

# Strategic Consolidation under Formula Apportionment\*

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**Abstract:** We provide empirical evidence that multi-jurisdictional enterprises (MJE) strategically exclude affiliates from the basis of consolidation under a formula apportionment (FA) regime. Our testing ground is the German local business tax that is raised at the municipality level and applies FA regulations. Using unique data for the whole population of German firms and exploiting an exogenous variation in the German business tax law, we show that MJE's tend to exclude affiliates from the basis of consolidation if their intra-group tax rate distribution implies large gains from profit shifting activities under non-consolidation. Our analysis therefore suggests that the advantages of FA will be limited if the consolidation base is subject to manipulations.

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# 1 Introduction

The last years have witnessed an increasing interest in the comparison of alternative systems for the taxation of multinational corporations. The scheme that is currently implemented at the international level follows separate accounting (SA) rules and prescribes that multinational profit is taxed in the country where it accrues. This system has, however, come under attack by politicians and researchers recently since it gives rise to profit shifting behavior within the multinational group and thereby introduces inefficiencies. Since several papers provide evidence that profit shifting activities are of relevant magnitude (for a survey see Devereux (2006)), economists currently think about alternative taxation schemes for multi-jurisdictional entities (MJE).

The main alternative to SA is thereby usually seen in consolidation in combination with formula apportionment (FA). With this regime profit is consolidated at the group level and apportioned to the affiliates according to a formula that measures the affiliates' relative corporate activity. Although FA has not been implemented at the international level yet, subnational corporate tax regimes in the US, Canada and Germany have applied FA regulations for decades. In 2001, the European Commission proposed to introduce FA within EU borders. Besides enhanced loss offset possibilities, an important advantage of this approach seems to be that incentives to shift profits between multi-jurisdictional locations are abolished. Intuitively, this however only holds if MJE have to consolidate *all* their group affiliates under FA regulations. If MJE, in contrast, may autonomously decide whether affiliates are included in the basis of consolidation, they might strategically refrain from consolidating certain affiliates to preserve profit shifting opportunities. This would reintroduce inefficiencies of the SA system and diminish the benefits from implementing a FA scheme.

The purpose of this paper is to empirically assess whether and to what extent MJE strategically manipulate the consolidation of affiliates under FA regulations. Our testing ground is the German local business tax which is levied at the community level and which significantly contributes to the corporate tax burden of firms in Germany. If an MJE observes affiliates in several municipalities, a FA scheme applies that renders group profit to be consolidated at the national level and prescribes apportionment according to the affiliates' relative payroll shares. However, under the German local business tax scheme not all affiliates are subject to profit consolidation within the corporate

group. Instead, analogously to other FA systems, the German scheme acknowledges that unitary assessment of group profit for tax purposes may not be economically sensible for every affiliate. This especially applies to corporate affiliates that are only partially owned by the group or that are not economically related to other group members. Thus, MJE's obtain some discretion on the inclusion of affiliates in the unitary tax assessment and may thus - within certain boundaries - decide if the local business tax burden of their subsidiaries is calculated based on SA or FA regulations. The possible gains from increased profit shifting opportunities under separate assessment have to be qualified against the costs associated with running individual subsidiaries separately from the consolidated group. This refers, particularly, to the limited loss offset opportunities between the consolidated group and separate subsidiaries. Since these limitations may well outweigh possible gains from profit shifting opportunities, many firms may actually decide to forgo possible profit shifting opportunities and to run all subsidiaries within the corporate group.

To empirically identify whether MJE's strategically exclude affiliates from the basis of consolidation, we employ some recent changes in German business taxation implemented in the course of a comprehensive business tax reform in 2001. Among others the German legislature substantially relaxed the loss offset rules of the federal corporation tax for MJE's. This legal change was implemented in January 1, 2001. It intended to facilitate the loss offset between MJE's affiliates if earnings were unequally distributed. Essentially, the changes allowed corporate groups to benefit from loss-offset opportunities for purposes of the federal corporation tax even if the groups were not consolidated for business tax purposes. Given to these legal changes we expect that the newly gained loss offset possibilities for the corporation tax substantially reduced the MJE's' costs of running individual subsidiaries apart from the consolidated group for purposes of the local business tax. Thus, after the corporate tax reform in 2001 MJE's are predicted to have an increased incentive to exclude affiliates from group consolidation under FA and thereby to benefit from profit shifting opportunities.

Intuitively, the incentive to exclude affiliates from the consolidation base should be higher the larger the potential profit shifting gains under non-consolidation. In a theoretical model, we therefore show that the MJE's' incentive to exclude affiliates from consolidation under FA should increase in the spread of tax rates within the group since

profit shifting gains are directly determined by the tax differences between affiliates. With respect to the German tax reform, we would henceforth presume that the number of affiliates that are consolidated under FA regulations observes a larger drop for MJE's with high intra-firm tax differentials.

