Oxford University
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May 2014

WP 14/08

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Working paper series | 2014

SAID BUSINESS SCHOOL
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Taxing Multinationals in the Presence of Internal Capital Markets*

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This version: May 2014

Abstract

There is ample evidence that internal capital markets incur efficiency costs for multinational enterprises (MNEs). This paper analyzes whether tax avoidance behavior interacts with these costs and how policies of competing governments respond to it. We show that the interaction in itself may lead to profit taxes that are inefficiently high (low), provided the costs are attenuated (magnified) by higher profit taxes. Further, internal efficiency costs might render infrastructure provision inefficiently low. We also clarify the implications of the decision to set up an internal capital market and of external finance for the behavior of competing governments. The results are consistent with empirical findings that are not inherently related to the notion of fiscal competition.

JEL-Classification: H25, D21, F23

Keywords: fiscal competition, multinational firms, internal efficiency costs, managerial behavior, corporate tax avoidance.

*We thank seminar and conference participants in Bergen, Cambridge (RES, 2012), Copenhagen, Göttingen (VfS, 2012) Malaga (EEA, 2012), Munich, Bloomington (APET, 2011), and Uppsala (IIPF, 2010) for their valuable comments. In particular, we are grateful for detailed comments by Dirk Schindler. Financial support through a grant from the European Policy Research Network (EPRN grant # 30570) and the German Science Foundation (DFG STI 619/1-1) is gratefully acknowledged. The usual disclaimer applies.

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1 Introduction

There is considerable evidence that cross-country tax rate differences incentivize multinational enterprises (MNEs) to adopt tax avoidance strategies.[1] MNEs might run an internal capital market which allows the headquarter of the MNE to flexibly locate capital between divisions of the MNE.[2] The MNE can thereby exploit unforseen investment opportunities in divisions in the same way as relocating capital from high-tax countries to low-tax countries.[3] The tax avoidance behavior raises concerns about the ability of governments to tax MNEs, prompting governments to engage in a 'race to the bottom' in tax competition by setting corporate taxes at an inefficiently low level. See Keen and Konrad (2014) for a review of the literature.

In this paper, we evaluate the role of internal capital markets for incentives of governments to compete for capital. We expand the literature by considering that internal capital markets do not only allow for a flexible allocation of capital (the so-called bright side of the internal capital market), but might also entail efficiency costs for the MNE, the so-called dark side of internal capital markets (Gertner and Scharfstein, 2013). There is ample evidence that internal capital markets incur efficiency costs for MNEs which capitalize in firm values. For instance, consistent with this notion of frictions in internal capital markets, Lang and Stulz (1994) and Berger and Ofek (1995) find that conglomerates trade at a discount relative to comparable stand-alone firms that do not have access to an internal capital market. Further, business units of the conglomerate overinvest and show a sensitivity of investment to Tobin's Q lower than that of matched stand-alone firms (Berger and Ofek, 1995; Rajan et al., 2000; and Ozbas and Scharfstein, 2010, among others). Glaser et al. (2012) empirically document that more powerful division managers influence internal decisions and receive larger capital allocations. The latter

[1] MNEs adjust investment behavior, the pricing of intra-firm trade or financial policy to exploit international tax differentials, see Hines (1999) and Gresik (2001), among others, for an overview of the literature. Egger et al. (2010) show that MNE face a significantly lower tax burden than comparable firms which do not have access to international tax avoidance strategies. On average, foreign ownership reduces the tax burden by about 56 percent. Mintz and Smart (2004) find multidivisional firms to have an elasticity of taxable income with respect to tax rates of 4.9, compared with 2.3 for other, comparable firms that are constrained in shifting income through the use of a consolidated corporate tax base.

[2] There are numerous highly publicised cases where MNEs internally relocate capital. For instance, car manufacturers such as Volkswagen or General Motors typically resize investments in their different production plants when new car models are added to the product line, where the most productive location produces the new car series at the expense of deinvestments in the remaining locations. Fiscal incentives might also be involved in decisions to internally relocate capital. Recently, Nokia closed its production in Bochum, Germany and moved it to Romania where the investment was eligible for subsidies while subsidy eligibility in Germany had expired.

[3] See, e.g., Hubbard and Palia (1999), Desai et al. (2005a) and Egger et al. (2014) on the working of internal capital markets in MNEs and, in particular, Desai et al. and Egger et al. on how internal capital markets facilitate corporate tax avoidance.

are not related to managerial ability or better investment opportunities, thereby reflecting an inefficiency in how capital is internally allocated. Relatedly, social connections to the CEO facilitate inefficient capital allocations in practice, in particular when corporate governance is weak (Dutchin and Sosyura, 2013).

Using this insight, we set up a model of a MNE that has divisions in two tax jurisdictions. The MNE runs an internal capital markets which allows the MNE to flexibly allocate capital across divisions, thereby adding value to the firm. At the same time, however, it lowers productive effort provision by division managers. Managers exert effort to generate funds internally. Anticipating that these funds may be re-allocated through the internal capital market undermines effort provision by division managers. This reduces the amount of internal funds that the MNE uses to finance investments in its divisions. The disincentive effect, thereby, depresses firm value. We analyze how the efficiency costs respond to fiscal policies by the two jurisdictions and how this in turn influences the non-cooperative choice of fiscal policies. We show that efficiency costs may provide an upward pressure on profit taxes in fiscal competition, inducing governments to adopt policies that are not as starkly associated with fiscal competition as conjectured. The finding conforms to the empirical finding that the effective marginal corporate tax rate (which is the relevant tax measure in our context) has not dropped too much in recent decades and that the welfare gains from tax coordination might be limited.[4] Further, the analysis provides an explanation for the empirical finding that there is no tax-induced substitution between capital stocks of divisions of a MNE or that capital stocks are even complements. See Desai, Foley and Hines (2005b, 2009) for instance. We show that the efficiency costs create resource linkages across divisions of a MNE which introduce a tendency that divisional capital stocks co-move in response to a higher tax in one jurisdiction. The forces we identify for the co-movement of capital stocks apply when both retained earnings and external finance are the marginal source of funds.

We find that a higher tax in one jurisdiction may lower investments in the other jurisdiction; a negative externality which turns out to be stronger when internal and external capital markets intertwine in providing funds to divisions. This is in contrast with the standard notion of tax competition which predicts that, by lowering taxes, a country attracts capital at the expense of investments in other countries. This reasoning conforms with the view that MNEs' wordwide investments is fixed due to resource constraints, for instance. As shown here, internal invest-

[4]See Devereux et al. (2002) and Sorensen (2004), for instance.

ment budgets might not be fixed, but responsive to government policy. The implied negative investment externality among divisions of a MNE is in line with empirical findings in Becker and Riedel (2012). They show that a 10 percentage point increase in corporate taxes lowers capital stocks of affiliate divisions in foreign countries by 5.6 percent. The negative effect neutralizes a significant fraction of the otherwise-prevailing tax competition externality. Relatedly, the analysis might be helpful in understanding more recent empirical evidence on profit shifting, suggesting relatively low levels of profit shifting elasticities. This is a puzzling observation since it contrasts anecdotal evidence on widespread tax planning of MNEs as well as predictions of conventional models of MNE behavior (Dharmapala 2014). The paper offers a possible explanation for it. Profit shifting devices such as transfer pricing make taxable profits more elastic to tax rate differentials. As shown in the paper, this effect might be counteracted by investment responses that are related to efficiency costs changes.

We provide additional results related to the use of internal capital markets for tax savings for MNEs, the public provision of infrastructure services, and the way efficiency costs induce cross-border tax effects on investments in divisions of MNEs. By providing a structural modelling of the benefits and the costs of internal capital markets, we show that, although an internal capital market allows for tax savings, a MNE will not always opt for an internal capital market when profit taxes rise. Key to understanding the finding is that not only the benefits but also the efficiency costs of using an internal capital markets rise when profit taxes increase. Further, the efficiency costs of internal capital markets provide a downward pressure on infrastructure provision, i.e. infrastructure provision might be inefficiently low. The inter-divisional resource linkage implies that more public infrastructure provision in one jurisdiction tends to raise capital investments in all divisions. The latter finding is in contrast to the prediction of conventional models of fiscal competition in which infrastructure provision lures capital away from other countries, thereby generating a negative fiscal externality (e.g., Keen and Marchand, 1997). Finally, changes in efficiency costs may not always influence investments and thus the profit tax bases of MNE divisions. It will be absorbed by adjustments in external financing decisions of MNEs and shifted onto external financiers rather than the fiscal budget. Thereby, the incidence of tax-induced changes of efficiency costs depends on the use of external finance.

1.1 Related literature

The common finding in models of tax competition is that tax policies of the host countries of a MNE and its divisions influence the investment allocation within the MNE. For instance, MNEs strategically allocate their investments across divisions and generically choose lower levels of investments in countries with higher taxes, see Hines (1997) and Griffith et al. (2010) for instance. The literature focuses on the bright side of internal capital markets, thereby, abstracting away from efficiency costs that are related to the allocation of investments within MNEs.[5] This differs from the corporate finance view of the firm where internal capital markets and their disincentive effects are central to the way capital is allocated within multi-divisional firms (e.g., Stein, 1997, Scharfstein and Stein, 2000, Brusco and Panunzi, 2005, and Inderst and Laux, 2005).[6] The paper builds on these two strands of literature. To the best of our knowledge, this is the first paper looking at how the two sides of the internal capital market influence fiscal policies of competing governments.

There is a growing body of literature that emphasizes the interaction between corporate tax avoidance and non-tax costs of tax aggressiveness that follow from the separation of ownership and control, see Chen and Chu (2005), Crocker and Slemrod (2005) and Desai and Dharmapala (2006, 2009), for instance. The overall conclusion from this literature is that tax avoidance might facilitate opportunistic behavior by managers such as managerial earnings manipulation or rent diversion. This paper shares the basic notion that tax avoidance incurs internal efficiency costs. We extend the literature by looking at MNEs and how internal efficiency costs connect policy choices of competing jurisdictions.

By analyzing the tax-sensitivity of the extensive and intensive margin of internal capital markets, the paper also refers to the recent literature on the internal organization of MNEs and the role of public policy. For instance, trade costs (such as tariffs) and the quality of the legal system influence the decision to set up a multinational firm structure (Yeaple, 2003; Grossman et al., 2006; Antràs et al., 2009). More related to this paper, national tax policy may incentivize

[5] An alternative tax avoidance strategy of MNEs is to strategically price intra-firm trade (e.g., Haufler and Schjelderup, 2000). In such a setting, Elitzur and Mintz (1996) analyze how agency problems influence the behavior of governments in tax competition. The nature of the tax avoidance strategy and, also, the type of the internal efficiency costs differ from what we explore. Schindler and Schjelderup (2012) analyze how a conflict of interest between shareholders affects the strategic use of debt in MNEs to lower tax payments. Instead, we focus on real investment responses, non-aligned interests between division managers and the headquarter, and on the efficiency implications for non-cooperative tax rate choices.

