

## STRATEGIC CONSOLIDATION UNDER FORMULA APPORTIONMENT

Thiess Buettner, Nadine Riedel, and Marco Runkel

*This paper argues that profit-shifting activities exist for multi-jurisdictional enterprises (MJE) under a tax system of consolidation and formula apportionment (FA). A theoretical model discusses how a MJE can exploit strategically its impact on the definition of the consolidated group. The analysis shows that the MJE will not consolidate if intra-group tax-rate differences — and thereby potential gains from profit shifting — are large. We test this prediction using confidential firm-level tax-return data for the local business tax in Germany. The identification strategy exploits a quasi-experiment derived from a major company tax reform in 2001 that significantly reduced the costs associated with separating out individual affiliates. Our results show that, evaluated at the sample mean, an increase in the tax-rate variance among a MJE's affiliates by one standard deviation reduces the number of consolidated affiliates by 20 percent.*

*Keywords:* corporate taxation, formula apportionment, individual taxpayer data

*JEL Codes:* H25, H32, H73

### I. INTRODUCTION

In recent years, ongoing economic integration has led to a steep increase in the number of firms that operate in more than one tax jurisdiction. Consequently, the taxation of multi-jurisdictional entities (MJE) has become an increasingly important policy issue as countries struggle with adjusting their tax systems to adapt corporate income taxation to multinational firms' activities. This is in particular true for Europe, where the European Commission (2001) proposed to replace the current true system of multinational group taxation according to separate accounting (SA) rules with a common consolidated corporate tax base (CCCTB) combined with a system of formula apportionment (FA).<sup>1</sup>

---

<sup>1</sup> See Fuest (2008) for a discussion of the proposal's details.

---

Thiess Buettner, Department of Economics, University of Erlangen-Nuremberg, Nuremberg, Germany (thiess.buettner@wiso.uni-erlangen.de)

Nadine Riedel, Department of Economics, University of Stuttgart-Hohenheim, Germany, and Oxford University Centre for Business Taxation, Oxford, UK (nadine.riedel@uni-hohenheim.de)

Marco Runkel, Faculty of Economics and Management, University of Magdeburg, Magdeburg, Germany (marco.runkel@ovgu.de)

The principle of SA treats affiliates as distinct entities.<sup>2</sup> The well-known problem of this regime is that multinationals that face international differences in corporation tax rates minimize their tax burden by shifting taxable profits to low-tax countries (see, e.g., the survey by Devereux, 2006). Under FA, in contrast, corporate profit is consolidated at the group level and apportioned to the affiliates according to a formula that measures the affiliates' relative activities (Wetzler, 1995; Mintz, 1999).<sup>3</sup> It is sometimes argued that consolidation should abolish the incentive to engage in "aggressive tax planning" (European Commission, 2001, p. 14) and other profit-shifting strategies. This feature of FA is generally considered to be one of its main advantages and was cited by the European Commission as a major reason for bringing forward the FA proposal.

Contrary to this presumption, our paper shows that profit-shifting incentives may remain important under FA. We argue that a particular problem under FA is that profit shifting within the corporate group is abolished only if all group affiliates of the MJE are consolidated. If firms, in contrast, are allowed to choose whether to consolidate and the extent of consolidation, they might strategically refrain from consolidation to preserve profit-shifting opportunities within the group. The appropriate group definition (i.e., which affiliates belong to a corporate group) is a well-known problem in almost all existing FA systems. In the FA system of the U.S. states, for example, the group definition hinges on a combination of a legal criterion ("ownership share") and an economic criterion ("unitary business"). Under the legal group definition, it is obvious that corporations can reduce their ownership share and their shareholding structure in order to maintain profit-shifting channels to economically related affiliates. This problem is to some extent mitigated by the much more complicated economic group definition, but it seems that significant manipulation opportunities still exist, as is suggested by the large amount of litigation in the United States regarding the determination of the relationship of affiliates to corporate groups (Martens-Weiner, 2006).<sup>4</sup> Hence, under FA multi-jurisdictional firms can, at least to some extent, determine or "cherry pick" the affiliates that are consolidated within the group. One of the key questions in the above-mentioned reform proposal of the European Commission is, therefore, how to properly define a group for tax purposes (European Commission, 2006a, 2006b, 2007a, 2007b; Schoen, 2007).

In order to address the issue of strategic consolidation, we develop a simple theoretical model of a MJE that operates affiliates in two jurisdictions and decides whether to consolidate these affiliates. We identify two basic determinants of the consolidation

---

<sup>2</sup> SA is also used in corporate income taxation at the international level. For more details, see the Organisation for Economic Cooperation and Development (OECD) Model Convention (OECD, 1992). Furthermore, international corporate taxation under SA and bilateral double-taxation treaties has been comprehensively studied in the literature. For surveys, see Gresik (2001), Haufler (2001), and Fuest, Huber, and Mintz (2005).

<sup>3</sup> FA is currently applied at the sub-national level in several countries, for example, in the United States, Canada, Germany, and Switzerland.

<sup>4</sup> The U.S. Supreme Court has ruled that there are multiple definitions of a unitary business. While it is undisputed that the existence of alternative criteria improves the group definition for tax purposes, the scientific debate about the pros and cons of the criteria suggests that they are not perfect and still prone to tax-planning activities (Martens-Weiner, 2006).

decision. First, the exclusion of affiliates incurs non-consolidation costs. In addition to costs associated with a smaller degree of economic integration (agency costs), these costs include higher tax expenses since non-consolidation often prevents benefits from inter-firm loss offsets and creates double taxation problems. Lower non-consolidation costs make consolidation less likely. Second, the consolidation decision is influenced by the dispersion of statutory tax rates among the jurisdictions in which affiliates operate. A larger tax-rate spread makes it more attractive for the MJE to transfer taxable income from high-tax to low-tax jurisdictions. Under SA, the MJE can shift paper profits to low-tax jurisdictions, e.g., by adjusting intra-firm transfer prices. Under FA, the MJE may gain from tax-rate differences if apportionment weights are affected by firm decisions, for instance, by relocating economic activity to low-tax jurisdictions.<sup>5</sup> But, even without those tax-induced distortions, the attractiveness of FA will be affected by the tax rate differential, depending on how much profit is assigned to low-tax jurisdictions. If the gains from profit-shifting under SA dominate the other effects, firms will find non-consolidation more attractive with a larger tax-rate spread between the affiliates. In this case, it seems unlikely that FA is well suited to curb profit-shifting since those MJEs that benefit the most from profit shifting due to large tax-rate differentials will decide not to consolidate. While it is an empirical question whether MJEs can more easily exploit tax arbitrage opportunities under SA than under FA, we argue that this is plausible, mainly because shifting paper profits is likely to be less costly than the relocation of real activities needed to affect the apportionment weights under FA.

In a second step, we test empirically whether this characterization of the strategic consolidation decision can be used to predict the observed structure of consolidated firms. Our testing ground is the German local business tax, which is levied at the municipal level. This tax contributes significantly to the company tax burden in Germany, and the associated tax rates display substantial variation among the roughly 12,000 municipalities that levy the tax. If a MJE has affiliates in several municipalities, a FA scheme applies that consolidates group profit and prescribes apportionment among the municipalities according to their shares in the MJE's total payroll. But similar to the U.S. case, at least in the time period analyzed below, the German FA scheme applies conditional on the appropriate legal, financial, and economic ties between the entities. Since a group's ownership pattern as well as its economic and financial connections are the outcomes of firm decisions, MJEs enjoy some discretion with regard to the consolidation of their affiliates and may thus — within certain boundaries — choose whether affiliates are subject to SA or FA regulations.

To identify the tax determinants of the MJEs' consolidation choices, we exploit a quasi-experiment that arises from a recent change in the German tax law associated with

---

<sup>5</sup> This is especially true if the consolidated income is apportioned according to relative capital and/or payroll shares. In this setting, tax saving strategies imply reallocating production inputs to the low-tax jurisdiction. By comparison, with apportionment according to relative corporate sales, the destination of the company's final sales is distorted in favour of low-tax jurisdictions in order to achieve a reduction in the group's corporate tax burden.

a comprehensive company tax reform in 2001. This reform significantly reduced the costs associated with non-consolidation under the local business tax because loss-offset opportunities were improved and double taxation problems were reduced for unconsolidated firms. The reform therefore allows us to test whether, in fact, consolidated firms that face significant profit-shifting opportunities tend to reorganize in a way that is consistent with strategic choice of consolidation. The empirical results confirm our theoretical predictions and suggest that the reduction in non-consolidation costs has intensified tax planning in the form of restructuring businesses for groups with large shifting opportunities. Consistent with this view, after the 2001 reform, the German tax authorities faced increasing pressures to restrict profit shifting at the sub-national level. In 2004 the federal legislature in Germany resorted to defining a minimum tax rate for the local business tax in order to restrict opportunities for profit shifting to low-tax municipalities.

The empirical analysis employs a unique dataset that is comprised of confidential tax return data for the whole population of firms subject to the German local business tax in the years 1998 and 2001. Exploiting these data, we show that MJE's with a large variation in tax rates across group affiliates significantly reduced the number of consolidated affiliates between 1998 and 2001, relative to MJE's with a small variation in tax rates across group affiliates. This result is robust to the inclusion of various control variables characterizing the corporate group and the economic conditions in the hosting municipalities. Evaluated at the sample mean, we find that an increase in the variation of the statutory tax rates by one standard deviation reduces the number of consolidated affiliates by 20 percent. This sizeable effect points to an important strategic component in the MJE's consolidation decisions.

Our paper adds to two main strands of the economic literature. First, it contributes to the discussion of the pros and cons of different corporate taxation schemes for MJE's. The comparison of the economic effects of SA and FA goes back to early papers by McLure (1980) and Gordon and Wilson (1986) who show that FA may lead to distortions in firm behavior similar to SA. Recent papers by Anand and Sansing (2000), Eggert and Schjelderup (2003), Sørensen (2004), Wellisch (2004), Kind, Midelfart, and Schjelderup (2005), Pethig and Wagener (2007), Pinto (2007), Riedel and Runkel (2007), Eichner and Runkel (2008), and Nielsen, Raimondos-Møller, and Schjelderup (2010) focus on the welfare implications of corporate taxation under SA and FA. Moreover, although the empirical evidence is still limited, recent years have seen the emergence of a literature that empirically quantifies the distortions and economic effects of corporate taxation under FA. Examples are papers by Goolsbee and Maydew (2000), Buettner (2003), Mintz and Smart (2004), Devereux and Loretz (2008), Fuest, Hemmelgarn, and Ramb (2007) and Riedel (2010). Nevertheless, to the best of our knowledge, the existing literature has largely neglected the endogenous consolidation decision of MJE's.<sup>6</sup>

---

<sup>6</sup> Gresik (2010) investigates theoretical aspects of the self-selection of firms into taxation according to SA and FA. His analysis, however, does not focus on the trade-off identified here.

