reflected by the first term on the right hand side of (26), and changes the corporate tax base, as the second term indicates. In contrast to the case of pure greenfield investment, there is a second margin which affects the tax base. An increase in the corporate tax induces firms to replace greenfield investment by acquisitions. For a given interest rate, the effect on tax revenue is equal to $-\left(\hat{\tau}(\pi + k^c) - \hat{\theta}\right) \frac{\partial k^c}{\partial \tau}$. Finally, tax policy affects the interest rate. This is captured by the term $\frac{\partial W}{\partial r} \frac{\partial r}{\partial \tau}$ with

$$\frac{\partial W}{\partial r} = S - h' \left(\left(\hat{\tau}(\pi + k^c) - \hat{\theta} \right) \frac{\partial k^c}{\partial r} + \hat{\tau} \Delta^c \frac{\partial \Delta^c}{\partial r} \right) \quad (27)$$

which can be simplified to $\frac{\partial W}{\partial r} = S - h' \frac{2\hat{\tau}(1+r) - \hat{\theta}}{(1-\hat{\tau})^2}$. What is the difference between this expression and the one from the pure greenfield case? Next to the effect on interest income (reflected by S), a rise in r lowers the total number of projects realized in the domestic country. This is reflected by an increase in the cutoff level Δ^c . In addition, the number of acquisitions increases (k^c rises), which affects tax revenue as discussed above.

How are taxes on acquisitions set in a tax competition equilibrium? The first order condition for the optimal tax on acquisitions is given by:

$$\frac{\partial W}{\partial \theta} = (h' - 1) \int_0^{k^c} dk - h' \left(\left(\hat{\tau}(\pi + k^c) - \hat{\theta} \right) \frac{\partial k^c}{\partial \theta} \right) + \frac{\partial W}{\partial r} \frac{\partial r}{\partial \theta} = 0 \quad (28)$$

Using (27) and $k^c = \frac{1+r-\hat{\theta}}{1-\hat{\tau}} - \pi$, equation (28) can be rewritten as

$$\frac{\partial W}{\partial \theta} = (h' - 1) \int_0^{k^c} dk - \frac{h'}{(1-\hat{\tau})^2} \left[\left(\hat{\theta} - \hat{\tau}(1+r) \right) \left(1 - \frac{\partial r}{\partial \theta} \right) + \hat{\tau}(1+r) \frac{\partial r}{\partial \theta} \right] = 0. \quad (29)$$

The optimal level of θ is given by:

$$\hat{\theta} = \frac{(1-\hat{\tau})^2}{\left(1 - \frac{\partial r}{\partial \theta}\right)} \left(\frac{h' - 1}{h'} \right) \int_0^{k^c} dk + \hat{\tau}(1+r) \left(\frac{1 - 2\frac{\partial r}{\partial \theta}}{1 - \frac{\partial r}{\partial \theta}} \right) \quad (30)$$

Since $\frac{dr}{d\theta} < 0, 5$ for all n and u'' , the right hand side of (30) is unambiguously positive. It thus turns out that the acquisitions tax which emerges under tax competition is positive. However, it is ambiguous whether or not the tax system as a whole discriminates acquisitions relative to greenfield investment (as mentioned above, neutrality requires $\hat{\theta} = \hat{\tau}(1+r)$).¹³

2.7 Tax Coordination

Is there any scope for welfare enhancing tax coordination? Consider first a coordinated change in τ , departing from the equilibrium under tax competition and holding constant the acquisition tax θ . The effect on the welfare of the country under consideration is given by

$$dW^d = \frac{\partial W^d}{\partial \tau_d} d\hat{\tau}_d + \sum_{i=1}^{n-1} \frac{\partial W^d}{\partial \tau_i} d\hat{\tau}_i \quad (31)$$