[6] For a survey of the theoretical and empirical literature on internal capital markets, see Gertner and Scharfstein (2013).

firms to decentralize decision authority in an MNE (Nielsen et al., 2008), affects the internal provision of inputs that are commonly used by MNE divisions (Nielsen et al., 2010)[7], and alters the decision to set up a multinational firm structure that allows for tax savings through profit shifting (Bucovetsky and Haufler, 2008). Matsusaka and Nanda (2002) and Inderst and Müller (2003) also explore the relation between internal capital markets and firm boundaries without, however, addressing managerial incentives and tax competition.

The paper is organized as follows. Section 2 presents the model. Section 3 analyzes the behavior of a MNE and its effect on government tax policy. Section 4 turns to infrastructure policy. Section 5 analyzes the incentives to set up an internal capital market and the role of government policy while Section 6 considers the implications of external finance for the efficiency effects of internal capital markets. Section 7 provides a summary of the main results and draws some conclusions.

2 Model

We consider a multinational enterprise (MNE) with two divisions which are located in different countries. Each division is run by a manager who might exert effort to increase the profitability of the division. As to manager preferences, it may be assumed that managers maximize the profit of the division, see Elitzur and Mintz (1996) and Nielsen et al. (2008), among others. Alternatively, division managers might be empire builders, maximizing the size of the division they control. The assumption that empire-building is central to the motivation of division managers conforms with the corporate finance view on how managers behave in MNEs with internal capital markets, see Stein (1997), Scharfstein and Stein (2000), Brusco and Panunzi (2003), and Inderst and Laux (2005), for instance.[8] In the analysis, we start out with the latter view on managerial preferences, but should emphasize that the qualitative findings tend to be unaffected by the modelling choice. In Appendix A.2, we present a model with incentive wages for division managers. The results remain unchanged.

Hence, the division manager in country i, $i = 1, 2$, derives utility from the size of the division net of the cost of effort provision:

$$u_i = \theta E(k_i) - \phi(e_i), \quad \theta > 0. \tag{1}$$

[7] We discuss the paper in detail in Section 3.

[8] Empirical evidence on empire building behavior in multi-divisional firms includes Glaser et al. (2012), for instance.

θ is a preference parameter, k_i denotes the size of the division, as measured by the capital stock, and $\phi(e_i)$ is the manager's cost of effort provision where $\phi(e_i) = (\omega/2)\, e_i^2$, $\omega > 0$. Effort is denoted by e_i and is non-verifiable.

Each division starts with an investment project whose final return characteristics only become known in the course of time. The amount of capital employed by each division accumulates in two stages: At the first stage, the two managers exert effort e_i to increase the profitability of the investment and thereby the amount of cash-flow that is available in division i (e.g., Brusco and Panunzi, 2003). The cash-flow production function is $x_i(e_i) = a_i e_i, a_i > 0$. We allow $a_i \geq a_j$. The asymmetry may reflect differences in the levels of infrastructure or human capital the two managers use in local production. We endogenize the productive endowment of the two countries in Section 4.

Similar to managers, the headquarter is an empire builder (now with a focus on the total size of the MNE), but prefers to run an efficient empire. The headquarter has the residual control right over the use of capital in the two divisions and may change the scale of the two investment projects after it has received new information on the profitability of the investment projects. It pools the divisions' cash flow and allocates it across the two divisions, depending on their relative profitability. This is consistent with the view that the headquarter has a comparative advantage in observing and using information on productivity realizations compared to shareholders or banks, for instance. The informational advantage is a source for creating value in the multidivisional firm by 'winner-picking' and thereby creates demand for an internal capital market to exist, see e.g. Stein (1997), Motta (2003) and Gertner and Scharfstein (2013).

Final output at stage 2 is given by[9]

$$y_i = \alpha_i f(k_i) = \alpha_i k_i^{\beta}, \quad \text{with} \quad \alpha_i > 0 \quad \text{and} \quad 0 < \beta < 1. \tag{2}$$

The productivity parameter α_i is stochastic ex-ante, i.e. at the beginning of period 1. The headquarter only learns at the end of stage 1, after the two managers have decided on their effort levels, which division has the more profitable investment project. The productivity realization take values $\overline{\alpha} > \underline{\alpha} > 0$. Productivities are perfectly negatively correlated across divisions.[10] With

[9]For the sake of simplicity, the first-stage cash-flow production function is linear in effort. Concavity of the second-stage production function is necessary to ensure that the headquarter continuously changes the capital allocation in response to tax policy. We abstract from managerial effort provision at the second stage, i.e. after the headquarter has redistributed capital, since second-stage effort levels would not be distorted by the internal capital market.

[10]When the two productivity parameters are perfectly positively correlated, the bright side of the internal

probability $p \in (0,1)$, division 1's project yields a higher return before tax, i.e. $(\alpha_1, \alpha_2) = (\overline{\alpha}, \underline{\alpha})$. With probability $1-p$, division 2 has the better project, $(\alpha_1, \alpha_2) = (\underline{\alpha}, \overline{\alpha})$.

Division i's profits are taxed at source at rate τ_i.[11] For simplicity, first-period output (cash-flow) is not taxed. In doing so, we focus on tax effects that influence effort choices through the internal capital market. A tax on first-period cash-flow would discourage cash-flow production, thereby amplifying the forces that yield overtaxation of profits and underprovision of infrastructure. Also, our definition of the tax base is simple, but sufficient to capture the tax sensitivity of internal efficiency costs in which we are interested. Expected profit of the multinational firm is

$$E(\pi) = p\left[(1-\tau_1)\overline{\alpha}f(\overline{k}_1) + (1-\tau_2)\underline{\alpha}f(\underline{k}_2)\right] + (1-p)\left[(1-\tau_1)\underline{\alpha}f(\underline{k}_1) + (1-\tau_2)\overline{\alpha}f(\overline{k}_2)\right]. \quad (3)$$

The variable $\overline{k}_i$ ($\underline{k}_i$) denotes the amount of capital the headquarter allocates to the high-performing (low-performing) division in country i.

The governments of the two countries compete for profits of the MNE divisions by setting the profit tax rates non-cooperatively. The tax proceeds in each country are spent on a public consumption good g_i that is consumed by the local population.

In sum, the sequence of decisions is as follows: At stage 0, the two countries engage in fiscal competition and set their tax rates non-cooperatively. At stage 1, each division manager chooses the effort level e_i which determines the amount of cash-flow x_i in division i. At stage 2, the headquarter learns the divisions' profitability and the re-allocates cash-flow $x_1 + x_2$ across divisions. Finally, production takes place and the firm is liquidated. We solve the game by backward induction.

capital market reduces to the advantage of adjusting investments in response to a different tax treatment of profits in the two countries.

[11] Despite the complexity of international tax treaties, there is a widely held presumption that the source principle of taxation is effectively in place. See Gresik (2001) for a review of tax principles that apply to MNEs. For instance, source-based taxes are influential when subsidiaries' profits are tax exempt in the country where the headquarter resides. Under a tax-credit system, tax credits for taxes already paid on repatriated profits are not neutral for the total tax liability of the MNE when the source tax rate is higher than the tax rate that applies upon repatriation. Also, for any tax principle, a time lag between taxation at source and repatriation of profits increases the effective role of source-based taxes for MNE behavior.

3 Equilibrium Analysis

3.1 MNE behavior

Assume that, at stage 2, division i is of high productivity and division j is of low productivity, i.e. $(\alpha_i, \alpha_j) = (\overline{\alpha}, \underline{\alpha})$. Since the headquarter is an empire builder, but prefers to run an efficient empire, it chooses $\overline{k}_i$ and $\underline{k}_j$ so as to solve

$$\begin{aligned} \max_{\overline{k}_i, \underline{k}_j} \qquad \pi \quad &= \quad (1-\tau_i)\overline{\alpha} f(\overline{k}_i) + (1-\tau_j)\underline{\alpha} f(\underline{k}_j) \\ \text{s.t.} \qquad & x_i + x_j \geq \overline{k}_i + \underline{k}_j. \end{aligned} \tag{4}$$

The first-order condition is

$$(1-\tau_i)\overline{\alpha} f'(\overline{k}_i) = (1-\tau_j)\underline{\alpha} f'(\underline{k}_j). \tag{5}$$

Given the empire-building preferences of the headquarter, it keeps the capital within the MNE and reallocates capital so as to align the net-of-tax marginal capital productivity across divisions.[12,13] It is the allocative advantage associated with favoring well-performing divisions which is the bright side of the internal capital market. Given (2), the amount of capital allocated to each division is

$$\overline{k}_i = \left(1 + \left(\frac{(1-\tau_j)\underline{\alpha}}{(1-\tau_i)\overline{\alpha}}\right)^{\frac{1}{1-\beta}}\right)^{-1} X \quad \text{and} \quad \underline{k}_j = \left(1 + \left(\frac{(1-\tau_i)\overline{\alpha}}{(1-\tau_j)\underline{\alpha}}\right)^{\frac{1}{1-\beta}}\right)^{-1} X, \tag{6}$$

where

$$X = a_1 e_1 + a_2 e_2. \tag{7}$$

is the total amount of cash flow the headquarter redistributes in the internal capital market. Each division receives a share k_i/X of cash flow X. The respective shares depend on the profit taxes in the two locations, the productivity parameters and the shape of the production function. Straightforwardly, a higher profit tax in the host country of a division reduces the share of the cash flow that is allocated to the division through the internal capital market, independently of its productivity realization. This is consistent with empirical findings of how

[12] This resembles the free-cash flow hypothesis by Jensen (1986). For investment projects that yield a rate of return below the market interest rate, shareholders prefer these projects not to be undertaken and the headquarter to initiate dividend distributions instead. As frequently argued, the free-cash flow problems might be more severe in MNEs with an internal capital market since it gives managers an easy access to capital and to bypass the external capital market and its disciplining role. We introduce external finance in Section 6.