Second, this article relates to a small literature that investigates how corporate taxation distorts the organizational structure of MJE's. Desai, Foley, and Hines (2004) analyze the determinants of partial ownership of foreign U.S. affiliates. Their evidence indicates that whole ownership is most common when firms benefit from worldwide tax-planning opportunities. Weichenrieder and Mintz (2008) in turn provide evidence that MJE's alter their corporate organizational structures by using conduit and holding companies to reduce their corporate tax burden. Desai, Foley, and Hines (2006) study tax incentives for MJE's' investments in tax havens. Huizinga and Voget (2009) show that ownership patterns within multinational entities are determined by profit tax rates and withholding taxes. Bucovetsky and Haufler (2008) discuss the consequences of preferential tax regimes for multinationals when firms can choose their multinational structure. However, this literature has not yet discussed the consolidation decision of MJE's under a formula apportionment taxation system.

The paper is structured as follows. Section II presents the theoretical model underlying our estimation strategy, which is explained in detail in Section III. Section IV contains a description of the data and provides basic descriptive statistics. Section V outlines the estimation methodology, Section VI presents the results, and Section VII provides a summary.

## II. A SIMPLE THEORETICAL MODEL

Consider a MJE with affiliates in two jurisdictions labeled by  $i \in \{a, b\}$ <sup>7</sup>. The profit of the affiliate in jurisdiction  $i$  is denoted by the random variable  $\pi_i$  which takes the value  $\pi > 0$  with probability  $p \in [0, 1]$  and  $-\pi < 0$  with probability  $1 - p$ . Hence, there are four states of the world for the MJE (Table 1). It may make positive profits in both jurisdictions, it may realize positive profit in jurisdiction  $a$  while making a loss in jurisdiction  $b$  and *vice versa*, or it may incur losses in both jurisdictions. In order to focus on the consolidation decision, we assume that the MJE has already decided on investment

Profits of affiliate $b$	Profits of affiliate $a$	
	$\pi$	$-\pi$
$\pi$	$p^2$	$p(1 - p)$
$-\pi$	$p(1 - p)$	$(1 - p)^2$

<sup>7</sup> Since our analysis focuses on source-based corporate taxation, it is irrelevant whether the headquarters of the MJE are located in jurisdiction  $a$  or jurisdiction  $b$ .

and employment, so the probability distribution of  $\pi_i$  is taken as given.<sup>8</sup> The MJE has discretion with regard to the inclusion of affiliates into a consolidated group. It can thus choose between FA taxation (consolidation) and SA taxation (no consolidation). In order to characterize this choice, we determine and compare the maximum expected after-tax profit of the MJE under the two options.

### A. Separate Accounting and Profit Shifting

If the MJE does not consolidate, it is taxed according to the SA principle. It may then shift profits from one jurisdiction to the other. Typical channels of profit shifting involve the manipulation of transfer prices in intra-firm trade, the use of internal debt, and the manipulation of the allocation of overhead costs (Devereux, 2006). Since the specific channel of profit shifting is immaterial for our purpose, we simply consider the total amount of profit shifted, denoted by  $s$ . If  $s > 0$ , the MJE shifts profit from jurisdiction  $a$  to jurisdiction  $b$ , while for  $s < 0$ , shifting takes place in the other direction. Profit shifting is not costless to the MJE, as it incurs concealment costs denoted by  $C(s)$ . These costs reflect, for example, the MJE's expenses for tax lawyers or the risk of additional tax payments if the tax authorities successfully challenge transfer prices or other aspects of income attribution. The concealment cost function satisfies  $C(0) = 0$ ,  $\text{sign}\{C'(s)\} = \text{sign}\{s\}$  and  $C''(s) > 0$ , i.e., it is U-shaped with the minimum at the point where the MJE is not shifting profits.

While profit shifting does not affect the probability distribution of profits depicted in Table 1, it changes the *reported* profits of the affiliates. If the reported profit in jurisdiction  $i$  is positive, it is taxed in this jurisdiction by a local business tax, where the tax rate is denoted by  $t_i \in [0, 1]$ . A negative reported profit (i.e., a tax loss) is not taxed, and a part  $\theta \in [0, 1]$  of it can be deducted from the tax base in the other jurisdiction (the inter-firm loss offset), provided the MJE reports a positive profit there. For instance, if the MJE reports  $\pi - s > 0$  in jurisdiction  $a$  and  $-\pi + s < 0$  in jurisdiction  $b$ , tax payments are zero in jurisdiction  $b$  and  $t_a[\pi - s + \theta(-\pi + s)]$  in jurisdiction  $a$ . When the MJE incurs losses in both jurisdictions, tax payments are zero in both jurisdictions.

We focus on the case where profit shifting does not change the sign of the affiliates' reported earnings, i.e.,  $s \in [-\pi, \pi]$ , so that if the MJE earns a positive profit  $\pi$  in a jurisdiction, profit shifting does not result in a reported loss. Moreover, in case of a loss  $-\pi$ , the MJE's shifting does not result in reporting a positive profit. A sufficient condition for  $s \in [-\pi, \pi]$  is that concealment costs are not too low.<sup>9</sup> The MJE's expected after-tax profit with SA taxation can then be written as

$$(1) \quad \pi_s(s) = p^2[(1 - t_a)(\pi - s) + (1 - t_b)(\pi + s)] \\ - p(1 - p)(1 - \theta)[t_a(\pi - s) + t_b(\pi + s)] - 2\pi(1 - p)^2 - C(s),$$

<sup>8</sup> Endogenizing the investment and labor choices of the MJE would complicate the analysis without yielding further insights. For instance, suppose the profit of an affiliate is given by  $\pi(k, l) = X(k, l) - rk - wl$  where  $X$  is the production function,  $k$  and  $l$  are capital and labor input, and  $r$  and  $w$  are the factor prices. It can then be shown that our results remain qualitatively unchanged.

<sup>9</sup> For example, it can be shown that with quadratic concealment costs  $C(s) = \beta s^2/2$  with  $\beta > 0$ , there always exists a  $\bar{\beta}$  such that the MJE chooses  $s \in [-\pi, \pi]$  if  $\beta > \bar{\beta}$ .

which equals the after-tax profit/loss in the four different states of the world, weighted by the probabilities of these states, less concealment costs.

Under SA taxation, the MJE maximizes the expected after-tax profit (1) with respect to profit shifting  $s$ . From the first-order condition  $\pi'_s(s) = 0$ , we obtain

$$(2) \quad (t_a - t_b)[p^2 + p(1-p)(1-\theta)] = C'(s).$$

According to (2), the MJE shifts profit up to the point where the expected marginal gain from profit shifting in terms of the tax-rate differential (LHS) just equals the marginal concealment costs (RHS). This condition determines optimal profit shifting as a function of the tax-rate differential, i.e.  $s^* = S(t_a - t_b)$  with  $S(t_a - t_b) \geq 0$  if and only if  $t_a - t_b \geq 0$ . Differentiating (2) with respect to  $t_a - t_b$  yields  $S'(t_a - t_b) = [p^2 + p(1-p)(1-\theta)]/C'' > 0$ . As is intuitively plausible, an increase in the tax-rate differential in absolute terms induces the MJE to shift more profit between the two jurisdictions.

Substituting the optimal amount of shifting  $S(t_a - t_b)$  into (1) yields the maximum expected after-tax profit under SA taxation. Using (2) and rearranging yields

$$(3) \quad \pi_s^* = \pi_s[S(t_a - t_b)] = 2\pi(2p-1) - T^s(t_a, t_b) - L(\theta) + F(t_a - t_b),$$

where we have defined  $T^s(t_a, t_b) = p^2\pi(t_a + t_b)$ ,  $L(\theta) = p(1-p)\pi(1-\theta)(t_a + t_b)$  and  $F(t_a - t_b) = S(t_a - t_b)C'[S(t_a - t_b)] - C[S(t_a - t_b)]$ . According to (3), the maximum expected after-tax profit under SA consists of four components. The term  $2\pi(2p-1)$  represents the expected maximum profit before taxes, loss-offset, and profit shifting. From this profit we have to subtract the expected tax payments before profit shifting and loss-offset,  $T^s(t_a, t_b)$ , and the additional tax payments due to restricted loss-offset,  $L(\theta)$ . Finally, we have to add  $F(t_a - t_b)$  which represents the net gain from profit shifting. Note that the properties of  $C$  and  $S$  imply  $F(0) = 0$ ,  $F(t_a - t_b) > 0$  if  $t_a - t_b \neq 0$  and  $F'(\cdot) = S(\cdot)S'(\cdot)C''[\cdot] \geq 0$  if and only if  $t_a - t_b \geq 0$ . Hence, an increase in the tax-rate differential in absolute terms raises the MJE's net gain from profit shifting.

## B. Formula Apportionment and Formula Distortion

If the MJE consolidates its affiliates, profit is taxed according to the FA principle. The pre-tax profit is first consolidated and then apportioned to the two jurisdictions according to a formula. Note that consolidation implies full loss offset.<sup>10</sup> Moreover, the MJE's profit-shifting incentive is eliminated since the consolidated tax base is independent of profit shifting. Hence, under FA taxation, the MJE chooses  $s = 0$  and thereby

<sup>10</sup> Full loss offset is only granted as long as losses in one affiliate are not larger than the profits in the other affiliate. In our model, this condition is satisfied as we assume that the loss in absolute terms ( $-\pi$ ) is equal to the profit ( $\pi$ ). In asymmetric scenarios, in which deductible losses at one subsidiary exceed profits earned at the other subsidiary, the MJE would only receive a partial loss offset since the government does not refund negative tax payments, although they may be carried forward. Accounting for this would not change the main conclusions of our analysis.