Given that $\frac{\partial W^d}{\partial \tau_d} = 0$ holds in the equilibrium under tax competition, and using the symmetry property $S^i = 0 \forall i$, the welfare effect can be expressed as

$$dW^d = \frac{\partial W^d}{\partial r} \sum_{i=1}^{n-1} \frac{\partial r}{\partial \tau_i} d\hat{\tau}_i = -h' \left[\left(\hat{\tau} (\pi + k^c) - \hat{\theta} \right) \frac{\partial k^c}{\partial r} + \hat{\tau} \Delta^c \frac{\partial \Delta^c}{\partial r} \right] \sum_{i=1}^{n-1} \frac{\partial r}{\partial \tau_i} d\hat{\tau}_i \quad (32)$$

The first term in the parentheses on the right hand side of (32) reveals that the existence of mergers and acquisitions gives rise to an additional fiscal externality of corporate tax cuts. A corporate tax cut in other countries increases the interest rate. This leads to an increase in acquisitions ($\frac{\partial k^c}{\partial r} > 0$) or, more precisely, to a substitution of greenfield investment by acquisitions. The increase in acquisitions may increase or decrease tax revenue, depending on whether $\tau(\pi + k^c) - \theta$ is positive or negative. If $\theta = 0$, (16) implies that tax revenue declines as greenfield investment is replaced by acquisitions. In this case, a negative fiscal externality arises, which reinforces the standard externality due to the decline in the overall number of projects. The latter is captured by the second term in the parentheses

¹³It is straightforward to show that $\hat{\theta} > \hat{\tau}(1+r)$ emerges if the number of countries n is large, which implies that $\frac{\partial r}{\partial \theta}$ converges to zero.

in (32). This implies that the possibility of replacing greenfield investment by acquisitions (and vice versa) unambiguously intensifies tax competition if there is no acquisitions tax. In contrast, if there is such a tax, the situation is different because the sign of the fiscal externality caused by the existence of acquisitions becomes ambiguous. Equation (32) can be rearranged to

$$dW^d = h' \frac{(\hat{\theta} - 2\hat{\tau}(1+r))}{(1-\tau)^2} \sum_{i=1}^{n-1} \frac{\partial r}{\partial \tau_i} d\hat{\tau}_i \quad (33)$$

Given (24), it is easy to show that this expression may in general be positive or negative. We summarize this in

Proposition 2 *In the absence of a tax on acquisitions, the possibility of replacing acquisitions by greenfield investment gives rise to an additional negative fiscal externality of corporate tax cuts. Tax competition is intensified. A coordinated increase of the corporate tax increases welfare.*

Proposition 3 *In the presence of an acquisitions tax, a coordinated increase of corporate tax rates is welfare enhancing if $\hat{\theta} < 2\hat{\tau}(1+r)$ and reduces welfare if $\hat{\theta} > 2\hat{\tau}(1+r)$. If $\hat{\theta} = 2\hat{\tau}(1+r)$, the different fiscal externalities compensate each other and coordination does not affect welfare.*

Proposition 3 implies that the question of whether corporate tax rates are too high or too low under tax competition depends on the level of the acquisition tax. As pointed out in the preceding section, $\hat{\theta}$ is unambiguously positive in the tax competition equilibrium, but whether it exceeds $2\hat{\tau}(1+r)$ is, in general, ambiguous. Given that the standard model with only greenfield investment unambiguously leads to undertaxation, the question arises whether a negative welfare effect of a coordinated corporate income tax increase is possible. The appendix provides an example showing that parameter ranges exist where $\hat{\theta} - 2\hat{\tau}(1+r) > 0$ holds in the equilibrium under tax competition. We may thus state:

Proposition 4 *The opportunity to levy a tax on acquisitions mitigates tax competition. In the presence of an acquisitions tax, a coordinated increase in corporate tax rates may reduce welfare.*

The result in proposition 4 shows that taking into account the existence of m&a investment in the analysis of tax competition is important because one of the benchmark results in the theory of corporate tax competition - the finding that tax competition leads to an undertaxation of corporate profits, is called into question. The economic explanation for this result is the following. A tax cut in country i drives up the interest rate r . This will reduce the level of greenfield investment in all other countries. Since the taxes on the marginal greenfield investment are positive, tax revenue and, hence, welfare in these countries declines. But at the same time, the higher interest rate leads to an increase in the number of acquisitions. If the tax on acquisitions is sufficiently high, this has a positive impact on overall tax revenue. The second fiscal externality may dominate the first, so that the fiscal externalities of corporate tax cuts may in fact be positive in our model.