[13] The first-order condition (5) is also consistent with the view that the MNE is finance constrained, preventing the market interest rate to be the benchmark for the required profitability of marginal investment choices (Holmstrom and Tirole, 1997; Egger et al., 2014).

headquarters allocate capital within MNEs (Dharmapala and Riedel, 2013). Also, the share the high-performing (low-performing) division receives is increasing (decreasing) in the productivity differential, $\overline{\alpha} - \underline{\alpha}$, and decreasing (increasing) in the concavity of the production function, as measured by β.

At stage 1, division managers choose the level of effort, which influences the amount of cash flow that is available in the two divisions. For instance, division manager 1 maximizes[14]

$$\theta \left(p\overline{k}_1 + (1-p)\underline{k}_1 \right) - \phi(e_1) \quad \text{s.t.} \quad (6) \text{ and } (7). \tag{8}$$

The first-order condition of division manager 1's problem is

$$\theta \left(p\frac{d\overline{k}_1}{de_1} + (1-p)\frac{d\underline{k}_1}{de_1} \right) - \phi'(e_1) = 0. \tag{9}$$

Using (6) and denoting $\overline{\delta}_i := \overline{k}_i/X < 1$ and $\underline{\delta}_i := \underline{k}_i/X < 1$ as the share of capital that is allocated to a high-performing and low-performing division in country i, the capital responses in (9) are

$$\frac{d\overline{k}_1}{de_1} = \overline{\delta}_1 a_1 \qquad \text{and} \qquad \frac{d\underline{k}_1}{de_1} = \underline{\delta}_1 a_1, \tag{10}$$

where $0 < \underline{\delta}_1 < \overline{\delta}_1 < 1$. The manager exerts effort up to the point where the change in the expected size of the division equals the marginal cost of effort provision. The first-order condition (9) captures the allocative disadvantage, i.e. the dark side of the internal capital market. Precisely, a rise in cash-flow in division 1 decreases its net-of-tax marginal productivity of capital. Given the strict concavity of the production function, the headquarter reallocates the rise in cash flow across the two divisions so as to align the net-of-tax marginal profitability of divisions. Effectively, division 1 loses a fraction $1 - \underline{\delta}_1$ or $1 - \overline{\delta}_1$ of self-generated cash-flow at the margin, depending on whether it has a low-performing or high-performing investment, c.f. (10). This dilutes managerial incentives to exert effort and lowers firm value (e.g., Scharfstein and Stein, 2000, Brusco and Panunzi, 2005, and Inderst and Laux, 2005).

3.2 The MNE's responses to taxes

Following (6), (7), and (9)

$$\frac{dk_i}{d\tau_i} = \left.\frac{\partial k_i}{\partial \tau_i}\right|_{dX=0} + \frac{\partial k_i}{\partial X}\frac{dX}{d\tau_i}. \tag{11}$$

[14]The formulation for division manager 2 is analogous.

The first term on the right-hand side of (11) captures the conventional investment response to taxes. Using (6),

$$\left.\frac{\partial k_i}{\partial \tau_i}\right|_{dX=0} = -\left.\frac{\partial k_j}{\partial \tau_i}\right|_{dX=0} < 0.$$

For a given size of the internal capital market X, the headquarter redistributes capital away from the division that faces an increase in the profit tax rate.

As captured by the second term in (11), the endogeneity of managerial effort choices opens up an additional channel through which tax policy influences the allocation of capital. Straightforwardly, a higher cash-flow pool X increases capital allocations to the two divisions, $\partial k_i/\partial X > 0$. More interestingly, tax policy influences effort choices and, thereby, the amount of cash flow X which is shared between the two divisions. From (6), (7) and (9), the response in effort levels following a tax change is[15]

$$\frac{de_i}{d\tau_i} < 0 \qquad \text{and} \qquad \frac{de_j}{d\tau_i} > 0. \tag{12}$$

A rise in τ^i lowers effort provision in country i and increases it in country j. The intuition for the asymmetric response is that a rise in effort e_i increases the amount of capital that the headquarter allocates to division i. The marginal return to effort interacts with the profit tax. A higher tax rate τ^i incentivizes the headquarter to allocate less capital to that country which reduces the marginal return to effort in country i. On the contrary, the additional cash-flow allocated to country j raises the marginal return to effort in this country and, thereby, the level of effort that the manager in country j exerts.[16]

The variation in effort provision changes the amount of cash flow X. Using (6), (7) and (9), the aggregate cash flow response is[17]

$$\frac{dX}{d\tau_i} \quad \begin{matrix} \geqq \\ \leqq \end{matrix} \quad 0 \text{ iff} \quad a_i - a_j \quad \begin{matrix} \leqq \\ \geqq \end{matrix} \quad 0. \tag{13}$$

The productivity differential $a_i - a_j$ indicates the relative importance of the two divisions in generating cash flow within the MNE. Intuitively, when $a_i > a_j$, the drop in e_i dominates in its effect on X and a higher tax τ_i lowers the amount of cash flow. The opposite conclusion holds when $a_i < a_j$. It is only for the knife-edge case $a_i = a_j$ that the counteracting effects of effort changes on X cancel out.

[15] All effort and cash flow responses to taxation are derived in Appendix A.1.

[16] Note, using (6), the capital shares $\overline{\delta}_i$ and $\underline{\delta}_i$, which influence managerial incentives (c.f. (9) and (10)), decrease as τ_i rises and, conversely, increase as τ_j rises.

[17] See Appendix A.1 for a derivation.

To summarize,

Lemma 1: *A rise in the profit tax rate τ_i lowers effort provision in division i and raises effort provision in division j. In response, total cash flow rises (decreases) if division i is less (more) important in generating cash flow, i.e. $a_i < (>)\ a_j$. If both division are equally important in generating cash flow ($a_i = a_j$), total cash flow is insensitive to taxation.*

In line with empirical evidence (Ozbas and Scharfstein, 2010, and Gertler et al., 2012, for instance), the internal capital market incurs efficiency costs for the MNE. Tax policy interacts with the internal efficiency costs. It magnifies costs when $dX/d\tau_i < 0$ and attenuates them when $dX/d\tau_i > 0$.[18] These internal changes influence tax choices, as analyzed in the next section.

3.3 Tax policy

We assume that residents of country i own a share $\gamma_i \in [0,1]$, $\gamma_1 + \gamma_2 = 1$, of the MNE and that managers reside outside the two countries.[19] Under these assumptions, welfare of country i depends on MNE profits π, which accrue to residents of country i at a rate γ_i, and on the residents' valuation of public consumption g_i, which is financed out of tax revenues $g_i = \tau_i \alpha_i f(k_i)$. Hence, expected welfare is

$$\gamma_i E(\pi) + \lambda_i \tau_i E(TB_i) \qquad \text{with } \lambda_i > 1. \tag{14}$$

The parameter λ_i is the citizens' valuation of public consumption and $E(TB_i)$ denotes the expected tax base in country i which follows from multiplying the ex-post tax bases $\overline{\alpha} f(\overline{k}_i)$ and $\underline{\alpha} f(\underline{k}_i)$ by the relevant probabilities.

To analyze the efficiency of tax policy choices, we look at the externality a country's tax rate choice exerts on welfare of residents in the neighboring country. The effect of country i's tax choice on country j's welfare is

[18] More precisely, in stand-alone firms, the shares $\overline{\delta}_i$ and $\underline{\delta}_i$ are equal to unity which strengthens effort provision, c.f. (9) and (10). Since for any $\tau_i \in [0,1]$ the shares are below unity in an internal capital market, changes in the costs of using an internal capital market will be attenuated or strengthened, but not eliminated by changes in taxes.

[19] The latter assumption simplifies the analysis without invalidating the basic insights. Alternatively, we might assume that managers may reside in the country where they work, but that the number of managers in the population is relatively small. Hence, the policy-induced utility change of managers may be negligible relative to the change that the rest of the population experiences. With managerial incentive pay and a binding participation constraint for managers, the metric (14) is a comprehensive measure for welfare also when managers reside within the country, see Appendix A.2. The results are the same.

$$\gamma_j \frac{dE(\pi)}{d\tau_i} + \lambda \tau_j \frac{dE(TB_j)}{d\tau_i}. \tag{15}$$

The first term marks the ownership externality and the second term is the fiscal externality associated with country i's tax policy. In what follows, we will dissect each externality term in (15) to isolate the impact of effort adjustments. The ownership externality in (15) summarizes two effects:

$$\frac{dE(\pi)}{d\tau_i} = \left.\frac{\partial E(\pi)}{\partial \tau_i}\right|_{dX=0} + \frac{\partial E(\pi)}{\partial X}\frac{dX}{d\tau_i}. \tag{16}$$

The response in MNE profits includes a mechanical and a behavioral response. The first term on the r.h.s. of (16) depicts the mechanical effect of a higher profit tax on MNE profits which is negative in sign.[20] The second term captures the behavioral response that is due to the adjustment in managerial effort provision. From (13), a higher tax τ_i lowers aggregate effort provision when $a_i > a_j$. In response to this, the total amount of internal cash flow X reduces and so does the profitability of the MNE.[21] The negative effect on shareholder wealth spills over to the owners in country j in proportion to their ownership share γ_j. A reversed result holds when $a_i < a_j$. Now, total cash flow increases following a tax rise and the effort-related ownership externality on country j's residents signs positive.

The fiscal externality term in (15) originates from two sources:

$$\frac{dE(TB_j)}{d\tau_i} = \left.\frac{\partial E(TB_j)}{\partial \tau_i}\right|_{dX=0} + \frac{\partial E(TB_j)}{\partial X}\frac{dX}{d\tau_i}. \tag{17}$$

The tax base change reflects the tax-induced reallocation of capital to the division in country j (first term on the r.h.s. of (17)), which positively affects country j's tax base. It is this tax base externality that is standardly related to the result of a "race to the bottom" in tax competition, in the sense that tax competition yields lower tax rates than coordination (Zodrow and Mieszkowski, 1986). The second term captures the effect of a higher tax τ_i on internal cash-flow X. For $a_i > a_j$, the overall amount of cash-flow reduces. This lowers the capital allotments to both divisions and, thereby, country j's tax base, c.f. (6) and(13).[22] Conversely, for $a_i < a_j$, total cash flow rises in response to a higher tax and so does the tax base in country j.

[20]Note, by an application of the envelope theorem, the change in the capital allocation by the headquarter at stage 2 does not affect profits of the MNE.

[21]From (3) and (6), the term $\partial E(\pi)/\partial X$ is positive since more internal cash flow increases investments and thereby MNE profits.

[22]Using (6), $\partial E(TB_j)/\partial X > 0$. Higher cash flow increases the capital allocations of the two divisions, a positive tax base effect which follows from the concavity of the production function.