$C(0) = 0$ . However, from the previous literature discussed in Section I, it is known that the apportionment mechanism may distort production decisions, depending on the definition of the apportionment factors. With capital and labor input as apportionment factors, for instance, the MJE may alter its production decisions by investing more capital and employing more labor in the low-tax jurisdiction than in the high-tax jurisdiction since, by doing so, it affects the formula weights and thus effectively allocates a larger part of the consolidated tax base to the low-tax jurisdiction, which reduces its tax burden. Since this tax distortion only arises under FA taxation, we refer to it as the formula-distortion.

To capture the formula-distortion incentive, albeit in a stylized way, we assume that the MJE directly chooses the shares of the consolidated tax base assigned to the two jurisdictions. For simplicity, we maintain the above assumption that the underlying distribution of profits is symmetric so that expected profits are identical at the two affiliates. Let the share of (pre-tax) profits assigned to jurisdiction  $a$  be denoted by  $\alpha \in [0,1]$ . Consequently, jurisdiction  $b$  receives a share of  $1 - \alpha$ . The share  $\alpha$  chosen by the MJE may differ from the “true” share  $\bar{\alpha} \in [0,1]$ , i.e., the share of (pre-tax) profits apportioned to jurisdiction  $a$  in a hypothetical situation in which the MJE is not subject to taxation. For example, if payroll is the only apportionment factor and if, in the absence of taxation, the MJE uses less (more) labor in jurisdiction  $a$  than in jurisdiction  $b$ , then  $\bar{\alpha} < 0.5$  ( $\bar{\alpha} > 0.5$ ). If both affiliates have the same payroll costs in the absence of taxation, we obtain  $\bar{\alpha} = 0.5$ . When taxation is introduced, the MJE may relocate input factors and hence choose  $\alpha$  to differ from  $\bar{\alpha}$  in order to reduce its tax burden. This is the formula-distortion incentive of the MJE. Deviation is not costless, however, since relocating input factors distorts the MJE’s production decision. These distortion costs are denoted by  $D(\alpha - \bar{\alpha})$  with  $D(0) = 0$ ,  $\text{sign}\{D'(\alpha - \bar{\alpha})\} = \text{sign}\{\alpha - \bar{\alpha}\}$  and  $D''(\alpha - \bar{\alpha}) > 0$ , i.e., the distortion costs are U-shaped with the minimum at the point where the MJE is not distorting the apportionment formula.

The consolidated tax base is  $2\pi$  with probability  $p^2$ , zero with probability  $2p(1-p)$ , and  $-2\pi$  with probability  $(1-p)^2$ . The MJE’s expected after-tax profit under consolidation is thus

$$(4) \quad \pi_f(\alpha) = 2p^2\pi[1 - \alpha t_a - (1 - \alpha)t_b] - 2\pi(1-p)^2 - D(\alpha - \bar{\alpha}).$$

The MJE maximizes (4) with respect to the apportionment share  $\alpha$ . From the first-order condition  $\pi'_f(\alpha) = 0$ , we obtain

$$(5) \quad -2p^2\pi(t_a - t_b) = D'(\alpha - \bar{\alpha}).$$

Condition (5) states that the optimal formula-distortion equates the expected marginal gain in terms of the tax-rate differential (LHS) and the marginal distortion costs (RHS). This condition determines the MJE’s optimal deviation from the true apportionment share as a function of the tax-rate differential. Formally, we can write  $\alpha^* - \bar{\alpha} = A(t_a - t_b)$

with  $A(t_a - t_b) \stackrel{\geq}{\leq} 0$  if and only if  $t_a - t_b \stackrel{\leq}{\geq} 0$ . Differentiating (5) yields  $A'(t_a - t_b) = -2p^2\pi/D'' < 0$ . Thus, the MJE distorts its factor allocation such that a larger share of the consolidated tax base is allocated to the low-tax jurisdiction, and the incentive to do so increases with the tax-rate differential (in absolute terms).

Inserting  $A(t_a - t_b)$  into (4) and rearranging yields the maximum expected after-tax profit under FA taxation

$$(6) \quad \pi_f^* = \pi_f [A(t_a - t_b) + \bar{\alpha}] = 2\pi(2p - 1) - T^J(t_a, t_b) + G(t_a - t_b),$$

where  $T^J(t_a, t_b) = 2p^2\pi[\bar{\alpha}t_a + (1 - \bar{\alpha})t_b]$ , and  $G(t_a - t_b) = A(t_a - t_b)D'[A(t_a - t_b)] - D[A(t_a - t_b)]$ . The maximum expected after-tax profit (6) consists of three components. The term  $2\pi(2p - 1)$  represents the expected profit before taxes and the formula-distortion and is the same as under SA. From this before-tax profit, we have to subtract tax payments before the formula distortion,  $T^J(t_a, t_b)$ , and add the net gain from distorting the apportionment formula,  $G(t_a - t_b)$ . The properties of  $A$  imply  $G(0) = 0$ ,  $G(t_a - t_b) > 0$  if  $t_a - t_b \neq 0$  and  $G'(\cdot) = A(\cdot)A'(\cdot)D''[\cdot] \stackrel{\geq}{\leq} 0$  if and only if  $t_a - t_b \stackrel{\geq}{\leq} 0$ . Hence, an increase in the tax-rate differential in absolute terms raises the net gain from formula-distortion.

### C. Consolidation Decision

In order to characterize the MJE's consolidation decision, we have to take into account the maximum expected after-tax profit under SA and FA in (3) and (6). Moreover, the MJE is assumed to incur additional costs  $\gamma > 0$  if it does not consolidate the affiliates. These non-consolidation costs reflect the costs of operating an affiliate as a separate entity for tax purposes. For example, in the institutional context of the empirical analysis below, the MJE would have to change the organizational, economic, and financial integration of the firms. As a consequence, agency costs with regard to the management of the affiliates may arise. Another example of non-consolidation costs is possible double taxation under SA; we provide some examples in the empirical analysis below.<sup>11</sup> Overall, the MJE will not consolidate if and only if  $\pi_s^* - \gamma > \pi_f^*$  or, equivalently, if

$$(7) \quad H(t_a - t_b, \gamma, \theta) = F(t_a - t_b) - L(\theta) - \gamma - G(t_a - t_b) - \Delta(t_a - t_b) > 0,$$

where  $\Delta(t_a - t_b) = T^S(t_a, t_b) - T^J(t_a, t_b) = p^2\pi(1 - 2\bar{\alpha})(t_a - t_b)$ . The function  $H$  can be interpreted as the expected net gain from non-consolidation. It equals the gain from profit shifting under SA ( $F$ ) less the additional tax payments due to the restricted loss-offset under SA ( $L$ ), the non-consolidation costs under SA ( $\gamma$ ), the gain from formula distortion under FA ( $G$ ), and a term  $\Delta(t_a - t_b)$  that reflects the difference in tax payments under the two tax methods. The last term indicates a possible selection effect of FA. To illustrate this, consider an example where, despite equal profits, the MJE has a lower true apportionment share in jurisdiction  $a$  ( $\bar{\alpha} < 0.5$ ). If jurisdiction  $a$  is the high-tax jurisdiction

<sup>11</sup> There may also be regulations that force the MJE to consolidate. Such regulations would further raise  $\gamma$ .

( $t_a > t_b$ ), then the MJE has a further incentive to opt for consolidation since this reduces the tax payments even without distorting the formula ( $\Delta > 0$ ). If jurisdiction  $a$  is the low-tax jurisdiction ( $t_a < t_b$ ), the opposite applies, and the MJE has a reduced incentive to opt for consolidation ( $\Delta < 0$ ).

Partial differentiation of (7) yields<sup>12</sup>

$$(8) \quad \frac{\partial H}{\partial(t_a - t_b)} = F'(\cdot) - G'(\cdot) - \Delta'(\cdot), \quad \frac{\partial H}{\partial \gamma} = -1, \quad \frac{\partial H}{\partial \theta} = -L'(\cdot) = \pi p(1-p)(t_a + t_b).$$

From (8), we immediately obtain the following result.

**Proposition.** *Consolidation of the MJE is less likely (1) the lower the non-consolidation costs  $\gamma$ ; (2) the more generous the loss-offset opportunities  $\theta$  available without consolidation; and (3) the larger the tax-rate differential  $t_a - t_b$  in absolute terms, provided that  $|F'(\cdot)| > |G'(\cdot) + \Delta'(\cdot)|$ .*

The intuition underlying parts (1) and (2) of this proposition is obvious. The lower the direct non-consolidation costs  $\gamma$ , the higher is the net gain from non-consolidation ( $H$ ) and the less likely is consolidation of the affiliates. A larger value of  $\theta$  reduces the limitation of loss-offset opportunities under SA taxation and thereby reduces the gap to complete loss offset under FA taxation. Hence, the net gain from non-consolidation ( $H$ ) increases and it becomes less likely that the MJE will consolidate the two affiliates.

According to part (3) of the proposition, the impact of the tax-rate differential  $t_a - t_b$  on the MJE's consolidation decision depends on the relative magnitudes of three effects. First, if the tax-rate differential increases in absolute terms, the net gain from profit shifting under SA taxation ( $F$ ) goes up and increases the net benefit from non-consolidation ( $H$ ). Second, a higher tax-rate differential in absolute terms also raises the net gain from formula distortion under FA taxation ( $G$ ), and thus lowers the net gain from non-consolidation ( $H$ ). Third, if the true apportionment share is lower in the high-tax jurisdiction ( $t_a > t_b$  and  $\bar{\alpha} < 0.5$ , or  $t_a < t_b$  and  $\bar{\alpha} > 0.5$ ), an increase in the tax-rate differential raises the benefit from the selection effect of consolidation ( $\Delta$ ) described above and thereby reduces the net gain from non-consolidation ( $H$ ). If the gain from profit shifting reacts more sensitively to changes in the tax-rate differential than the gain from formula distortion and the benefit from the selection effect, i.e.,  $|F'| > |G' + \Delta'|$ , the total effect on the net gain of non-consolidation ( $H$ ) is positive. Under this condition, if the tax-rate differential rises, it becomes more attractive to opt against consolidation and to exploit profit-shifting opportunities offered by the SA regime.