Is there any scope for welfare enhancing tax coordination of acquisition taxes? The welfare effect of a coordinated tax change, departing from the equilibrium under tax competition and holding constant the corporate tax τ , is given by

$$dW^d = \frac{\partial W}{\partial r} \sum_{i=1}^{n-1} \frac{\partial r}{\partial \theta_i} d\hat{\theta}_i \quad (34)$$

Using (27) and (25), this can be expressed as:

$$dW^d = h' \frac{(\hat{\theta} - 2\hat{\tau}(1+r))}{(1-\hat{\tau})^2} \left(\frac{n-1}{n} \right) \left(\frac{u''}{2u'' - (1-\hat{\tau})} \right) d\hat{\theta} \quad (35)$$

We may therefore state

Proposition 5 *Departing from the equilibrium under tax competition, a coordinated reduction in the tax on acquisitions increases (reduces) welfare if $\hat{\theta} < 2\hat{\tau}(1+r)$ ($\hat{\theta} > 2\hat{\tau}(1+r)$).*

The welfare effects of tax coordination of both τ and θ depend on whether $\hat{\theta}$ is larger or smaller than $2\hat{\tau}(1+r)$. This is not surprising because in our model fiscal externalities are transmitted through the interest rate in the international capital market. If $\hat{\theta} < 2\hat{\tau}(1+r)$, tax changes which drive up the interest rate give rise to negative fiscal externalities and vice versa.

3 Extensions

In this section, we consider three extensions of the above presented model. In subsection 3.1, we show that our results are robust to modifications in the tax treatment of acquisitions. Subsection 3.2 discusses the implications of cross-border acquisitions. In subsection 3.3, we provide a brief discussion of imperfect competition and its importance for the analysis of mergers and acquisitions.

3.1 Taxation of capital gains and deductibility of acquisition expenditures

An important but certainly restrictive assumption we have made is that the revenue from selling the firm, which accrues to the initial owners, is not subject to tax, and the investor firm cannot deduct the purchase price. The tax consequences of acquisitions are important in our model because it is relevant for a key effect which drives our results: the finding that a higher corporate income tax induces firms to replace greenfield investment by acquisitions. The question is how robust this result is. An alternative approach would be to assume that the vendor has to pay tax on the revenue from selling the firm while the acquiring firm may deduct the purchase price. This would be a simple way of modelling the usual tax treatment of an asset deal, as opposed to a share deal. In this case, the investor firm will be indifferent between acquiring any firm g and making a greenfield investment if

$$\frac{(\Delta_j - k^g)(1 - \tau) - \theta}{1 + r} - P(k^g)(1 - \tau) = \frac{\Delta_j(1 - \tau)}{1 + r} - 1. \quad (36)$$

The initial owners will sell their firm if

$$P(k^g)(1 - \tau) - \frac{\pi(1 - \tau)}{1 + r} \geq 0 \quad (37)$$

This implies that all target firms characterized by a level of k satisfying $k \leq k^c$ will sell their firms, where k^c is given by

$$k^c = \frac{1 + r - \theta}{1 - \tau} - \pi \quad (38)$$

which is identical to the expression in equation (16). The reason is that, compared to the baseline version of our model, the tax disadvantage of the vendor is exactly equivalent to the tax advantage of the buyer. It is straightforward to show that our results are robust with respect to different ways of treating acquisitions for tax purposes, provided that the vendor and the seller are treated symmetrically. Situations where this is not the case are captured by our parameter θ .