Hence, effort adjustments propagate through the internal capital market and systematically generate spill-overs. For $a_i > (<) \, a_j$, a tax rise $d\tau_i > 0$ produces a negative (positive) externality on household income and on the tax base of country j. It is only when $a_i = a_j$ that the dark side of the internal capital market has no implications for the marginal welfare effects of tax choices. Thus, we can summarize:

Proposition 1: *(i) When both countries are equally endowed with infrastructure a_i, the disincentive effect of the internal capital market is neutral for tax policy. (ii) When countries are differently endowed, the managerial behavior modifies the ownership externality and the fiscal externality. In particular, the disincentive effect of the internal capital market in isolation incentivizes the country that is more (less) amply endowed with a_i to choose inefficiently high (low) profit taxes.*

Proposition 1 predicts that internal efficiency effects alter the two types of policy externalities in the same direction. This implies that they may even qualitatively change the outcome of the policy game from an equilibrium with undertaxation to an equilibrium with overtaxation and vice versa.[23]

Multiple aspects of Proposition 1 are worth discussing. First, except for the knife-edge case $a_i = a_j$, the size of the cash flow pool changes with taxes. Internal efficiency effects thus induce divisional capital stocks to co-move following a change in tax policy of one country. The tendency for investments to co-move is in line with evidence on MNE investment behavior, as reported in Desai et al. (2005b, 2009), for instance.

Second, the possibility of a negative tax base externality, which is associated with adjustments in internal efficiency costs, is consistent with empirical findings in Becker and Riedel (2012). Using data for European MNEs, Becker and Riedel (2012) find evidence that taxes in the parent country reduce affiliate investment abroad. A parent tax increase by ten percentage points dampens affiliate investment by 5.6 percent. This lowers taxable profits abroad. Compared with the standard tax competition externality, the estimated negative externality is

[23] To illustrate this point, assume tax rate choices are efficient for some $a_i = a_j$, i.e. the ownership externality and tax base externality offset each other in equilibrium. For instance, efficiency holds for $\underline{\alpha} = \overline{\alpha} = \theta = \lambda = a_i = \omega = 1$, $\beta = 0.3$ and $\gamma_i = 0.5$, among other parameter constellations. Now, a rise in a_i generically results in an inefficient tax policy. The new tax rate τ_i might become inefficiently high. Otherwise, by symmetry, it is a drop in a_i that implies an inefficiently high tax rate τ_i. As such, for some small $\epsilon > 0$, moving from $a_i - \epsilon$ to $a_i + \epsilon$ changes the qualitative property of the policy equilibrium.

estimated to be of quantitative importance and neutralizes a significant fraction of the standard tax competition externality.

Third, Nielsen et al. (2010) show that the provision of a common input (e.g., blue prints) by the headquarter of a MNE equally introduces a tendency to "overtax" local divisions. The mechanism we propose here is different to the one underlying the choice of a common input. The cash provision by managers is akin to a private provision of a private good in a MNE, whereas the choice of common inputs by the headquarter is akin to a public provision of a public good. The two types of mechanisms lead to different outcomes. Whereas the cash provision in isolation may lead to inefficiently high or low taxes, the tax-efficient use of a common input unambiguously points towards overtaxation. Relatedly, the way the associated tax spill-overs operate between countries is through the relocation of capital in the present paper and the complementarity of production factors (capital and the common input) in Nielsen et al.

Finally, Proposition 1 points to a different source of asymmetry in capital tax competition than differences in population size, in per-capita capital endowments and in market size (see Bucovetsky, 1991, Wilson, 1991, and Haufler and Wooton, 2010, among others). Depending on the sign and magnitude of the differential $a_i - a_j$, $dX/d\tau_i$ might be positive or negative. This asymmetrically influences equilibrium taxing incentives. Precisely, a differential $a_i > a_j$ reduces taxing incentives in country i and, conversely, strengthens taxing incentives in country j.[24] The asymmetry in policy incentives implies that, with $\lambda_1 = \lambda_2$ and $\gamma_i = p = 0.5$, the equilibrium tax differential is $\tau_i < \tau_j$.[25] The more productive country undercuts the less productive country in fiscal competition. The finding stands in contrast to the general notion that more productive countries find it easier to attract capital and set higher taxes in response, see Hindriks et al. (2008) and Black and Hoyt (1989), for instance.[26]

[24]This follows from the first-order condition $\gamma_i dE(\pi)/d\tau_i + \lambda_i \left(E(TB_i) + \tau_i dE(TB_i)/d\tau_i\right) = 0$. When $a_i > a_j$, the negative cash flow response $dX/d\tau_i$ reduces shareholder wealth in country i in proportion to the ownership share γ_i and lowers the profit tax base in country i. The effects work through the first term in the first-order condition, $dE(\pi)/d\tau_i$, and through the second term in brackets, $dE(TB_i)/d\tau_i$. The two terms are formally given by (16) and (17), when setting $i = j$, and the influence of the response $dX/d\tau_i$ on taxing incentives is captured by the second terms in these two equations.

[25]The conclusion is subject to the caveat that standard regularity conditions hold, i.e. that any strategic complementarity or substitutability of tax rates does not overturn the first-order effect of $a_i > a_j$ on tax choices. A more elaborated analysis of the equilibrium tax differential is available upon request.

[26]Black and Hoyt (1989) are exemplary for the literature on bidding for FDI, showing that a country can set a higher tax on mobile firms to the extent that it offers locational advantages (such as a higher factor productivity) relative to its closest competitors. Hindriks et al. (2008) show that a higher level of public infrastructure allows governments to set higher profit taxes.

4 Infrastructure investment

In this section, we endogenize the amount of infrastructure that each region non-cooperatively provides. We consider two types of infrastructure spending: one that enhances the productivity of effort provision, as measured by a_i, and one that increases the productivity of capital that is used in each division to produce output. To incorporate the latter, we rewrite the term α_i in the production function $y_i = \alpha_i k_i^\beta$ as $\alpha_i = \tilde{\alpha}_i A_i$. $\tilde{\alpha}_i$ is a stochastic productivity parameter (with the same properties as before) and A_i is a policy variable to be chosen by region i.[27] With this modification, expected public consumption reads $E(g_i) = \tau_i E(TB_i) - a_i - A_i$ where the price of infrastructure is normalized at unity. Stage 0 of the game now involves the two countries to engage in fiscal competition by setting tax rates and infrastructure spending non-cooperatively. The other stages of the model are the same as in the previous section.

We first turn to the choice of a_i. Following (6), (7), and (9), the effect of a rise in a_i on effort provision is

$$\frac{de_i}{da_i} > 0 \quad \text{and} \quad \frac{de_j}{da_i} = 0. \tag{18}$$

Intuitively, a rise in a_i raises the marginal return to effort of the manager in division i, while leaving the marginal return to effort for the manager in division j unchanged.

The effect of a higher productivity a_i on the amount of capital that each division receives through the internal capital market is

$$\frac{dk_l}{da_i} = \left.\frac{\partial k_l}{\partial a_i}\right|_{de_i=0} + \frac{\partial k_l}{\partial e_i}\frac{de_i}{da_i} > 0 \qquad l = 1, 2. \tag{19}$$

From (6) and (7), $\partial k_l/\partial a_i|_{de_i=0} > 0$ and $\partial k_l/\partial e_i > 0$ which, together with (18), signs the capital response positive. The total effect can be decomposed in a direct effect that follows from the rise in a_i for a given level of effort, as captured by the first term on the right-hand side of (19). More capital is available in the internal capital market that can be shared between the two divisions. As captured by the second term, the rise in effort provision in division i additionally expands the pool of cash flow that benefits the two divisions through the internal capital market.

Thus, we can summarize:

[27] One might think of a_i as a metric that measures the extent to which creative firm clusters, which are fostered by public policy, make managers more productive, while A_i might capture public infrastructure or government-supported technological innovations.

Lemma 2: *(i) A rise in the productivity of generating cash flow in division i, a_i, raises effort provision in division i and leaves incentives to exert effort in division j unchanged. (ii) Following a rise in infrastructure provision a_i, both divisions receive more capital through the internal capital market due to the direct effect of higher infrastructure provision and the associated managerial incentive effect.*

At stage 0, government i chooses a_i to maximize welfare of the local population. The welfare measure is (14), modified to account for infrastructure spending:

$$\gamma_i E(\pi) + \lambda_i \left(\tau_i E(TB_i) - a_i - A_i\right) \qquad \text{with} \quad \lambda_i > 1. \tag{20}$$

Tax revenues net of infrastructure expenditure are spent on the domestic consumption good that is valued by local residents at rate $\lambda_i > 1$ per unit of consumption spending.

In order to single out the implications of the disincentive effect of the internal capital market for the efficiency of decentralized policy choices, we look at the impact of country i's infrastructure policy on welfare in country j:

$$\gamma_j \frac{dE(\pi)}{da_i} + \lambda_j \tau_j \frac{dE(TB_j)}{da_i}. \tag{21}$$

Disentangling the first term in (21), the effect on the profits of the multinational firm is

$$\frac{dE(\pi)}{da_i} = \left.\frac{\partial E(\pi)}{\partial a_i}\right|_{de_i=0} + \frac{\partial E(\pi)}{\partial e_i}\frac{de_i}{da_i} > 0. \tag{22}$$

The first term is the positive mechanical effect of a higher infrastructure spending on MNE profit. Internal efficiency costs add a second effect. The rise in effort in country i, which follows from infrastructure provision, equally increases profits which partially accrue to residents in country j.

As to the tax base change in country j, we find

$$\frac{dE(TB_j)}{da_i} = \left.\frac{\partial E(TB_j)}{\partial a_i}\right|_{de_i=0} + \frac{\partial E(TB_j)}{\partial e_i}\frac{de_i}{da_i} > 0. \tag{23}$$

A more generous infrastructure spending a_i directly increases the capital allocation in country j, as captured by the first term. The associated rise in tax revenues is reinforced through the effort increase in country i, c.f. second term in (19) and (23). Thus, we can summarize:

Proposition 2: *In an uncoordinated equilibrium, infrastructure spending a_i generates a positive ownership and fiscal externality. In particular, the two externalities are positive in the absence of discretionary behavior by managers and are both reinforced through the change in managerial behavior in response to infrastructure spending a_i.*

Proposition 2 shows that infrastructure spending is inefficiently low in competition for MNE profits. The result differs from the conventional finding that infrastructure spending generates a negative fiscal externality in fiscal competition. Countries use infrastructure spending to lure more capital to the jurisdiction, at the expense of capital investments in other countries, see Keen and Marchand (1997), for instance. An internal capital market modifies the sign of the spill-over. It generates a positive spill-over on tax revenues since the return to infrastructure policy (higher cash flow) is shared between the two divisions through the re-allocation of capital by the headquarter.