The validity of the condition  $|F'| > |G' + \Delta'|$  is an empirical question. It is often argued that the reallocation of profit is substantially easier via the shifting of paper profits under SA than via changing the apportionment factors under FA, which requires a relocation of real economic activity (i.e.,  $|F'| > |G'|$ ). Mintz and Smart (2004) present empirical

<sup>12</sup> Note that  $F$  does not depend on  $\theta$  due to the envelope theorem.

evidence consistent with this view. Their analysis for the Canadian corporate tax system suggests that the tax bases of firms that are taxed according to SA react more sensitively to corporate tax-rate changes than the tax bases of firms that are taxed according to FA. This is also likely to hold true in our empirical setting, as many low-tax municipalities in Germany are located in remote areas with inferior labor market access and poor infrastructure. Thus, the advantage of profit shifting strategies under SA is that it allows the transfer of profits to tax haven municipalities while production locations can remain in agglomeration centres that commonly charge high local business tax rates. Under FA with payroll apportionment, the MJE, in contrast, has to shift a significant part of its work force to low-tax jurisdictions in order to reduce its corporate tax burden which — despite low property prices — is likely to be associated with significant costs due to forgone benefits from labor market access, proximity to other companies (i.e., benefits from technological spillovers), and inferior infrastructure.

The condition stated in the proposition also hinges on the selection effect. If the selection effect favors consolidation ( $\Delta > 0$ ) then, because more weight is attached to low-tax locations since  $\Delta' > 0$ , it is possible that firms with large tax-rate differentials find it more attractive to opt for consolidation. If we observe empirically that firms facing large tax-rate differentials opt for non-consolidation, we can infer that the gains from profit shifting outweigh the gains from manipulating the apportionment factors under FA ( $|F'| > |G'|$ ). Provided the gains from formula distortion dominate the selection effect, this also holds if the selection effect works against consolidation,  $\Delta < 0$ . While this depends on the actual formula weights used for the apportionment, we argue that in the specific case we analyze below, if a general selection effect exists, it is more likely to favour consolidation ( $\Delta > 0$  and  $\Delta' > 0$ ).

### III. INSTITUTIONAL BACKGROUND AND INVESTIGATION APPROACH

To test the predictions of the theoretical model, we investigate local business taxation in Germany, which applies FA principles to the taxation of multi-jurisdictional firms. The local business tax is levied autonomously by German municipalities while the tax law that defines the tax base is determined at the national level. Moreover, tax administration is assigned to the state level. Thus, local autonomy is confined to setting the tax rate. The tax is levied on all income that is considered to be business income under the income tax, regardless of whether it accrues to incorporated or unincorporated firms. Corporations and individuals are subject to local business taxation if they operate a permanent establishment in a municipality. If corporations or individuals run several establishments or branches, which may or may not be located in other municipalities, business income is consolidated. The income of separate entities with their own legal status is consolidated if three criteria are fulfilled: (1) an entity is owned with a direct majority, (2) it is integrated in the hierarchical organization of the group, and (3) it has an economic relationship to the group's business. Once taxable income is determined, the tax base is then apportioned among all municipalities according to the payroll shares in the municipalities.

The local business tax burden on the tax base allocated to a municipality is determined by the municipality's business tax rate. This tax rate is measured in local business "tax points" and varies substantially between municipalities ranging from zero to 900 points in our data set, with an average of 325 points. To calculate a firm's actual tax rate, the municipality's local business tax points are divided by 100 and multiplied by the base tax rate of 5 percent. Thus, the average rate amounts to 16.25 percent ( $= 325/100 \cdot 0.05$ ). Taking into account the self-deductibility of the business tax, the resulting statutory tax rate on profits (ignoring the corporation tax) in 2001 varied between zero and 31 percent, with a mean of about 14 percent.<sup>13</sup> The tax base essentially corresponds to the firm's annual profits as defined for purposes of the corporation tax, but there are some important additions; most notably, 50 percent of interest payments (excluding short-term debt) are added to the local business tax base.

To relate the empirical analysis to our theoretical model, we have to clarify how the determinants of the consolidation decision identified in the above proposition work under the German local business tax. Consider first the dispersion of tax rates ( $t_a - t_b$  in the model). Due to the inclusion of interest payments in the tax base, profit shifting between unconsolidated affiliates by means of internal debt is quite costly. However, at least until 2008, other payments between affiliates such as license fees/royalties or intermediate inputs have not been taxed, and thus offer ample opportunities to exploit tax-rate differences for profit shifting. Indeed, restricting profit shifting between unconsolidated affiliates was the basic motivation for implementing group taxation in Germany in 1906, and has been supported by the highest courts continuously (e.g., Bundesfinanzhof, 1990). With group status, the profits of an MJE are apportioned according to the payroll of the branches and subsidiaries. Hence, in order to reduce the effective tax burden under FA, a MJE needs to relocate payroll to low-tax jurisdictions. While this is certainly possible, it might be rather costly as it is the actual location of the work place of each individual worker that matters for apportionment — it is not sufficient to issue payment at another location (Lenski and Steinberg, 2009). Thus, even though MJEs may to some extent engage in manipulating the location of factors that serve as apportionment weights under the German local business tax, this is likely to be more costly than shifting paper profits between unconsolidated affiliates (which implies  $|F'| > |G'|$  in the theoretical model). Thus, given the definition of formula weights, if a general selection effect exists in the German case, it is likely to be positive. To see why, note that with weights based on payroll a positive selection effect arises if more profitable activities are carried out in the jurisdictions with higher tax rates. Since local tax rates in Germany are closely associated with population size and density (Buettner, 2001; Koh and Riedel, 2010), and since densely populated jurisdictions tend to host the more profitable headquarters activities as well as R&D, the selection effect is likely to be positive and increasing in the tax rate differential.

<sup>13</sup> The self-deductibility of the local business tax implies that the tax payment  $T$  is calculated as  $T = t(\pi - T)$ , with  $t$  denoting the local business tax rate (in percentage values) and  $\pi$  denoting the company profits. Rearranging yields  $T = t/(1 + t)\pi$ . Hence, the statutory local business tax rate that is implied by a local business tax of 16.25 percent, for example, is  $0.1625/1.1625 = 14$  percent.

Analogously to other FA systems and consistent with the basic presumption of our theoretical model, MJE's under the German local business tax have some discretion with regard to a consolidation decision. As mentioned above, in the period under consideration, the legal group definition relies on three separate but related criteria: (1) majority ownership; (2) a hierarchical organization; and (3) some economic relationship. In order to avoid group status, it is sufficient for a multijurisdictional entity to fail to meet one of the three criteria. For instance, since the ownership criterion requires that the dependent affiliate be held with a *direct* majority, group status could be avoided if the affiliate were indirectly held. The separate entity would then not be considered as being financially integrated even if it is held indirectly. Another option for avoiding group status would be to change the organizational structure such that the board of the separated entity has discretion with regard to business decisions. A third option would be to sever economic relations with the entity, although whether this is feasible depends on the specifics of the firm.

Even if group status can easily be avoided, operating separate affiliates under the German local business tax nevertheless incurs costs. For example, it may reduce the efficiency of management processes and increase agency costs with regard to the management of the separated affiliates. Such costs correspond to the parameter  $\gamma$  in our model. Moreover, separating out affiliates implies that there is no direct inter-firm loss offset for tax purposes, i.e., a loss of one affiliate cannot be offset against the profit of another affiliate. This disadvantage is exacerbated by the link between the group definition for the purpose of local business taxation and the group definition for the purpose of the German corporation income tax which is levied at the federal level.<sup>14</sup> Before 2000, the criteria for group taxation with regard to the federal corporation tax were the same as with regard to the business tax, except that a profit-transfer agreement also needed to be signed.<sup>15</sup> As a consequence, a reorganization of the firm to avoid group status for the local business tax implied that no group status and hence no loss offset could be obtained under the federal corporation tax. Since the federal corporation tax accounted for about two-thirds of the total effective tax rate on corporate profits in Germany in 2001, this non-consolidation for purposes of the federal corporation tax imposed significant costs on MJE's. In addition, until 2000, expenses related to tax-exempt activities were not deductible without group status. Lacking group status also limits the ability to avoid transfer taxes such as the real estate transfer tax (Herrmann, Heuer, and Raupach, 2001). In a stylized way, the tax costs of non-consolidation due to limitations on loss offsets and double taxation are captured by  $\theta$  and  $\gamma$  in our model.

Against this background, the empirical analysis exploits an exogenous variation in the German tax law that significantly lowered non-consolidation costs and thus increased the net gain from operating separate affiliates. In 2001, the German government

---

<sup>14</sup> With a statutory rate of 25 percent and a surcharge of 5.5 percent, the effective corporation tax rate is about 26.4 percent. Assuming the municipality sets the statutory rate of the local business tax at 20 percent, which was typical for German cities in 2001, and taking into account the deductibility of the local business tax, the total tax rate is 38.5 percent.

<sup>15</sup> A profit transfer agreement regulates the relationship between a parent firm and its subsidiary. The subsidiary places itself under the control of the parent firm and agrees to transfer its total profit to the parent.

implemented a broad company tax reform. Although the reform did not directly alter the consolidation rules for the purposes of the local business tax, the rules governing group status with regard to the federal corporation tax were significantly altered. The new rule defining corporation tax group status is characterized by a simple ownership requirement, including indirect participation and a profit transfer agreement. This has created a situation where MJE's have considerable freedom to select group status (Krebs, 2001) since they now can decide separately whether to consolidate a firm for the purpose of the local business tax and the federal corporation tax (Kirsch and Grube, 2001).<sup>16</sup>

By allowing the firm to keep group status for purposes of the corporation tax, the 2001 reform significantly decreased the costs of separating some affiliates from the rest of the group for purposes of the local business tax. The MJE may reap tax savings from separate assessment of affiliates for local business tax purposes by exploiting profit-shifting opportunities. However, this separate assessment does not automatically imply that the MJE has to forgo the benefits of group taxation under the federal corporation tax.