3.2 Cross-border m&a investment

So far, our analysis has been restricted to national acquisitions. What happens if we allow for cross-border acquisitions in our model? The simplest way of introducing cross-border acquisitions is to assume that the investor firms from one country also undertake greenfield investments and acquisitions in other countries. Since the location of the headquarter of the investor firms does not play any economic role in our model, this would be equivalent to assuming that investor firms which undertake projects in country i are owned by residents of some other country i . This would change our results only in so far that the desire to tax profits accruing to foreign residents would be added as an additional motive to tax corporate profits. It is well known that this may lead to corporate overtaxation under tax competition (Huizinga and Nielsen (1997)).¹⁴ Of course, cross-border acquisitions would also raise issues like double taxation agreements or profit shifting. We are confident that adding these elements to the model would not change the key insights provided by the analysis, but a thorough analysis of these issues may nonetheless be valuable. We leave these questions for future research.

3.3 Imperfect Competition among Firms

Another limitation of our analysis is that we abstract from what is widely seen as an important factor for mergers and acquisitions: the existence of imperfect competition among firms. We have deliberately done so in order to keep our model as close as possible to the standard model of (harmful) tax competition. An alternative approach to analyse the role of m&a investment for tax competition would

¹⁴In an earlier version of this paper, we considered a framework with border crossing acquisitions. The results of the analysis are available from the authors on request.

be to start with a model of oligopolistic competition and add intergovernmental fiscal competition to it. Several additional issues would arise in this case. Firstly, m&a investment may change the number of firms in the market. If one firm which is active in the market acquires another active firm, consumers may be negatively affected by increasing prices. However, if the merger paradox applies, mergers will only arise if they give rise to synergies, which has further implications for both consumers and the fisc. It is even possible that prices decline, due to lower marginal costs of the newly created firm. Of course, greenfield investment may also change the number of firms in a market. In general, effects of investment on the intensity of competition in markets for private goods are not only an issue for tax policy but also for competition policy and merger control. Secondly, if the desire to reduce competition is a factor driving m&a investment, greenfield investment would not be considered as a substitute. Possibly, a framework without greenfield investment would be appropriate. There is no doubt that these issues are worth to be investigated in models of fiscal competition. But doing so would divert attention from the focus of this paper. In addition, the effects arising in our model are also likely to be relevant in models which do account for imperfect competition among firms.

4 Discussion and concluding remarks

This paper departs from the observation that the literature on international tax competition has neglected the role of mergers and acquisitions. It mainly focuses on greenfield investment although the former type of investment is empirically at least as important as the latter. We therefore suggest a simple framework which introduces mergers and acquisitions into a standard tax competition model. Investor firms choose between acquiring existing firms or realizing greenfield projects. We show that, if we abstract from the possibility of levying a specific tax on acquisitions, the introduction of m&a investment intensifies tax competition because it gives rise to an additional negative fiscal externality of corporate tax cuts. Interestingly, an increase in corporate taxes raises the number of acquisitions in a country but reduces the total number of investment projects. Therefore, a tax increase does not only affect the quantity of investment but also its composition

and, hence, its quality in terms of welfare.¹⁵

If an acquisition tax is available, uncoordinated policies lead to a positive tax in our model. Whether the tax system as a whole discriminates acquisitions relative to greenfield investment in a tax competition equilibrium is ambiguous. If the number of countries is large, a systematic discrimination of acquisitions relative to greenfield investment emerges. The existence of the acquisition tax implies that the fiscal externalities of corporate tax rate changes are different. If acquisition taxes are sufficiently high in the uncoordinated equilibrium, the fiscal externality which arises due to the existence of m&a investment becomes positive. As a result, corporate tax competition is mitigated, and it may even be that overtaxation occurs.

In terms of policy implications, our analysis draws attention to the fact that corporate tax coordination which focuses on the (tax inclusive) cost of capital for greenfield investment is incomplete. The tax treatment of acquisitions is an important factor as well. Clearly, it has to be taken into account that our model only highlights a rather specific aspect of mergers and acquisitions: the possibility of replacing a greenfield investment by an acquisition. There are many other factors driving mergers and acquisitions investment, and these factors are likely to be relevant for the workings of tax competition as well. This is an agenda for future research.