The uncoordinated Nash equilibrium is inherently asymmetric w.r.t. the level of infrastructure a_i in each country. Most notably, the ownership share, γ_i, and the preference for public consumption spending, λ_i, may differ across countries and so will the amount of infrastructure each country provides in equilibrium. An equilibrium infrastructure differential $a_i - a_j \neq 0$ renders the total amount of effort sensitive to tax rate changes, c.f. (13). In consequence, managerial behavior generically influences the uncoordinated equilibrium choice of profit taxes, as summarized by part (ii) of Proposition 1.

The second type of infrastructure A_i enhances the productivity of the amount of capital that is finally allocated to division i. Inserting $\alpha_i = \tilde{\alpha}_i A_i$ into (5) shows that, since an increase in $1 - \tau_i$ is equivalent to a rise in A_i in terms of its impact on divisional capital budgets, the response in k_i to changes in A_i is opposite in sign to the response to a changes in τ_i. It follows from (9) that the response of managerial effort choices to τ_i and A_i are opposite in sign as well. Using $X = a_1 e_1 + a_2 e_2$, this implies

$$\frac{dX}{dA_i} = -\frac{dX}{d\tau_i}. \tag{24}$$

Combining (24), Lemma 1 and Proposition 1, we find:[28]

Proposition 3: *In an uncoordinated equilibrium with $a_i \neq a_j$, the managerial incentive*

[28]Since Proposition 3 involves perturbations in A_i and g_i (to balance the budget), the result holds with exogenous levels of a_i, as in Section 3, and with endogenously chosen levels of a_i, as in this section.

effect of the internal capital market in isolation incentivizes the country with the higher (lower) level of a_i to choose an inefficiently low (high) level of infrastructure spending A_i. If $a_i = a_j$ in equilibrium, the efficiency of infrastructure provision A_i is not affected by the managerial incentive effect.

The finding is in line with the general notion that profit taxes and infrastructure services are differently used in fiscal competition (e.g., Keen and Marchand, 1997), but differs nevertheless from it in an important way. Profit taxes might be inefficiently high, while infrastructure spending might be inefficiently low, and this qualitative difference is related to the efficiency costs of the internal capital market.

5 Choosing to set up an internal capital market

Headquarters may decide on how strongly divisions are financially integrated through an internal capital market. For instance, divisions may operate on a stand-alone basis where investment outlays are only financed by, e.g., retained earnings of the division. In this case, the headquarter loses the flexibility to reallocate funds in response to productivity shocks in each division, but also saves on efficiency costs inherent to an internal capital market. In this section, we analyze the incentive by MNEs to create an internal capital market and how the incentive relates to profit taxation.[29] Consider a continuum of MNEs which differ w.r.t. the range of the productivity differential $\Delta = \overline{\alpha} - \underline{\alpha}$. The productivity differential is distributed on $[0, \overline{\Delta}]$ with density $h(\Delta) > 0$ for $\Delta \in [0, \overline{\Delta}]$. Δ indicates the magnitude of the productivity gain associated with a relocation of capital through an internal capital market. The model extension reflects the observation that firms might operate in differently risky business environments and are exposed to a different range of productivity shocks.[30]

The sequence of decisions is as follows: At stage 0, the two jurisdictions engage in fiscal competition and set their tax rates non-cooperatively. At stage 1, each multinational headquarter

[29]The decision is equivalent to the choice of committing not to interfere with the capital allocation after information on the profitability of each division becomes available. Headquarters may do so by refraining from obtaining information on the profitability of each division. For instance, this can be accomplished by not assigning resources to the headquarter ex-ante that are necessary to learn about productivity differentials ex-post and to resize investment projects in response. In such a MNE, decision authority would exclusively lie with divisions. See, e.g., Mookherjee (2006) for an analysis of how information influences the (de)centralization of decision authority in firms, and Acemoglu et al. (2007) for empirical work on the relation between decentralization of decision authority in firms and the amount of information headquarters might use.

[30]See Mookherjee (2006) for a review of the literature.

decides whether to set up an internal capital market. At stage 2, each division manager exerts effort e_i which determines the amount of cash-flow x_i. At stage 3, the headquarter learns the divisions' profitability and, provided an internal capital market has been set up at stage 1, the headquarter re-allocates cash-flow $x_1 + x_2$ across divisions. Finally, production takes place and the firm is liquidated. We solve the game by backward induction.

We first turn to the managerial effort choices in a MNE without an internal capital market. For instance, division manager 1 solves

$$\max \theta(p\overline{k}_1 + (1-p)\underline{k}_1) - \phi(e_i) \quad \text{s.t.} \quad \overline{k}_1 = \underline{k}_1 = a_1 e_1. \tag{25}$$

The first-order condition is $\theta(pa_1+(1-p)a_1)-\omega e_1 = 0$ and the optimal effort level is $e_1 = \theta/\omega a_1$. Two observations immediately emerge. First, managers do not have to share the return to effort with the other division through an internal capital market. In response, they will exert more effort, a positive incentive effect that is the mirror image of the dark side of the internal capital market. Second, the managerial choice problem is independent of profit taxes and so is the managerial effort choice and the level of gross profits in each division. Division manager 2's decision problem is analogous in structure.

Denoting the expected profit level before taxes of a stand-alone division and of a division that is integrated in an internal capital market by $E(\Phi_i^S)$ and $E(\Phi_i^I)$, respectively, the headquarter decides to set up an internal capital market if and only if

$$(1-\tau_i)E(\Phi_i^S) + (1-\tau_j)E(\Phi_j^S) < (1-\tau_i)E(\Phi_i^I) + (1-\tau_j)E(\Phi_j^I). \tag{26}$$

Since MNEs differ w.r.t. the range of the productivity realization $\overline{\alpha} - \underline{\alpha}$, those MNEs which operate in industries with a high productivity differential opt for an internal capital market. Their benefit of equalizing the marginal productivity of capital (net of tax) across divisions is high relative to the costs of diluted managerial incentives to generate cash flow.[31] To analyze how the decision to set up an internal capital market is affected by profit taxes, we differentiate both sides of (26) w.r.t. the profit tax in country i:[32]

$$-E(\Phi_i^S) \gtreqless -E(\Phi_i^I) + \left((1-\tau_i)\frac{dE(\Phi_i^I)}{dX} + (1-\tau_j)\frac{dE(\Phi_j^I)}{dX} \right) \frac{dX}{d\tau_i}. \tag{27}$$

[31] We assume that $\overline{\Delta}$ is sufficiently large so that the cut-off differential Δ^*, at which a MNE is indifferent, is interior, i.e. $\Delta^* \in (0, \overline{\Delta})$.

[32] Expected profits $E(\Phi_i^I)$ and $E(\Phi_j^I)$ are affected by the relocation of capital by the headquarter. Its effect on profits when τ_i is increased drops out due to an application of the envelope theorem and, in consequence, does not show up on the right-hand side of (27).

The first term on both sides of inequality (27) is the mechanical effect of a higher tax τ_i. The second term on the right-hand side captures the role of effort provision and its effect on cash flow X. Taking the latter effect in isolation, more firms will opt for an internal capital market provided total cash flow rises with the profit tax and vice versa.[33] From Lemma 1, the response in aggregate cash flow of the MNE is positive if $a_i < a_j$ and negative if $a_i > a_j$. We can hence summarize the influence of effort choices on the extensive margin as follows:

Lemma 3: *Following a tax rise in country i, the incentive effect of internal capital markets incentivizes MNEs to set up (not to set up) an internal capital market when country i is relatively poorly endowed (amply endowed) with infrastructure, i.e. $a_i < (>) a_j$. With a symmetric endowment, $a_i = a_j$, changes in managerial behavior are neutral for the organizational decision of MNEs.*

Lemma 3 predicts that MNEs will less likely opt for an internal capital market when the country in which the tax is raised is relatively amply endowed with infrastructure. Intuitively, using an internal capital market entails the costs of diluted managerial incentives and a tax rise in the more amply-endowed country increases these costs. Lemma 3 might be surprising. An internal capital market provides more flexibility in avoiding taxes. One may therefore expect that MNEs will expand their options to avoid taxes when the profit tax rate rises.[34] The finding in this paper is based on a structural modelling of the costs and benefits of using organizational forms that allow for tax savings. It thereby allows for a more detailed comparative static analysis, unravelling more comprehensive and possibly unexpected interdependencies.

Based on Lemma 3, it appears that, in particular, high-tax countries with good infrastructure will host divisions which are less financially-integrated with other divisions of the MNE. The divisions in these countries will face high efficiency costs when being integrated in an internal capital market. The prediction bears resemblance to previous explanations of how tightly divisions are financially integrated. Internal capital markets may serve as a substitute to a malfunctioning external capital market that local divisions would have to resort to otherwise (Desai

[33] Note, $dE(\Phi_i^I)/d(X) > 0$ since a larger cash-flow pool benefits all divisions.

[34] The finding may be the result of a reduced-form reasoning of tax avoidance behavior. The cost of using tax avoidance strategies is frequently summarized by a cost function that is convex in the extent of tax avoidance. With this specification, higher taxes lead to more tax avoidance in the tax-raising jurisdiction, either through more intense profit shifting or through organizational changes that allow for tax savings.

et al., 2005). To the extent that a poor infrastructure positively correlates with the quality of the local capital market, both explanations tend to suggest that divisions in countries with a lower institutional quality are integrated in an internal capital market.