In terms of our formal model, the reform not only lowered the non-consolidation costs  $\gamma$  but also increased the loss-offset parameter  $\theta$ . Hence, in line with the results of the theoretical analysis, we predict that the reform increased the MJE's incentives to exclude affiliates for local tax purposes, and that this behavioral response is likely to be especially important for groups facing a large dispersion of statutory local tax rates.

#### IV. DATA SET AND SAMPLE STATISTICS

We test for strategic consolidation using a unique dataset provided by the German Statistical Offices at the federal and state levels. The data contain information from confidential tax returns for the whole population of German companies that are subject to local business taxation. The information is gathered directly from German tax authorities and is available for the years 1998 and 2001.<sup>17</sup>

---

<sup>16</sup> A subsequent reform synchronized the consolidation rules under the local business tax with the less stringent regulations for federal corporate income tax purposes (Herzig, 2003). While this has further relaxed the constraints on the choice between FA and SA and created further profit-shifting opportunities (Rädler, 2003), the partial loss-offset opportunity that was created by the 2001 reform was abolished.

<sup>17</sup> While this allows us to analyse German companies before and after the reform, one may wonder whether the changes in the tax law that were effective until January 1, 2001 could trigger significant responses in the first year after enactment. This may be possible because this particular tax reform received substantial attention prior to its enactment. When the idea to simplify group taxation was first announced by the German government in February 2000, it generated considerable discussion not only among tax professionals but also in the policy arena. The result was a contested decision by the tax committee of the German parliament in May 2000 to change only the rules for the corporation tax. After the Senate (Bundesrat) agreed to the reform in July 2000, tax accountants and tax journals provided detailed discussions of the implications of the new law in order to help their clients to take full advantage of the reform (Doetsch and Pung, 2000; Oppenhoff & Rädler Partnership, 2000). As a consequence, the costs and benefits of consolidation and separation were known well in advance of 2001. As consolidation and separation of firms is to a large extent simply a matter of changing agreements between the affiliated firms, the time for adjustment prior to 2001 should have been sufficient. In particular, the separation of firms that is the subject of our analysis is rather simple in terms of administration as it may even be sufficient to change from direct to indirect ownership (see above). The policy reform discussed, however, may also affect later group structure choices that occur after the year 2001; for example, the decision to consolidate or not consolidate new group affiliates. As such long-run effects are not captured by our analysis, our empirical results should be interpreted as a lower bound for the full effect.

The dataset includes information about the capital stock, payroll, industry, multi-jurisdictional status (multi-jurisdictional versus uni-jurisdictional firms), legal form (incorporated versus unincorporated firms), taxable profits, and the characteristics of the firms' hosting locations. Since we are interested in investigating tax effects on the MJE's consolidation decisions, we restrict our attention to entities that operate affiliates (i.e., branches or separate entities that are considered to be part of the same corporate group) in several municipalities and are therefore subject to FA regulations. One major advantage of the data is that they allow us to identify *all* group affiliates that are consolidated. To determine tax effects on the number of consolidated affiliates between 1998 and 2001, we restrict attention to MJEs for which data are available in both sample years. The resulting dataset covers 50,342 groups.<sup>18</sup>

Table 2 presents basic sample statistics for the corporate groups in our dataset. In 1998, the average number of affiliates that are consolidated under FA rules is 4.1 for the MJEs in our data set. Between 1998 and 2001, this number increases by 0.11. Calculating the average growth rate in the number of consolidated affiliates for the same time period yields a figure of 5.47 percent. The positive average trend in firm numbers possibly reflects a host of different trends in the German economy. This includes the macroeconomic performance of the German economy, structural changes in industry composition, and business cycle effects. Moreover, the growth rate in the number of consolidated affiliates varies considerably across the groups in our sample because, first, almost 50 percent of the MJEs report a non-zero change in their number of consolidated affiliates and, second, the standard deviations reported in Table 2 also suggest considerable differences in the quantitative magnitude of the changes in firm numbers across observations.

Our theoretical discussion suggests that, given the decline in non-consolidation costs, the rate of growth in the number of affiliates should be inversely related to the variation in the local business tax rates across affiliates, since this determines the potential gains from profit shifting. To measure the variation of the statutory tax rates, we employ two alternative indicators. First, we calculate the variance of the distribution of local business tax rates within each multi-jurisdictional group prior to the reform in 1998. The average variance measure in local business tax points is 950.35 and exhibits considerable variation across groups. Second, we calculate the ratio of the business tax points at the 90th percentile of the group's tax distribution to the business tax points at the 10th percentile of the group's tax distribution in 1998. The average of this measure amounts to 1.15 and indicates that the tax rate at the 90th percentile exceeds the tax rate at the 10th percentile by about 15 percent.<sup>19</sup>

We control for the characteristics of the groups' hosting municipalities as well as for several firm characteristics. The sample statistics for these variables are also

---

<sup>18</sup> The cross sections for 1998 and 2001 are linked by the respective group's tax account identifier which may potentially change over time, mainly in the course of tax office restructuring or headquarters relocations to other jurisdictions or, in larger cities, relocation to other quarters. While this reduces the sample size, it mainly constitutes random sample selection that is innocuous for our analysis.

<sup>19</sup> Measuring the tax-rate spread within the group by the variance or the above-described percentile ratio are two alternative ways to provide a multi-affiliate analog to the absolute tax-rate differential in the two-affiliate case that was used in the theoretical model.

**Table 2**  
Descriptive Statistics

Variable	Mean	Standard Deviation
Affiliate Numbers		
Difference in number of affiliates 2001–1998	0.1077	11.40
Growth rate of number of affiliates 2001–1998	0.0547	0.6298
Number of affiliates 1998	4.133	49.26
Measures of Tax-Rate Variation		
Tax variance 1998 (in local business tax points)	950.3	1632
90th/10th percentile, tax rate	1.153	0.1627
Other jurisdictional characteristics		
Inhabitants 1998	104,424	152,841
Employment 1998	48,516	78,397
Unemployment rate 1998	0.1295	0.0456
Group Characteristics		
Capital 1998 (in 1,000 DM <sup>1</sup> )	8,363	414,000
Pre-tax profit 1998 (in 1,000 DM <sup>1</sup> )	56.50	1,792
Capital intensity 1998	657.5	84,672
90th/10th percentile, capital 1998	1140	110,603
90th/10th percentile, pre-tax profit 1998	37.70	709.7
90th/10th percentile, relative wages 1998	2617	277,361
90th/10th percentile, capital intensity 1998	591.2	175,943

Notes: (1) DM is the abbreviation for “Deutsche Mark,” the German currency prior to the introduction of the euro. The Deutsche Mark to euro exchange rate is approximately two to one.

presented in Table 2. The hosting municipalities’ characteristics are based on data from the German Statistical Offices’ REGIOSTAT database. We calculate unweighted average values for the number of inhabitants, the number of employees, and the average unemployment rate for municipalities of the MJEs’ affiliates in 1998. Table 2 indicates that the multi-jurisdictional groups in our dataset are on average located in relatively large municipalities with 104,423 inhabitants and 48,516 employees on average. The average official unemployment rate in these municipalities is 12.9 percent.

The groups’ average capital stock in 1998 is calculated to be 8.3 million Deutsche Mark (DM) or approximately 4 million euros. The MJEs’ average (pre-tax) profits are 56,467 DM. Additionally, the descriptive statistics indicate considerable heterogeneity among

the MJE's consolidated affiliates with respect to size, profitability, and apportionment shares. Analogous to measuring the intra-group tax-rate distribution, we employ two measures, the variance and the ratio of the 90th to the 10th percentile of the intra-firm distribution, to capture how the capital stock, pre-tax profits, relative payroll shares, and capital intensities vary across group affiliates in 1998. Since the variance calculation exhibits similar findings, Table 2 reports the descriptive statistics for the 90/10 ratio only. The 90/10 ratio of the affiliates' capital stock points to considerable heterogeneity among affiliates. A similar picture emerges with regard to the variation of pre-tax profits, relative payroll shares, and capital intensities in 1998. All reported ratios are large and suggest heterogeneity across affiliates in the respective dimensions.

## V. ESTIMATION METHODOLOGY

We now assess empirically whether — as suggested by our theory — a large variation in statutory tax rates across multi-jurisdictional affiliates is indeed associated with a tendency to exclude affiliates from consolidation in 2001, when the cost of non-consolidation decreased substantially. Formally, we estimate the following model

$$(9) \quad \hat{n}_i = \beta_0 + \beta_1 v_i + \beta_2 \log n_i + \beta_3 x_i + \varepsilon_i,$$

where  $\hat{n}_i$  depicts the growth rate in the number of consolidated affiliates of MJE  $i$  between 1998 and 2001, and  $v_i$  symbolizes the intra-firm corporate tax-rate variation in 1998, measured either by the group's tax-rate variance in 1998 or the ratio of the business tax rate at the 90th percentile of the intra-firm tax distribution in 1998 to the business tax rate at the 10th percentile. Our theoretical model predicts that MJE's with a higher tax rate spread have a larger incentive to de-consolidate affiliates from the group in order to exploit profit shifting opportunities, and hence we expect  $\beta_1 < 0$ . The effect of profit shifting is thus identified by comparing, in the year after the tax reform, MJE's with a relatively large tax-rate spread to MJE's with a relatively small tax-rate spread. Technically speaking, the former firms constitute the treatment group and are predicted to have a stronger tendency to de-consolidate affiliates than the control group where the tax-rate spread is smaller. This identification strategy presupposes that the tax-rate spread in 1998 is uncorrelated to unobserved group characteristics that may affect the change in the number of consolidated affiliates. We consider that to be very likely, as the analysis includes a large set of control variables that absorb effects related to industry, firm size, profitability, capital intensity, and other factors (see below).

Note moreover that our investigative approach focuses on the multi-jurisdictional group. It does not attempt to predict how the reorganization of the group actually takes place. Given our theoretical result that the tax-rate differential captures the size of possible gains from profit shifting, we might, for instance, expect that affiliates whose tax rate significantly deviates from the group mean would have a higher probability of

being separated from the group. However, the separation decision will also depend on the specific cost of using separate accounting as well as on the cost of profit shifting. Moreover, it should be noted that the empirical variation that can be used to shed light on tax planning with regard to group status is at the level of the group rather than at the level of the individual affiliate. In other words, the decisions on whether to separate individual affiliates from group consolidation are hardly independent. We therefore restrict the analysis to the group level.