References

- Andrade, G., Mitchell, M. and Stafford, E. (2001). New Evidence and Perspectives on Mergers, *Journal of Economic Perspectives* **15**(2): 103–120.
- Auerbach, A. J. and Slemrod, J. (1997). The Economic Effects of the Tax Reform Act of 1986, *Journal of Economic Literature* **35**(June): 12–13.
- Becker, J. and Fuest, C. (2007a). Quantity versus Quality - The Composition Effect of Corporate Taxation on Foreign Direct Investment, *CESifo Working Paper No. 2126* .

¹⁵The idea that taxation may affect not only the quantity of investment but also its composition and, hence, its quality, is developed in greater detail in Becker and Fuest (2007a) .

- Becker, J. and Fuest, C. (2007b). Taxing Foreign Profits with International Mergers and Acquisitions, *Oxford University Center for Business Taxation Working Papers Series No. 07/19* .
- Bond, E. W. and Samuelson, L. (1989). Strategic Behavior and the Rules for International Taxation of Capital, *Economic Journal* **99**: 1099–1111.
- Bucovetsky, S. and Wilson, J. (1991). Tax Competition with Two Tax Instruments, *Regional Science and Urban Economics* **21**: 333–350.
- Collins, J., Kemsley, D. and Shackelford, D. (1995). Tax Reform and Foreign Acquisitions: A Microanalysis, *National Tax Journal* **48**(1): 1–21.
- Desai, M. A. and Hines, J. R. (2003). Evaluating International Tax Reform, *National Tax Journal* **56**(3): 487–502.
- Desai, M. A. and Hines, J. R. (2004). Old Rules and New Realities: Corporate Tax Policy in a Global Setting, *National Tax Journal* **57**(4): 937–60.
- Desai, M. A. and Hines, J. R. (2005). Old Rules and New Realities: Corporate Tax Policy in a Global Setting: Reply to Grubert, *National Tax Journal* **58**(2): 275–278.
- Devereux, M. P. (1990). Capital Export Neutrality, Capital Import Neutrality, Capital Ownership Neutrality and All That, *Unpublished Working Paper* .
- Devereux, M. P. (2007). The Impact of Taxation on the Location of Capital, Firms and Profit: A Survey of Empirical Evidence, *Oxford University Centre for Business Taxation Working Paper Series No. 07/2* .
- Feldstein, M. and Hartman, D. (1979). The Optimal Taxation of Foreign Source Investment Income, *Quarterly Journal of Economics* **93**(4): 613–629.
- Fuest, C. and Huber, B. (2004). Why Do Countries Combine the Exemption System for the Taxation of Foreign Profits with Domestic Double Taxation Relief?, *Journal of International Economics* **62**(1): 219–231.

- Fuest, C., Huber, B. and Mintz, J. (2005). Capital Mobility and Tax Competition, *Foundations and Trends in Microeconomics* **1**(1): 1–62.
- Gordon, R. H. and Bovenberg, A. L. (1996). Why is Capital So Immobile Internationally? Possible Explanations and Implications for Capital Income Taxation, *American Economic Review* **86**: 1057–1075.
- Grubert, H. (2005). Comment on Desai and Hines, "Old Rules and New Realities: Corporate Tax Policy in a Global Setting.", *National Tax Journal* **58**(2): 263–274.
- Haufler, A. and Nielsen, S. B. (forthcoming). Merger Policy to Promote Global Players? A Simple Model, *Oxford Economic Papers* .
- Haufler, A. and Schulte, C. (2007). Merger Policy and Tax Competition, *Working Paper* .
- Hines, J. R. (1999). Lessons from Behavioral Responses to International Taxation, *National Tax Journal* **52**(2): 305–322.
- Huck, S. and Konrad, K. A. (2004). Merger Profitability and Trade Policy, *Scandinavian Journal of Economics* **106**(1): 107–122.
- Huizinga, H. and Voget, J. (2006). International Taxation and the Direction and Volume of Cross-Border M&As, *CEPR Discussion Paper No. 5974* .
- Kaplan, S. (1989). Management Buyouts: Evidence on Taxes as a Source of Value, *Journal of Finance* **44**(3): 611–632.
- Musgrave, P. B. (1969). *United States Taxation of Foreign Investment Income: Issues and Arguments*, Cambridge (MA), International Tax Program, Harvard Law School.
- Neary, J. P. (2007). Cross-Border Mergers as Instruments of Comparative Advantage, *Review of Economic Studies* **74**(4): 1229–57.
- Scholes, M. S. and Wolfson, M. A. (1990). The Effects of Changes in Tax Laws on Corporate Reorganization Activity, *Journal of Business* **63**(1): S141–164.