In this setting, internal efficiency costs influence policy externalities through two decision margins of the MNE. From Lemma 3, a tax rise in a poorly-endowed country incentivizes more MNEs to create financial linkages between divisions. Those MNEs with an internal capital market also have a larger cash flow pool following the tax rise. The adjustments in the extensive and intensive margin positively spill over to the amply-endowed country in form of higher shareholder wealth and of a larger profit tax base. In sum,

Proposition 4: *Following a tax rise in country i, the effort-related adjustments in the intensive margin and extensive margin of an internal capital market reinforce each other, and tend to reduce (increase) the profit tax rate below (above) the efficient level when country i is relatively poorly-endowed (amply-endowed) with infrastructure, i.e.* $a_i < (>)\ a_j$. *In the absence of a productivity differential,* $a_i - a_j = 0$, *the intensive margin and extensive margin of an internal capital market are shielded from adjustments in managerial effort provision and so are taxing incentives of governments.*

6 External Finance

In Section 3, corporate capital is internally generated or inherited from the past (due to historical capital injections). In either case, retained earnings are the prime source of funds for investments in each division, as generally assumed in the literature on internal capital markets (e.g., Stein, 1997, Scharfstein and Stein, 2000, Brusco and Panunzi, 2005, and Inderst and Laux, 2005). In the following, we allow external finance to be endogenously determined by shareholders. The model extension is particularly descriptive of MNEs in fast growing markets in which capital demand is in excess of internally generated or historically injected funds. As until now, we assume that the headquarter has an informational advantage in observing the productivity realization in the divisions (which creates demand for an internal capital market to exist). Shareholders know the distribution from which the productivity in each division follows. They may inject capital that the headquarter distributes among the two divisions, along with internally generated

cash flow, after the headquarter has observed the productivity level in each division. All this implies that shareholders have no direct control over resource allocation and need to resort to the headquarter to channel external capital toward divisions, see Motta (2003) and Gertner and Scharfstein (2013), among others.[35]

To include external finance, we extend the decision sequence in Section 2 as follows. Shareholders decide on the amount of capital injections K at stage 0.5, i.e. after governments have decided on the level of taxes at stage 0, but before managers decide on the level of effort at stage 1. The headquarter gets to know the productivity of the two divisions at stage 2 and internally allocates capital. The adjusted sequence of decisions reflects the view that corporate finance might change following tax changes and that internal decisions will adapt to the new financial situation.

At stage 2, the headquarter allocates the pool of capital, now denoted by $\hat{X} = K + x_1 + x_2$, to the two divisions. The capital allocations follow from (6). At stage 1, managers choose effort to satisfy (9). Note, using (6) and (9), where X is replaced by $\hat{X}$, effort choices do not vary with K. External capital does not crowd out internal cash flow by changing managers' effort choices.

At stage 0.5, shareholders choose K so as to maximize expected MNE profit $E(\pi)$, as given by (3) where X is replaced by $\hat{X}$, net of the opportunity costs of external capital. Denoting the opportunity costs of capital injections by r, the board of shareholders solves

$$\max_K E(\pi) - rK \quad \text{s.t.} \quad (6) \quad \text{and} \quad \hat{X} = K + x_1 + x_2. \tag{28}$$

Using (5), the first-order condition for K is

$$E\left(\sum_i (1-\tau_i)\alpha_i f'(k_i)\delta_i\right) - r = 0. \tag{29}$$

Shareholders equate the sum of the expected net-of tax marginal productivity of capital in the two divisions (weighted by the cash flow share allocated to division i, δ_i) to the opportunity cost r. An implicit assumption herein is that, in the absence of external capital injections, the expected overall net-of-tax marginal productivity of capital exceeds r. Otherwise, $K = 0$ would be optimal. To save on notation, we abstract from this possibility.

[35] External capital might take the form of equity or debt. Shareholders may provide own-source funds in form of equity or debt, as in Motta (2003), or attract funds from external investors by new share issue or debt finance, as in Holmstrom and Tirole (1997). In general, shareholders might have a preference for one or the other form of finance due to a different tax treatment of debt and equity. Such a tax preference would not change the basic mechanism we are analyzing in this paper.

An interesting observation is that the share of resources allocated to each division, δ_i, is exogenous to shareholders. It is chosen by the headquarter which observes the productivity of the divisions and determines the share, depending on the tax rate differential and productivity realizations, c.f. (6). These relative investment considerations are independent of the amount of external finance K. However, by selecting K, shareholders effectively choose the overall size of the internal capital market $\hat{X}$, as implicitly defined by (29). The required size of K residually follows from $K = \hat{X} - x_1 - x_2$. This has implications for how effort choices affect MNE profits. Since K adjust residually, any change in efficiency costs is absorbed by adjustments in capital injections K so as to satisfy (29). For instance, when internal cash flow rises, the overall net-of-tax marginal productivity of capital falls below r and, in order to restore (29), capital injections K will be reduced.

Lemma 4: *Assuming $K > 0$, the size of the internal capital market is independent of the level of managerial effort and its impact on internal cash flow. In particular, the tax-induced change in external capital is*

$$\frac{dK}{d\tau_i} = \frac{d\hat{X}}{d\tau_i} - \frac{d(x_1 + x_2)}{d\tau_i}, \tag{30}$$

where $d\hat{X}/d\tau_i < 0$ is implicitly defined by (29) and $d(x_1 + x_2)/d\tau_i$ follows from Lemma 1.

The governments decide on taxes, anticipating the responses of shareholders, the headquarter and managers. The associated external effect of country i's tax policy on welfare in country j is (15). Unlike the ownership externality, the fiscal externality is qualitatively different with external finance. As shown above, external capital absorbs changes in internal efficiency costs. MNE profits are insulated from these responses. They only depend on the capital budget $\hat{X}$ which unambiguously shrinks following a rise in τ_i. Given (29), the response $d\hat{X}/d\tau_i < 0$ captures the desire of shareholders to adjust capital injections because a tax rise $d\tau_i > 0$ renders investments in division i less profitable (net of tax). The drop $d\hat{X}/d\tau_i < 0$ is shared between the two divisions through the internal capital market, thereby generating a negative effect on the tax base in country j. Hence,

Proposition 5: *Assume $K > 0$. Following a tax rise in country i, the externality on shareholder wealth in country j depends on changes in internal efficiency costs, as predicted by*

Lemma 1. However, the tax base externality on country j is independent of the effects of taxes on managerial effort choices. They are neutralized by adjustments in the amount of external capital. Still, the size of the internal capital market, as measured by $\hat{X} = K + x_1 + x_2$*, reduces in response to a tax rise which in itself generates a negative fiscal externality.*

Compared to a situation with no external finance, where the cash flow-related tax base externality is ambiguous in sign, the adjustment in the size of the internal capital market $\hat{X}$ strengthens the tendency to overtax profits at source.

Proposition 5 implies that, when the fiscal effect of tax rate changes is the dominant force for domestic welfare effects (since domestic MNE ownership is miniscule, for instance[36]), a higher tax rate in a competing country possibly reduces tax revenues and welfare at home. From (6) with X being replaced by $\hat{X} = K + x_1 + x_2$, the sign of the expected tax revenue change at home is

$$\text{sign}\left(\tau_i \frac{dE(TB_i)}{d\tau_j}\right) = \text{sign}\left(\frac{E\left(\Delta_i \; d\delta_i/d\tau_j\right)}{E(\Delta_i \delta_i)} + \frac{d\hat{X}/d\tau_j}{\hat{X}}\right), \tag{31}$$

where $\Delta_i = \alpha\beta k_i^{\beta-1}$. The possibility of a negative spill-over becomes relevant when the internal reallocation of capital is not too sensitive to differences in tax rates, i.e. $dE(\delta_i)/d\tau_j > 0$ is small. Given the implied low degree of tax avoidance through the headquarter, shareholders will more starkly reduce the scale of MNE operation, as measured by $\hat{X}$, after a rise in the competing country's tax rate.[37] Consequently, the size of the domestic division and with it the domestic profit tax base become smaller. All these observations are consistent with empirical findings showing that division capital stocks are positively correlated (Desai et al., 2005b, 2009) and that the cross-border tax effect on affiliate's investments is negative in sign (Becker and Riedel, 2012).

[36] For instance, the ownership distribution might be highly skewed across the two countries. MNE owners might also live outside the countries that host the MNE, as frequently observed in practice. In the model, allowing for third-country ownership would require $\gamma_1 + \gamma_2 \leq 1$ and $\gamma_i \in [0, 1]$. The generalization leaves the results in the previous sections qualitatively intact.

[37] The sets of structural parameters that govern the two behavioral responses do not completely overlap. The interest rate r influences $d\hat{X}/d\tau_j$, but not $dE(\delta_i)/d\tau_j$. In principle, this renders the interplay between the tax sensitivity of internal capital reallocations and capital injections ambiguous in sign and examples can readily be constructed in which one or the other response dominates in its effect on tax revenues.

7 Conclusion

This paper analyzes how tax policy diffuses through internal capital markets and how governments respond to it in their choice of fiscal policy. Unlike previous literature on multinational taxation, this paper accounts for one significant concern of MNEs in reality: the efficiency costs of internal capital markets. Tax avoidance by a MNE interacts with these non-tax costs and the interaction might generate a co-movement of division investments in MNEs and a negative tax base externality. It thereby provides a possible explanation for empirical results that are not inherently related to the notion of fiscal competition. We develop the results in a setting in which managers are only intrinsically motivated. The results remain unchanged when intrinsically-motivated division managers are also extrinsically motivated through incentive pay, see Appendix A.2.

Multiple extensions are possible. For instance, we focus on a specific type of internal efficiency costs and how it relates to multinational firm behavior. Arguably, other profit shifting devices such as the strategic pricing of intra-firm trade will complement the tax-avoidance behavior that is analyzed in this paper. Transfer pricing might equally incur internal efficiency costs that interact with policy choices in important ways. Second, a recurrent theme in the literature on fiscal competition is how a country's tax base is related to profits of the MNE, see Gordon and Wilson (1986), Kind et al. (2005), and Nielsen et al. (2010), for instance. While the principle of separate accounting, which we adopt in this paper, is the dominant rule for MNEs with cross-national operations, there are policy discussions in the European Union about adopting a formula-based apportionment rule instead. In our model, capital weights can be used to implement such a formula-based system. An analysis of the relative efficiency effects of the two systems is analytically involved, however. A focus on symmetric tax competition equilibria, as commonly adopted in the literature, would eliminate the role of internal efficiency costs for tax competition in our setting.[38] Hence, such a comparison must be pursued for asymmetric equilibria. We leave a formal analysis of these and other interesting extensions to future research.

[38] In our basic setting, countries may differ in terms of γ_i, p, λ_i and a_i. Simplifying the analysis by imposing symmetry, i.e. $p = \gamma_i = 0.5$, $\lambda_1 = \lambda_2$, and $a_1 = a_2$, eliminates equilibria in which the disincentive effect of internal capital markets interacts with policy choices. These equilibria only prevail when $a_1 \neq a_2$.