Our analysis controls for several group characteristics. We include the number of affiliates  $n_i$  that are consolidated under FA regulations in 1998, as well as various other variables that may exert an influence on the growth rate of the number of consolidated group affiliates. Since size and profitability may be important, we include each group's stock of capital, profitability, and capital intensity in 1998 as control variables. To account for structural differences between groups, we include a full set of industry dummies at the two-digit NACE level<sup>20</sup> and dummies for different legal forms (individual firms, non-incorporated firms, and incorporated firms).

Moreover, we control for the average characteristics of the MJE's hosting municipalities as described in the previous section. These variables capture some characteristics at the local or regional level that might be correlated with the changes in the numbers of consolidated affiliates. Finally, it seems reasonable to control for variation in other firm characteristics across subsidiaries to test whether the estimated effect simply picks up other types of heterogeneity among affiliates. Thus, we include control variables in our estimation equation for the variation in the affiliates' relative payroll share in 1998, as well as for the variation in capital stock, pre-tax profits, and capital intensity in 1998. The calculation of these measures of variation thereby follows the calculation methodology for the tax-rate variable, i.e., we calculate the variance of the measures across group affiliates and the ratio of the 90th to the 10th percentile of the variables' intra-group distribution.

In our baseline regression, we estimate (9) based on OLS methodology. However, although a relatively large fraction (almost 50 percent) of the MJEs report a change in the number of consolidated affiliates, the majority of these groups have a variation of only one consolidated affiliate, and less than 10 percent of these groups have a change of two or more.<sup>21</sup> This suggests that we should check whether the results are robust to the use of an alternative limited-dependent variable model. Hence, as a robustness check, we also construct a categorical variable that depicts whether the number of affiliates has increased, stayed constant, or declined, and then perform the analysis again using an ordered probit model.

---

<sup>20</sup> NACE is the abbreviation for "Nomenclature des Activites Economiques" and depicts the classification of economic activities in the European Community.

<sup>21</sup> Note, however, that this does not mean that the variation in the number of consolidated affiliates is small. An increase by one consolidated affiliate for a MJE that initially consists of three affiliates corresponds to a growth rate of 33 percent in the number of affiliates.

## VI. RESULTS

This section presents our estimation results. For all regressions the unit of observation is the multi-jurisdictional group. Table 3 displays the results of our baseline OLS regression.

The tax-rate variation  $v_i$  is captured by the variance across consolidated group affiliates in specifications (1) to (4) and by the ratio of the 90th to the 10th percentile of a group's tax-rate distribution in specifications (5) to (8). Heteroscedasticity-robust standard errors are reported in parentheses below the coefficient estimates. Specification (1) regresses the growth rate in the number of consolidated affiliates on the group's tax-rate variance and control variables for the number of consolidated group affiliates in 1998, the groups' legal form, a full set of industry fixed effects, and a dummy variable that indicates so-called integrated corporate groups that do not only comprise branches but also incorporated affiliates. As predicted by our theory, the variance of the statutory tax rates exerts a significantly negative influence on the number of consolidated affiliates. Evaluated at the sample mean, the coefficient estimate suggests that an increase in the tax variance measure by one standard deviation reduces the growth rate of the number of consolidated affiliates by 21.7 percent.<sup>22</sup>

Specification (2) adds additional control variables for the group's size, productivity, and capital intensity. Larger corporate groups (measured in terms of the total capital stock) display a higher growth rate of affiliate numbers. Moreover, the larger the group profit, the larger is the growth rate in affiliate numbers. In contrast, a high capital intensity is associated with a decline in the number of affiliates. The inclusion of these control characteristics renders the coefficient estimate for the number of consolidated affiliates in 1998 negative and statistically significant, suggesting that corporations with a larger number of affiliates increase the number of affiliates at a lower rate, all else equal. This might indicate that group level variables such as profits matter relative to the number of firms involved, or it might just reflect a stochastic mean-reversion effect. Specification (3) further controls for differences in local economic conditions, employing averages of the hosting jurisdictions' characteristics. Only the coefficient estimate for the average employment variable suggests a marginally significant positive influence on the growth rate of the number of affiliates, as the coefficient estimates for the other control variables remain statistically insignificant. At any rate, though, the inclusion of the additional controls does not affect the estimate of the coefficient for the tax-rate variance, which remains statistically significant, suggesting that an increase in the variance of the tax rate by one standard deviation reduces the growth rate of the number of consolidated affiliates by 22.4 percent.

---

<sup>22</sup> An increase in the tax variance by one standard deviation (= 1,631.8, Table 2) reduces the growth rate of the number of consolidated affiliates by 1.18 percentage points (= 1,631.8\*0.0726/10,000; see specification (1) of Table 3). Relative to the average growth rate in the number of consolidated affiliates of (= 5.47 percent, Table 1), this corresponds to a reduction of 21.7 percent.

**Table 3**  
 OLS Model - Dependent Variable: Growth Rate of the Number of Affiliates  
 Tax Dispersion Variable: Columns (1)-(4); Tax Variance/10,000; Columns (5)-(8): 90th/10th Percentile Tax Distribution

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dispersion Tax Rates	-0.0726*** (0.0172)	-0.0567*** (0.0195)	-0.0751*** (0.0244)	-0.0766*** (0.0235)	-0.0558*** (0.017)	-0.0622*** (0.0229)	-0.0778*** (0.0273)	-0.0696*** (0.0259)
Log Affiliate Number	-0.0005 (0.0003)	-0.0624*** (0.0085)	-0.0626*** (0.0084)	-0.0591*** (0.0092)	-0.0558*** (0.0063)	-0.0587*** (0.0081)	-0.0581*** (0.0079)	-0.0540*** (0.0067)
Integrated Group	0.0406* (0.0224)	0.0416 (0.037)	0.0411 (0.1955)	0.0385 (0.0371)	0.0786*** (0.0243)	0.0414 (0.0371)	0.0408 (0.0369)	0.044 (0.0372)
Log Capital		0.0176*** (0.0028)	0.0175*** (0.0028)	0.0172*** (0.0032)		0.0177*** (0.0028)	0.0177*** (0.0028)	0.0143*** (0.0029)
Log Pre-tax Profit		0.0074*** (0.0021)	0.0070*** (0.002)	0.0068*** (0.002)		0.0073*** (0.0021)	0.0070*** (0.002)	0.0089*** (0.0019)
Log Capital Intensity		-0.0153*** (0.0027)	-0.0148*** (0.0027)	-0.0144*** (0.003)		-0.0153*** (0.0027)	-0.0149*** (0.0027)	-0.0121*** (0.0022)
Log Inhabitants			-0.0179 (0.0112)	-0.0156 (0.0111)			-0.0196* (0.0114)	-0.0091 (0.0086)
Log Employment			0.0189* (0.0101)	0.0171* (0.0100)			0.0201** (0.0103)	0.0124 (0.0077)
Unemployment Rate			-0.0769 (0.0799)	-0.0842 (0.0796)			-0.0626 (0.0784)	0.0411 (0.0646)
Dispersion Relative Wages				-0.0088 (0.0716)				-0.0029 (0.0031)

Dispersion Capital / 10 <sup>15</sup>					0.0014*** (0.0003)					0.0032 (0.0033)
Dispersion Pre-tax Profit / 10 <sup>15</sup>					-9.58** (3.98)					-0.0002 (0.0002)
Dispersion Capital Intensity / 1000					-0.0302*** (0.0125)					-0.0027 (0.0028)
Industry dummies	√	√	√	√	√	√	√	√	√	√
Legal form dummies	√	√	√	√	√	√	√	√	√	√
Number of observations	52,342	31,740	31,727	31,727	31,687	52,340	31,738	31,725	31,138	
R-squared	0.0034	0.0093	0.0094	0.0094	0.0114	0.0065	0.0093	0.0095	0.0138	

Notes: Robust standard errors in parentheses. Asterisks indicate significance at the 1% (\*\*\*), 5% (\*\*), and 10% (\*) levels.

In specification (4) we check whether the coefficient for the variance of the tax rate simply picks up variation of other firm characteristics like size or profitability that may be correlated with the variation of tax rates across affiliates as well as with the growth rate in the group's number of consolidated affiliates. We also include a measure of the variance of payroll shares, which might affect consolidation decisions if a selection effect exists. The results suggest that the variance in affiliate size exerts a significant positive effect on the growth rate of the number of consolidated affiliates. This indicates that groups which consist of rather heterogeneous affiliates in terms of size in 1998 are more likely to increase the number of consolidated affiliates. The coefficient estimate for the variance in affiliate profits exhibits a statistically significant negative effect. This might indicate that with a strong variation in profitability between affiliates in 1998, a MJE may have an incentive to shut down the relatively unprofitable subsidiaries. However, an alternative explanation, in line with the theoretical model presented above, is that MJEs that had a relatively large variance of profits but avoided separate accounting before the reform to take advantage of the possibility of loss offset are now re-organizing. This directly translates into a reduction in the growth rate of affiliate numbers. A similar explanation applies to the negative significant effect of the variation in the affiliates' capital intensity. However, the coefficient estimate for the variation of the tax rates again remains stable and statistically significant. Evaluated at the sample mean, the coefficient estimate suggests that an increase in the tax variance measure by one standard deviation reduces the affiliate growth rate by 22.8 percent.<sup>23</sup>

To check whether our results are robust to alternative measures of the tax-rate distribution, we re-estimate the specifications employing the ratio of the 90th to the 10th percentile of a group's tax-rate distribution. Large values of this tax measure imply greater variation in the tax-rate distribution within the corporate group in 1998 and should result in a lower growth rate in the number of affiliates. This presumption is strongly confirmed by the results for specification (5) of Table 3. The coefficient estimate for the measure of the tax-rate dispersion is negative and statistically significant at the 1 percent level, suggesting that an increase in this indicator by one standard deviation reduces the growth rate of the number of consolidated affiliates by 15 percent. Specifications (6) to (8) show that this result is robust to the inclusion of the control variables employed above, which have the same signs as previously. The coefficient estimate in specification (8) indicates that an increase in the tax-rate dispersion measure by one standard

---

<sup>23</sup> While the F-test for the joint significance of the variables is highly significant at the 1 percent significance level in all specifications, the R-squared values are rather small. This indicates that a large fraction of the variation in the growth rate of the number of consolidated affiliates is explained by (firm-specific) factors not captured by our model. The small R-squared values may also point to lumpiness of the dependent variable. Nevertheless, given previous studies, we are not too concerned about this issue, since low R-squared values in regression equations are very common in the literature, especially for cross-sectional analysis. Moreover, the potential problem of a large error variance relative to the variance of the dependent variable is offset by the large sample size in our model specifications. Furthermore, it is widely acknowledged that empirical analyses should focus on the theoretical relevance of the explanatory variables to the dependent variable and their statistical significance rather than the R-squared statistic (Wooldridge, 2009).