- Swenson, D. L. (1994). The Impact of U.S. Tax Reform on Foreign Direct Investment in the United States, *Journal of Public Economics* **54**(2): 243–266.
- Wilson, J. D. (1986). A Theory of Interregional Tax Competition, *Journal of Urban Economics* **19**: 296–315.
- Zodrow, G. R. and Mieszkowski, P. (1986). Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods, *Journal of Urban Economics* **19**: 356–370.

Appendix: An example for corporate overtaxation due to the existence of m&a

In this appendix, we show that the tax competition equilibrium may indeed imply $\theta > 2\tau(1+r)$, so that corporate overtaxation (i.e. a positive welfare effect of corporate tax rate reductions) emerges. We do so by providing a simple example which makes the following assumptions.¹⁶ The number of countries n is large, so that $\frac{\partial r}{\partial \tau_i}$ converges to zero. The representative household's utility function takes the quadratic form

$$u(C_1) + C_2 = (a - bC_1)C_1 + C_2 \quad (39)$$

where a and b are positive parameters. Assume further that $h' = \alpha > 0$ and $h'' = 0$. Δ and k are uniformly distributed, with $\Delta^- = 0$. π is normalized to zero.

With the budget constraints given by (21) and (22), optimal period 1 consumption is given by $C_1 = \frac{a-(1+r)}{2b}$ which implies savings of

$$S = E - \int_{\Delta^c}^{\Delta^+} d\Delta + \int_0^{k^c} dk - \frac{a - (1+r)}{2b} \quad (40)$$

Due to symmetry, $S = 0$ holds in equilibrium. Therefore, (40) determines r . The total number of projects is given by $\frac{\Delta^+ - \Delta^c}{\Delta^+} m$ and the total number of acquisitions is $\frac{k^c}{k^+} m$. Note further that $\frac{k^{c2}}{2k^+} m = \int_0^{k^c} k dk$ and $\frac{(\Delta^+ - \Delta^c)(\Delta^+ + \Delta^c)}{2\Delta^+} m = \int_{\Delta^c}^{\Delta^+} \Delta d\Delta$.

¹⁶A more detailed description of how we derived the results in this example is available upon request.

Equations (26), (28) and (40) determine the equilibrium values of τ , θ and r . Starting with the optimality condition for θ , we can solve for θ and replace it in (40). Then, the resulting expression for r is replaced in (26). Assuming parameter values for α , m , E , k^+ , Δ^+ , a and b , τ can be determined iteratively. If $\alpha = 1.25$, $m = 20$, $E = 10$, $k^+ = 1$, $\Delta^+ = 3$, $a = 10$ and $b = 0.5$, the equilibrium values are

$$\hat{\tau} = 0.35, \quad \hat{\theta} = 0.97, \quad r = 0.19 \quad (41)$$

which implies $2\hat{\tau}(1+r) < \hat{\theta}$.¹⁷

¹⁷Note that these parameter values also imply $1+r > \theta$, which makes sure that an equilibrium with a positive number of acquisitions is considered.

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