A Appendix

A.1 Derivation of Effort Responses (12) and Cash Flow Change (13)

Denoting

$$\overline{\delta}_i = \left(1 + \left(\frac{(1-\tau_j)\underline{\alpha}}{(1-\tau_i)\overline{\alpha}}\right)^{\frac{1}{1-\beta}}\right)^{-1} \text{ and } \underline{\delta}_i = \left(1 + \left(\frac{(1-\tau_j)\overline{\alpha}}{(1-\tau_i)\underline{\alpha}}\right)^{\frac{1}{1-\beta}}\right)^{-1} \tag{32}$$

as the share of cash flow which is allocated to the high-performing division and low-performing division in country i, we can use (6) to write the first-order condition (9) as

$$\theta\left(p\overline{\delta}_1 a_1 + (1-p)\underline{\delta}_1 a_1\right) - \omega e_1 = 0. \tag{33}$$

Differentiating (33) w.r.t. τ_i and rearranging we get

$$\frac{de_1}{d\tau_i} = \frac{\theta}{\omega}\left(p\frac{d\overline{\delta}_1}{d\tau_i}a_1 + (1-p)\frac{d\underline{\delta}_1}{d\tau_i}a_1\right). \tag{34}$$

Analogously, we find

$$\frac{de_2}{d\tau_i} = \frac{\theta}{\omega}\left(p\frac{d\underline{\delta}_2}{d\tau_i}a_2 + (1-p)\frac{d\overline{\delta}_2}{d\tau_i}a_2\right). \tag{35}$$

Note, from (32), that $\text{sign}\{d\overline{\delta}_i/d\tau_j\} = \text{sign}\{d\underline{\delta}_i/d\tau_j\} < 0$ if $i = j$ and $\text{sign}\{d\overline{\delta}_i/d\tau_j\} = \text{sign}\{d\underline{\delta}_i/d\tau_j\} > 0$ if $i \neq j$. Thus, (12) holds.

Using the individual effort responses derived above, total cash flow $X = a_1e_1 + a_2e_2$ changes as follows:

$$\begin{aligned}\frac{dX}{d\tau_i} &= a_1\frac{de_1}{d\tau_i} + a_2\frac{de_2}{d\tau_i} \\ &= \frac{\theta}{\omega}\left(p\left(\frac{d\overline{\delta}_1}{d\tau_i}a_1^2 + \frac{d\underline{\delta}_2}{d\tau_i}a_2^2\right) + (1-p)\left(\frac{d\underline{\delta}_1}{d\tau_i}a_1^2 + \frac{d\overline{\delta}_2}{d\tau_i}a_2^2\right)\right).\end{aligned} \tag{36}$$

Consider first $a_1 = a_2$. Since, from (32), $\overline{\delta}_i + \underline{\delta}_j = 1$ and thus $d\overline{\delta}_i/d\tau_i + d\underline{\delta}_j/d\tau_i = 0$, the cash flow response $dX/d\tau_i$ (36) is zero.

Now, consider $a_1 > a_2$. Since $d\overline{\delta}_i/d\tau_i + d\underline{\delta}_j/d\tau_i = 0$, total cash flow decreases if the response (36) is evaluated for $i = 1$ and increases if the response is evaluated for $i = 2$. Hence, (13) holds.

A.2 Managerial Incentive Wages

In this appendix, we extend the model by allowing for incentive wages. For analytical simplicity, we consider a discrete managerial effort model, which is widely used in the literature on internal capital markets and, more generally, on corporate finance as well as in applications of corporate

agency models in public finance, see Holmstrom and Tirole (1997), Elitzur and Mintz (1996), Inderst and Laux (2005), Tirole (2006) and Egger et al. (2012), among others.[39] A model with incentive pay and continuous managerial effort is available upon request. In the more complex framework, the results in the main part of the paper remain unchanged as well.

Managers exert effort $e_i \in \{e_i^h = 1, e_i^l = 0\}$, $i = 1, 2$. Division cash flow is $x_i = a_i e_i + \overline{x}$ with $a_i, \overline{x} > 0$. The cost of exerting effort $\phi(e_i)$ is $\omega > 0$ if $e_i = e_i^h$ and zero otherwise. The manager receives a wage payment $w_i \in \{w_i^h, w_i^l\}$. The optimal wage contract for manager i is chosen at stage 0.5 of the sequence of events and is conditioned on the level of cash flow x_i. It is a sufficient statistic for incentive provision (Holmstrom, 1979). Note, division profits are uncertain ex-ante. The productivity realization is unrelated to effort choices and conditioning wages on division profits only adds noise to the performance measure. With a high level of cash flow $x_i^h = a_i + \overline{x}$, the wage payment is w_i^h, while it is w_i^l when $x_i^l = \overline{x}$. w_i^h is chosen so as to incentivize the manager to exert a high level of effort.[40] Utility of the division manager is $u_i = \theta E(k_i) + w_i - \phi(e_i)$, $\theta > 0$. Following (6), the incentive compatibility constraint of division manager 1 is

$$\theta \left(p\overline{\delta}_1 a_1 + (1-p)\underline{\delta}_1 a_1 \right) + w_1^h - \omega \geq w_1^l. \tag{37}$$

where $\overline{\delta}_1 := \overline{k}_1/X$ and $\underline{\delta}_1 := \underline{k}_1/X$. Assuming that the manager has a reservation utility of zero, the participation constraint is $u_1 = 0$. Combining this insight with the incentive-compatibility constraint (37), which holds as an equality at the optimum, incentive wages are $w_1^l = 0$ and

$$w_1^h = \omega - \theta \left(p\overline{\delta}_1 + (1-p)\underline{\delta}_1 \right) a_1. \tag{38}$$

The intrinsic motivation of the manager substitutes for monetary incentives. The higher the utility that manager 1 derives from the division's increment in capital when exerting effort, $\theta(p\overline{\delta}_1 + (1-p)\underline{\delta}_1)a_1$, the more intrinsically motivated the manager. The wage payment w_1^h can be lowered in response.

[39] The aggregate implications of public policy in the model with continuous effort, which we use in the main part of the paper, are similar to the aggregate outcome of a model with discrete effort choices and heterogeneous MNEs. For instance, MNEs and their divisions may exhibit cross-sectional heterogeneity in the cost of effort provision, ω, or the preference for empire-building, θ. With a sufficiently large number of MNEs, aggregate divisional capital allocations vary continuously with the amount of taxes and infrastructure, similar to the model in the main part of this paper.

[40] Implicit to the analysis is the assumption that, from the shareholders' perspective, it is optimal to induce a high effort level. That is, the increment to the cash-flow pool is positive. A sufficient condition for the increment to be positive is $a_i > \omega$.

The incentive-compatibility condition for division manager 2 is analogous in structure to (37). The optimal wage scheme is $w_2^l = 0$ and

$$w_2^h = \omega - \theta \left(p\underline{\delta}_2 + (1-p)\overline{\delta}_2 \right) a_2. \tag{39}$$

Cash flow that can be distributed between the two divisions is now $x_1 + x_2$ corrected for the wage payments that need to be financed out of the divisions' cash flow. Hence, the size of the internal capital market is $X = \sum_{i=1,2}(x_i - w_i)$. Note, from (38) and (39), incentive wages will not eliminate the dark side of internal capital markets, see also Brusco and Panunzi (2003), Motta (2003) and Inderst and Laux (2005), for instance. In the absence of the managerial disincentive effect (i.e., $\overline{\delta}_i = \underline{\delta}_i = 1$), wages are lower and the amount of internal cash flow X is higher in response.

MNE profit and the tax base are as before, with $X = \sum_{i=1,2}(x_i - w_i)$ now being the relevant measure of the cash flow pool. One of the noteworthy implications of this extension is that, given the manager's participation constraint is binding, utility of the manager does not need to be included in the welfare analysis. The metric (14) provides a comprehensive measure of welfare, independently of where the manager resides.

Effect of taxes Differentiating $X = \sum_{i=1,2}(x_i - w_i)$ w.r.t. τ_j, while noting (6), (38), and (39), after some rearranging, yields

$$\frac{dX}{d\tau_j} = (a_1 - a_2) \left(p\frac{d\overline{\delta}_1}{d\tau_j} + (1-p)\frac{d\underline{\delta}_1}{d\tau_j} \right). \tag{40}$$

From (6), the response in X is negative (positive) if $a_j > (<)\ a_i$, as in the absence of incentive wages, c.f. Lemma 1. Consequently, the findings in Proposition 2 equally hold with monetary incentive provision.

Effect of infrastructure Differentiating $X = \sum_{i=1,2}(x_i - w_i)$ w.r.t. a_1 and using (38) and (39) yields

$$\frac{dX}{da_1} = 1 + \theta \left(p\overline{\delta}_1 + (1-p)\underline{\delta}_1 \right) > 0. \tag{41}$$

Two effects are responsible for the positive response in the size of the internal capital market X. First, a higher a_1 makes manager 1 more productive in generating cash flow. Second, given that manager 1 receives more capital through the internal capital market when exerting effort

e_1^h, manager 1 is more intrinsically motivated to exert effort. The associated savings in his wage payment is $\theta\left(p\overline{\delta}_1 + (1-p)\underline{\delta}_1\right)$. The change in X when a_2 rises is analogous in structure.

As such, a higher level of a_i increases the size of the internal capital market which spills over to division j through higher internal capital allocations. Shareholder wealth and the tax base in country j increase. The implications are the same as summarized in Lemma 2 and Proposition 3.

To consider the second type of infrastructure spending, we replace α in (2) by $\tilde{\alpha}_i A_i$ where A_i is a policy variable and $\tilde{\alpha}$ is a stochastic term which has the same properties as in Section 5. Inserting $\alpha_i = \tilde{\alpha}_i A_i$ into (5) shows that, since an increase in $1-\tau_i$ is equivalent to a rise in A_i in terms of the impact on divisional capital budgets, $d\overline{\delta}_j/d\tau_i = -d\overline{\delta}_j/dA_i$ and $d\underline{\delta}_j/d\tau_i = -d\underline{\delta}_j/dA_i$, $i,j = 1,2$. Using this insight coupled with $X = \sum_{i=1,2}(x_i - w_i)$, (38) and (39), we find

$$\frac{dX}{dA_i} = -\frac{dX_i}{d\tau_i} \tag{42}$$

The effect of higher infrastructure provision A_i is opposite in sign to the effect of a higher profit tax, τ_i. This relationship underlies the result in Proposition 4. Hence, the findings reported in Proposition 4 also apply in the setting with incentive wages.