**Table 4**  
 Ordered Probit Model – Dependent Variable: Growth Rate  
 of the Number of Affiliates  
 Tax Dispersion Variable: 90th/10th Percentile Tax Distribution

Variable	(1)	(2)	(3)	(4)
Dispersion Tax Rates	-0.2782*** (0.0379)	-0.3443*** (0.0491)	-0.3746*** (0.0533)	-0.3185*** (0.0544)
Log Affiliate Number	-0.1993*** (0.0138)	-0.1695*** (0.0180)	-0.1669*** (0.0181)	-0.1513*** (0.0185)
Integrated Group	0.1262*** (0.0301)	-0.0349 (0.0393)	-0.0378 (0.0393)	-0.0447 (0.0399)
Log Capital		0.0477*** (0.0055)	0.0476*** (0.0056)	0.0444*** (0.0056)
Log Pre-tax Profit		0.0292*** (0.0044)	0.0284*** (0.0045)	0.0290*** (0.0046)
Log Capital Intensity		-0.0361*** (0.0058)	-0.0349*** (0.0059)	-0.0294*** (0.0059)
Log Inhabitants			-0.0056 (0.0231)	-0.0042 (0.0234)
Log Employment			0.0134 (0.0198)	0.0120 (0.0200)
Unemployment Rate			-0.2304 (0.1529)	-0.1957 (0.1550)
Dispersion Relative Wages				-0.0007 (0.0008)
Dispersion Capital / 10 <sup>15</sup>				0.0014 (0.0008)
Dispersion Pre-tax Profit / 10 <sup>15</sup>				-0.0007*** (0.0003)
Dispersion Capital Intensity / 1000				-0.0012 (0.0007)
Industry dummies	√	√	√	√
Legal form dummies	√	√	√	√
Number of observations	52340	31738	31725	31138
Pseudo R-squared	0.0122	0.0134	0.0135	0.0127

Notes: Robust standard errors are in parentheses. Asterisks indicate statistical significance at the 1% (\*\*\*), 5% (\*\*), and 10% (\*) levels.

deviation reduces the growth rate of affiliate numbers by 20.7 percent.<sup>24</sup> Thus, the estimated effect is quantitatively close to the effect found using the tax variance measure.<sup>25</sup>

As described above, we re-estimated our regressions in an ordered probit framework where the dependent variable takes on three values: “affiliate number decreased” (= 1), “affiliate number stayed constant” (= 2), and “affiliate number increased” (= 3). The results are presented in Table 4 where the local business tax rate variation across group affiliates is captured by the ratio of the 90th to the 10th percentile of the tax distribution (employing the local business tax variance leads to comparable results).

Specifications (1) to (4) resemble the estimations presented in Table 3 and confirm the previous results in the sense that the dispersion measure exerts a statistically significant negative impact on the change in affiliate numbers. We also experimented with alternative categorizations of the dependent variable (e.g., the use of five categories) and obtained comparable results. To save space, the corresponding results are not presented here, but are available from the authors upon request.

We conclude from our empirical analysis that the evidence supports our theoretical prediction. MJE's experiencing a large variation in the tax-rate distribution among affiliates are found to have reduced the number of consolidated affiliates compared with MJE's with a low variation of tax rates across affiliates. This corresponds to the view that the former groups can generate larger profit-shifting gains under non-consolidation, and therefore reduced the numbers of their consolidated affiliates to a greater extent in response to the change in German tax law in 2001.

## VII. SUMMARY

While SA rules govern the taxation of multinational enterprises in the current system of international taxation, these rules are often criticized as giving rise to profit-shifting opportunities. As an alternative, a FA system of profit consolidation and apportionment has been suggested in the literature and in the policy arena, primarily on the grounds that group-wide consolidation is believed to eliminate profit-shifting incentives. However, our paper shows that profit-shifting incentives remain important under FA. We argue that a particular problem faced under FA is that profit shifting within the corporate group is eliminated only if all group affiliates of a MJE are consolidated. Since the rules that determine the consolidated group usually depend on the degree of economic and financial integration which ultimately reflect firm decisions, MJE's will have some

---

<sup>24</sup> Note that the dispersion measures for affiliate characteristics (e.g., capital stock and profit levels) that are included in specification (8) are calculated as the ratio of the 90th percentile of the intra-group distribution to the 10th percentile of the intra-group distribution to be consistent with the calculation of the measure of the tax-rate variation.

<sup>25</sup> Although the two measures for the groups' tax rate spread (the variance and percentile ratio) differ in size by construction (see the descriptive statistics in Table 1), interpreting effects on the affiliate growth rate in terms of one standard deviation from the variables' sample mean allows us to directly compare the magnitudes of the estimated effects.

flexibility in deciding whether their affiliates are included in the consolidated group. As a result, consolidation becomes a strategic tax planning tool for a MJE.

To analyze strategic consolidation, we develop a theoretical model of a MJE that operates affiliates in different jurisdictions and determines whether to consolidate these affiliates. Within this model, we identify the basic trade-off involved in the consolidation decision. On the one hand, exclusion of affiliates has costs, notably, loss-offset opportunities that cannot be exploited and the possibility of double-taxation. On the other hand, non-consolidation has the benefit of maintaining profit-shifting opportunities. This benefit, and thus the incentive for non-consolidation of affiliates, increases in importance as the dispersion of statutory tax rates within the whole corporate group increases. Provided that the net gain from profit shifting is larger than the net gain from manipulating apportionment shares and the selection effect under formula apportionment, we expect that consolidation is more likely if the tax-rate differential is small and if the costs of non-consolidation, including those arising from incomplete loss offset, are high.

The empirical analysis provides evidence that MJEs that are taxed according to FA do, in fact, strategically exclude affiliates from consolidation. The analysis uses a unique firm-level data set that includes confidential tax-return data for the whole population of German firms in 1998 and 2001. To identify the strategic consolidation decision, we use an exogenous variation in the German tax law that came into effect in January 2001 and reduced the costs of excluding affiliates from the consolidated group under the German local business tax system. Our empirical results confirm our theoretical prediction, and suggest that an increase in the variation of tax rates within a corporate group by one standard deviation reduces the growth rate of the number of consolidated affiliates by around 20 percent. This finding is stable for a large set of specifications and robustness checks.

The paper thus indicates that MJEs tend to strategically exclude affiliates from consolidation under FA taxation in order to preserve profit-shifting opportunities within the multi-jurisdictional group. However, if profit-shifting channels to unconsolidated group affiliates remain open, this may — at least to some extent — undermine the effectiveness of the FA system in eliminating profit-shifting activities. Since anecdotal and empirical evidence suggest that MJEs have greater flexibility in transferring income to low-tax jurisdictions under SA than under FA (mainly because the latter requires changes in the real economic activities captured by the apportionment formula rather than the shifting of paper profits required under SA), the non-consolidation option may cause additional welfare losses under the FA regime. For instance, in a tax competition setting, the jurisdictions' incentives for a detrimental race-to-the-bottom in tax rates may be aggravated if firms decide against consolidation.<sup>26</sup>

Thus, a direct policy implication of our paper is that the design of FA regimes should try to minimize the possibility that consolidated groups can exclude affiliates. Otherwise

---

<sup>26</sup> It should be noted, however, that some recent papers point out that profit shifting may mitigate tax competition since it effectively allows discrimination between mobile and immobile firms (Hong and Smart, 2010).

MJEs will tend to leave affiliates in low-tax jurisdictions unconsolidated and engage in profit-shifting activities, despite the existence of a FA regime. In practical terms, this suggests that FA regimes should set the ownership participation threshold above which affiliates must be consolidated within multi-jurisdictional groups as low as possible; this will result in the inclusion of the maximum number of affiliates in the consolidated group, and make strategic non-consolidation more costly for the MJE. Moreover, emphasis should be placed on the definition of economic and organizational criteria for the consolidation of group affiliates, since this further restricts the MJE's latitude to alter its group structure compared to a situation where the rules for consolidation are based only — or primarily — on legal status. Hence, with regard to the currently debated design of a CCCTB in the European Union, our analysis suggests that the European Commission should regard manipulation of the group structure as a serious threat to the effectiveness of an FA regime in curbing tax planning, and should opt for a group definition that ensures that tax-motivated manipulations of group structure are costly for MJEs. To underpin this policy recommendation, the German case again offers an interesting example. After a series of reforms that have relaxed the rules for consolidation, starting with the reform analyzed in this paper, tax authorities faced increasing problems in limiting profit shifting at the sub-national level, despite the implementation of FA. As a result, in 2004, federal legislation in Germany resorted to defining a minimum tax rate for the local business tax.

## ACKNOWLEDGEMENTS

We thank the editor George Zodrow, Charles McLure, two anonymous referees, and participants of the Meeting of the Association for Public Economic Theory (APET) in Seoul for helpful comments. Thiess Buettner gratefully acknowledges support by the German Science Foundation (DFG) (SP1142). Nadine Riedel gratefully acknowledges financial support of the Economic and Social Research Council (grant number RES-060-25-0033). Marco Runkel gratefully acknowledges the financial support from the Deutsche Forschungsgemeinschaft DFG (grant number RU 1466/1-1).

## REFERENCES

- Anand, Bharat N., and Richard Sansing, 2000. "The Weighting Game: Formula Apportionment as an Instrument of Public Policy." *National Tax Journal* 53 (2), 183–200.
- Bucovetsky, Sam, and Andreas Haufler, 2008. "Tax Competition When Firms Choose Their Organizational Form: Should Tax Loopholes for Multinationals Be Closed?" *Journal of International Economics* 74 (1), 188–201.
- Bundesfinanzhof, 1990. Federal Fiscal Court 1990, IR 183/85 (June 27).
- Buettner, Thiess, 2001. "Local Business Taxation and Competition for Capital: The Choice of the Tax Rate." *Regional Science and Urban Economics* 31 (2–3), 215–245.

Buettner, Thiess, 2003. "Tax Base Effects and Fiscal Externalities of Local Capital Taxation: Evidence from a Panel of German Jurisdictions." *Journal of Urban Economics* 54 (1), 110–128.

Desai, Mihir A., C. Fritz Foley, and James R. Hines, Jr., 2004. "The Costs of Shared Ownership: Evidence from International Joint Ventures." *Journal of Financial Economics* 73 (2), 323–374.

Desai, Mihir A., C. Fritz Foley, and James R. Hines, Jr., 2006. "The Demand for Tax Haven Operations." *Journal of Public Economics* 90 (3), 513–531.

Devereux, Michael P., 2006. "The Impact of Taxation on the Location of Capital, Firms and Profit: A Survey of Empirical Evidence." Working Paper No. 0702. Centre for Business Taxation, Oxford University, Oxford, UK.

Devereux, Michael P., and Simon Loretz, 2008. "The Effects of EU Formula Apportionment on Corporate Tax Revenues." *Fiscal Studies* 29 (1), 1–33.

Doetsch, Ewald, and Alexandra Pung, 2000. "Steuersenkungsgesetz: Die Änderungen bei der Körperschaftsteuer und bei der Anteilseignerbesteuerung" (The Tax Reform: Changes in Corporate Income Taxation and Taxation of Shareholders). *Der Betrieb* 34 (10), 1–27 (in German).

Eggert, Wolfgang, and Guttorm Schjelderup, 2003. "Symmetric Tax Competition under Formula Apportionment." *Journal of Public Economic Theory* 5 (2), 439–446.

Eichner, Thomas, and Marco Runkel, 2008. "Why the European Union Should Adopt Formula Apportionment with a Sales Factor." *Scandinavian Journal of Economics* 110 (3), 567–589.

European Commission, 2001. "Towards an Internal Market without Tax Obstacles: A Strategy for Providing Companies with a Consolidated Corporate Tax Base for their EU-Wide Activities." COM(2001)582. European Commission, Brussels, Belgium.

European Commission, 2006a. "An Overview of the Main Issues that Emerged at the First Meeting of the Subgroup on Group Taxation, Common Consolidated Corporate Tax Base Working Group." Working Document. European Commission, Brussels, Belgium.

European Commission, 2006b. "An Overview of the Main Issues that Emerged at the Second Meeting of the Subgroup on Group Taxation, Common Consolidated Corporate Tax Base Working Group." Working Document. European Commission, Brussels, Belgium.

European Commission, 2007a. "An Overview of the Main Issues that Emerged at the Third Meeting of the Subgroup on Group Taxation, Common Consolidated Corporate Tax Base Working Group." Working Document. European Commission, Brussels, Belgium.

European Commission, 2007b. "CCCTB: Possible Elements of the Administrative Framework." Working Document. European Commission, Brussels, Belgium.

Fuest, Clemens, 2008. "The European Commission's Proposal for a Common Consolidated Corporate Tax Base." *Oxford Review of Economic Policy* 24 (4), 720–739.

- Fuest, Clemens, Thomas Hemmelgarn, and Fred Ramb, 2007. "How Would the Introduction of an EU-Wide Formula Apportionment Affect the Size and the Distribution of the Corporate Tax Base? An Analysis Based on German Multinationals." *International Tax and Public Finance* 14 (5), 605–626.
- Fuest, Clemens, Bernd Huber, and Jack Mintz, 2005. "Capital Mobility and Tax Competition — A Survey." *Foundations and Trends in Microeconomics* 1 (1), 1–62.
- Goolsbee, Austan, and Edward L. Maydew, 2000. "Coveting thy Neighbor's Manufacturing: the Dilemma of State Income Apportionment." *Journal of Public Economics* 75 (1), 125–143.
- Gordon, Roger, and John D. Wilson, 1986. "An Examination of Multijurisdictional Corporate Income Taxation under Formula Apportionment." *Econometrica* 54 (6), 1357–1373.
- Gresik, Thomas A., 2001. "The Taxing Task of Taxing Transnationals." *Journal of Economic Literature* 39 (3), 800–838.
- Gresik, Thomas A., 2010. "Formula Apportionment versus Separate Accounting: A Private Information Perspective." *European Economic Review* 54 (1), 133–149.
- Haufler, Andreas, 2001. *Taxation in a Global Economy*. Cambridge University Press, Cambridge, UK.
- Herrmann, Carl, Gerhard Heuer, and Arndt Raupach, 2001. *Einkommensteuer- und Körperschaftsteuergesetz: Kommentar* (Commentary on Income and Corporate Income Tax Law), Schmidt, Cologne, Germany (in German).
- Herzig, Norbert, 2003. "Einführung" (Introduction). In Herzig, Norbert (ed.), *Organschaft*, 1–35. Schäffer-Poeschel, Stuttgart, Germany (in German).
- Hong, Quing, and Michael Smart, 2010. "In Praise of Tax Havens: International Tax Planning and Foreign Direct Investment." *European Economic Review* 54 (1), 82–95.
- Huizinga, Harry P., and Johannes Voget, 2009. "International Taxation and the Direction and Volume of Cross-Border M&As." *Journal of Finance* 64 (3), 1217–1249.
- Kind, Hans-Jarle, Karen Helene Midelfart, and Guttorm Schjelderup, 2005. "Corporate Tax Systems, Multinational Enterprises, and Economic Integration." *Journal of International Economics* 65 (2), 507–521.
- Kirsch, Martina, and Frank Grube, 2001. "Die Organschaft nach dem Steuersenkungsgesetz - fuer die Gewerbesteuer noch keine wirkliche Vereinfachung" (Group Taxation after the Tax Reform – Not Really a Simplification for the Local Business Tax). *GmbHHR - GmbH-Rundschau* 9, 371–375 (in German).
- Koh, Hyun-Ju, and Nadine Riedel, 2010. "Do Governments Tax Agglomeration Rents?" Working Paper 10/04. Centre for Business Taxation, Oxford University, Oxford, UK.

Krebs, Hans-Joachim, 2001. “Die ertragsteuerliche Organschaft: Überlegungen vor dem Hintergrund des Berichts der Bundesregierung zur Fortentwicklung des Unternehmenssteuerrechts” (Group Taxation: Considerations in the Federal Government Report on the Future of Corporate Taxation). *Betriebs-Berater* 56, 2029–2036 (in German).

Lenski, Edgar, and Wilhelm Steinberg, 2009. *Kommentar zum Gewerbesteuergesetz* (Commentary on the Local Business Tax). Schmidt, Cologne, Germany (in German).

Martens-Weiner, Joann, 2006. *Company Tax Reform in the European Union: Guidance from the United States and Canada on Implementing Formulary Apportionment in the EU*. Springer, New York, NY.

McLure, Charles E., 1980. “The State Corporate Income Tax: Lambs in Wolves’ Clothing.” In Aaron, Henry J., and Michael J. Boskin (eds.), *The Economics of Taxation*, 327–336. The Brookings Institution, Washington, DC.

Mintz, Jack M., 1999. “Globalization of the Corporate Income Tax: The Role of Allocation.” *Finanzarchiv* 56 (3–4), 389–423.

Mintz, Jack M., and Michael Smart, 2004. “Income Shifting, Investment, and Tax Competition: Theory and Evidence from Provincial Taxation in Canada.” *Journal of Public Economics* 88 (6), 1149–1168.

Nielsen, Søren Bo, Pascalis Raimondos-Møller, and Guttorm Schjelderup, 2010. “Company Taxation and Tax Spillovers: Separate Accounting and Formula Apportionment.” *European Economic Review* 54 (1), 121–132.

Oppenhoff & Rädler Partnership, 2000. *Reform der Unternehmensbesteuerung, Steuersenkungsgesetz, Erläuterungen und Gestaltungshinweise für die Beratungspraxis* (Reform of Company Taxation: Explanations and Suggestions for Tax Consultants). Stuttgart, Germany (in German).

Organisation for Economic Cooperation and Development, 1992. *Model Tax Convention on Income and on Capital*. Organization for Economic Cooperation and Development, Paris, France.

Pethig, Ruediger, and Andreas Wagener, 2007. “Profit Tax Competition and Formula Apportionment.” *International Tax and Public Finance* 14 (6), 631–655.

Pinto, Santiago M., 2007. “Corporate Profit Tax, Capital Mobility, and Formula Apportionment.” *Journal of Urban Economics* 62 (1), 76–102.

Rädler, Albert J., 2003. “Überlegungen zur Gewerbesteuer” (Considerations on the Local Business Tax). *ifo Schnelldienst* (56) 9, 14–19 (in German).

Riedel, Nadine, 2010. “The Downside of Formula Apportionment: Evidence on Factor Demand Distortions.” *International Tax and Public Finance* 17 (3), 236–258.

Riedel, Nadine, and Marco Runkel, 2007. “Company Tax Reform with a Water’s Edge.” *Journal of Public Economics* 91 (7–8), 1533–1554.

Schoen, Wolfgang, 2007. "Group Taxation and the CCCTB." *Tax Notes International* 48 (11), 1063–1080.

Sørensen, Peter Birch, 2004. "Company Tax Reform in the European Union." *International Tax and Public Finance* 11 (1), 91–115.

Weichenrieder, Alfons J., and Jack M. Mintz, 2008. "What Determines the Use of Holding Companies and Ownership Chains?" Working Paper No. 08/03. Centre for Business Taxation, Oxford University, Oxford, UK.

Wellisch, Dietmar, 2004. "Taxation under Formula Apportionment – Tax Competition, Tax Incidence, and the Choice of Apportionment Factors." *Finanzarchiv* 60, 24–41.

Wetzler, James W., 1995. "Should the U.S. Adopt Formula Apportionment." *National Tax Journal* 48 (3), 357–362.

Wooldridge, Jeffrey M., 2009. *Introductory Econometrics. A Modern Approach*. South-Western, Cincinnati, OH.