Extensive margin Managers of stand-alone divisions are more intrinsically motivated. Their incentive constraint is (37) where δ_i takes the value of unity. As such, the wage rate w_i^h is lower than in the presence of an internal capital market, being equal to $w_i^h = \omega - a_i$. Managerial incentives are not diluted by an ex-post adjustment in capital allocations and the choice to set up an internal capital market is influenced by the comparison of the drop in internal cash flow with the rise in profits when capital investments in the two divisions adapt to the productivity of the divisions. Hence, imposing the model structure w.r.t. the distribution of the productivity differential $\Delta = \overline{\alpha} - \underline{\alpha}$ (as in Section 6) and noting (40), tax rate changes yield the same implications for the incentive to set up an internal capital market, as summarized in Lemma 3 and Proposition 5.

External finance With external finance, the size of the internal capital market is $\hat{X} = K + \sum_{i=1,2}(x_i - w_i)$. Note that managerial effort choices do not depend on K, c.f. (38) and (39). The choice of the level of K follows from maximizing (28) and the associated first-order condition is (29). As explained above, the first-order condition implicitly fixes $\hat{X}$ and changes in $\sum_{i=1,2}(x_i -$

w_i) are absorbed by adjustments in K. Thus, Lemma 4 and Proposition 6 apply. The intuition is that shareholders channel external resources to division through the headquarter, which has superior information about productivity and adds value to the MNE by 'winner-picking'. This also applies with incentive-based wages for managers.

References

[1] Acemoglu, D., P. Aghion, C. Lelarge, J. van Reenen and F. Zilibotti (2007), Technology, information, and the decentralization of the firm, Quarterly Journal of Economics, 122, 1759 - 1799.

[2] Antràs, P., M. Desai, and F.C. Foley (2009), Multinational firms, FDI flows, and imperfect capital markets, Quarterly Journal of Economics, 124, 1171-1219.

[3] Becker, J. and N. Riedel (2012), Cross-border tax effects on affiliate investment — evidence from European multinationals, European Economic Review, 56, 436-450.

[4] Berger, P. and E. Ofek (1995), Diversification's effect on firm value, Journal of Financial Economics, 37, 39-65.

[5] Black, D.A. and W.H. Hoyt (1989), Bidding for firms, American Economic Review, 79, 1249-1256.

[6] Brusco, S. and F. Panunzi (2005), Reallocation of corporate resources and managerial incentives in internal capital markets, European Economic Review, 49, 659-681.

[7] Bucovetsky, S. (1991), Asymmetric tax competition, Journal of Urban Economics, 30, 167-181.

[8] Bucovetsky, S. and A. Haufler (2008), Tax competition when firms choose their organizational form: Should tax loopholes for multinationals be closed?, Journal of International Economics, 74, 188-201.

[9] Chen, K.P. and C.Y.C. Chu (2005), Internal control versus external manipulation: a model of corporate income tax evasion, RAND Journal of Economics, 36, 151-164.

[10] Crocker, K.J. and J. Slemrod (2005), Corporate tax evasion with agency costs, Journal of Public Economics, 89, 1593-1610.

[11] Desai, M. and D. Dharmapala (2006), Corporate tax avoidance and high-powered incentives, Journal of Financial Economics, 79, 145-179.

[12] Desai, M. and D. Dharmapala (2009), Corporate tax avoidance and firm value, Review of Economics and Statistics, 91, 537-546.

[13] Desai, M., C.F. Foley, and J.R. Hines (2005a), A multinational perspective on capital structure choice and internal capital marktes, Journal of Finance, 59, 2451-2487.

[14] Desai, M., C.F. Foley, and J.R. Hines (2005b), Foreign direct investment and the domestic capital stock, American Economic Review, 95, 33-38.

[15] Desai, M., C.F. Foley, and J.R. Hines (2009), Domestic effects of the foreign activities of US multinationals, American Economic Journal: Economic Policy, 1, 181-203.

[16] Devereux, M.P., R. Griffith and A. Klemm (2002), Corporate income tax reforms and international tax competition, Economic Policy, 35, 451-495.

[17] Dharmapala, D. (2014), What do we know about base erosion and profit shifting? A review of the empirical literature, CESifo Working Paper No. 4612, Munich.

[18] Dharmapala, D. and N. Riedel (2013), Earnings shocks and tax-motivated income shifting: Evidence from European multinationals, Journal of Public Economics, 97, 95-107.

[19] Duchin, R. and D. Sosyura (2013), Divisional managers and internal capital markets, Journal of Finance, 68, 387-429.

[20] Egger, P., C. Keuschnigg, V. Merlo and G. Wamser (2014), Corporate taxes and internal borrowing within multinational firms, American Economic Journal: Economic Policy, forthcoming.

[21] Egger, P., W. Eggert, and H. Winner (2010), Saving taxes through foreign plant ownership, Journal of International Economics, 81, 99-108.

[22] Elitzur, R. and J. Mintz (1996), Transfer pricing rules and corporate tax competition, Journal of Public Economics, 60, 401-422.

[23] Gertner R. and D. Scharfstein (2013), Internal capital markets, in: R. Gibbons and J. Roberts, eds., The Handbook of Organizational Economics, Princeton University Press, chapter 16.

[24] Glaser, M., F. Lopez-de-Silanes, and Z. Sautner (2012), Opening the black box: internal capital markets and managerial power, Journal of Finance, forthcoming.

[25] Gordon, R. and J.D. Wilson (1986), An examination of multijurisdictional corporate income taxation under formula apportionment, Econometrica, 54, 1357-73.

[26] Gresik, T. (2001), The taxing task of taxing transnationals, Journal of Economic Literature, 39, 800-838.

[27] Griffith, R., J.R. Hines and P.B. Sørensen (2010), International capital taxation, in: James A. Mirrlees, Stuart Adam, Timothy Besley, Richard Blundell, Steve Bond, Robert Chote, Malcolm Gammie, Paul Johnson, Gareth D. Myles, and James Poterba, eds., Dimensions of Tax Design: the Mirrlees Review, Oxford University Press, chapter 10.

[28] Grossman, G., E. Helpman, and A. Szeidl (2006), Optimal integration strategies for the multinational firm, Journal of International Economics, 70, 216-238.

[29] Haufler, A. and I. Wooton (2010), Competition for firms in an oligopolistic industry: the impact of economic integration, Journal of International Economics, 80, 239-248.

[30] Haufler, A. and G. Schjelderup (2000), Corporate tax systems and cross country profit shifting, Oxford Economic Papers, 52, 306-325.

[31] Hindriks, J., S. Peralta, and S. Weber (2008), Competing in taxes and investment under fiscal equalization, Journal of Public Economics, 92, 2392-2402.

[32] Hines, J. (1997), Tax policy and the activities of multinational corporations, in Auerbach, A. (Ed.) Fiscal Policy: Lessons from Economic Research. Cambridge: MIT Press, 401-445.

[33] Holmstrom, B. (1979), Observability and moral hazard, Bell Journal of Economics, 10, 74-91.

[34] Holmstrom, B. and J. Tirole (1997), Financial intermediation, loanable funds, and the real sector, Quarterly Journal of Economics, 112, 663-691.

[35] Hubbard, R. and D. Palia (1999), A reexamination of the conglomerate merger wave in the 1960s: An internal capital markets view, Journal of Finance, 54, 1131–1152.

[36] Huizinga, H. and S.B. Nielsen (1997), Capital income and profit taxation with foreign ownership of firms, Journal of International Economics, 42, 149-165.

[37] Inderst, R., and H.M. Müller (2003), Internal versus external financing: an optimal contracting framework, Journal of Finance, 58, 1033-1062.

[38] Inderst, R. and C. Laux (2005), Incentives in internal capital markets, RAND Journal of Economics, 36, 215-228.

[39] Jensen, M.C. (1986), Agency costs of free cash flow, corporate finance, and takeovers, American Economic Review, 76, 323–329.

[40] Keen, M. and K. Konrad (2013), The theory of international tax competition and coordination, in: Handbook of Public Economics, Volume 5, A. Auerbach, R. Chetty, M. Feldstein and E. Saez, eds., North-Holland, chapter 5.

[41] Keen, M. and M. Marchand (1997), Fiscal competition and the pattern of public spending, Journal of Public Economics, 66, 33-53.

[42] Kind, H., K.H. Midelfart, and G. Schjelderup (2005), Corporate tax systems, multinational enterprises, and economic integration, Journal of International Economics, 65, 507-521.

[43] Lang, L. and R. Stulz (1994), Tobin's Q, corporate diversification, and firm performance, Journal of Political Economy, 102, 1248-1280.

[44] Matsusaka, J.G. and V. Nanda (2002), Internal capital markets and corporate refocusing, Journal of Financial Intermediation, 11, 176-211.

[45] Mintz, J. and M. Smart (2004), Income shifting, investment, and tax competition: theory and evidence from provincial taxation in Canada, Journal of Public Economics, 88, 1149-1168.

[46] Mookherjee, D. (2006), Decentralization, hierachies and incentives: a mechanism design approach, Journal of Economic Literature, 64, 367-390.

[47] Motta, A. (2003), Managerial incentives and internal capital markets, Journal of Finance, 58, 1193-1220.

[48] Nielsen, S.B., P. Raimondos-Møller and G. Schjelderup (2008), Taxes and decision rights in multinationals, Journal of Public Economic Theory, 10, 245-258.

[49] Nielsen, S.B., P. Raimondos-Møller and G. Schjelderup (2010), Company taxation and tax spillovers: Separate accounting versus formula apportionment, European Economic Review, 54, 121-132.

[50] Ozbas, O. and D. Scharfstein (2010), Evidence on the dark side of internal capital markets, Review of Financial Studies, 23, 581-599.

[51] Scharfstein, D. and J. Stein (2000), The dark side of internal capital markets: Divisional rent-seeking and inefficient investment, Journal of Finance, 55, 2537-2564.

[52] Schindler, D. and G. Schjelderup (2012), Debt shifting and ownership structure, European Economic Review, 56, 635-647.

[53] Sorensen, P.B. (2004), International tax coordination: Regionalism versus globalism, Journal of Public Economics, 88, 1187-1214.

[54] Stein, J. (1997), Internal capital markets and the competition for corporate resources, Journal of Finance, 52, 111-133.

[55] Tirole, J. (2006), The Theory of Corporate Finance, Princeton University Press, Princeton.

[56] Wilson, J. (1991), Tax competition with interregional differences in factor endowments, Regional Science and Urban Economics, 21, 423-452.

[57] Yeaple, S.R. (2003), The complex integration strategies of multinationals and cross country dependencies in the structure of foreign direct investment, Journal of International Economics, 60, 293-314.

[58] Zodrow, G.R. and P. Mieszkowski (1986), Pigou, Tiebout, property taxation, and the underprovision of local public goods, Journal of Urban Economics, 19, 356-370.

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