In order to test this prediction we employ a unique data set that comprises accounting data for the whole population of German firms in the years 1998 and 2001. Our results indicate robust behavioral patterns that are in line with our theoretical predictions. Thus, MJE's with a large spread in corporate tax rates across group affiliates observe a lower growth rate in the number of consolidated affiliates between 1998 and 2001. This result is robust against various alternative explanations of this pattern and the inclusion of control characteristics for the corporate group and the economic situation in the hosting communities. Evaluated at the sample mean, we find that an increase in the tax variance within a MJE by one standard deviation reduces the growth rate of the number of consolidated affiliates by 20%. This points to an important strategic component in the decision whether to include corporate affiliates in the basis of consolidation under FA or not.

Our paper adds to several strands of the economic literature. First, we contribute to the discussion on the appropriate corporate taxation scheme for MJE's. The comparison of SA and FA thereby goes back to early papers by McLure (1980) and Gordon and Wilson (1986) who show that FA may similarly to SA lead to significant distortions in firm behavior. Recent papers by Nielsen et al. (2002), Kind et al. (2005) and Riedel and Runkel (2007) focus on a welfare comparison between corporate taxation under SA and FA. Moreover, although the evidence is still thin, the recent years have also seen the emergence of a literature that empirically quantifies the distortions and economic outcome of corporate taxation under FA. Examples are papers by Goolsbee and Maydew (2000), Büttner (2003), Mintz and Smart (2004) and Riedel (2007). Nevertheless, to the best of our knowledge neither the existing theoretical nor the existing empirical papers have so far analyzed the endogenous consolidation decision under FA.

Additionally, our paper relates to a small literature that investigates how corporate taxation distorts the organizational structure of MJE's. Desai et al. (2004) analyze the determinants of partial ownership of foreign US affiliates. Their evidence indicates that whole ownership is most common when firms coordinate integrated production

activities across different locations, transfer technology, and benefit from worldwide tax planning. Weichenrieder and Smart (2007) in turn provide evidence that MJE's distort the corporate organizational structure by using conduit and holding companies to reduce their corporate tax burden. Huizinga and Voget (2006) present results that indicate ownership patterns within multinational entities to be determined by profit tax rates and withholding taxes.

The paper is structured as follows. Section (2) presents a simple model that outlines the theoretical considerations that underly our estimation strategy. Section (3) contains a short description of the data and provides basic sample statistics. Section (4) outlines the estimation methodology, Section (5) presents the estimation results and Section (6) concludes.

## 2 A Simple Theoretical Model

In order to derive testable hypotheses, we develop a simple model of the consolidation decision of a single MJE. Suppose the MJE has affiliates in two jurisdictions. The jurisdictions are labeled by  $a$  and  $b$ . For our purpose, it is irrelevant whether the headquarter of the MJE is in jurisdiction  $a$  or jurisdiction  $b$ . Each affiliate earns a before-tax profit denoted by  $\pi$ . This before-tax profit is exogenously given meaning that the MJE has already decided on its investment and labor demand in both affiliates. Such an assumption is simplifying, but it allows us to focus on the consolidation decision of the MJE which is the main focus of our analysis.

The MJE may shift profit from one jurisdiction to the other. Typical channels of profit shifting are the manipulation of transfer prices of intra-firm trade, the distortion of the affiliates' debt-equity structure and the manipulation of the distribution of overhead cost. The specific channel of profit shifting is immaterial for our purpose. We therefore simply assume that profit shifting is reflected by the variable  $s$ . If  $s > 0$ , then the MJE shifts profit from jurisdiction  $a$  to jurisdiction  $b$ . For  $s < 0$  profit shifting is the other way round. Profit shifting is not costless to the MJE. It causes concealment cost denoted by  $C(s)$ . This concealment cost reflects, for example, the MJE's cost for tax lawyers or the risk of being detected if the MJE uses illegal measures of profit shifting. The concealment cost function satisfies  $\text{sign}\{C'(s)\} = \text{sign}\{s\}$  and  $C''(s) > 0$ ,

i.e. it is U-shaped with the minimum at the point where the MJE does not shift profit from one jurisdiction to the other. Moreover, we assume  $C(0) = 0$  so that concealment cost is zero if the MJE does not engage in profit shifting.

We consider corporate taxation according to the FA principle with tax base consolidation. As already discussed in the Introduction, however, even under such a taxation system MJEs have some discretion on the inclusion of affiliates in the unitary tax assessment. Hence, the MJEs have in fact the choice between FA and SA taxation. This choice is explicitly considered in our theoretical model. We assume that the MJE may decide whether it consolidates the two affiliates (FA) or not (SA). If it does not consolidate, it will incur a cost denoted by  $\gamma > 0$ . This cost has different interpretations. Analogously to the concealment cost of profit shifting, for example,  $\gamma$  may reflect the risk of being detected when the lack of consolidation violates tax law. In a stylized way,  $\gamma$  may also be interpreted as the disadvantage that a loss offset is hardly possible under SA. This interpretation is important for our subsequent analysis since the above mentioned reform of the German tax law and the associated improvement in the loss offset opportunities between consolidated groups and separate affiliates can be modeled as a decline in the non-consolidation cost  $\gamma$ .

The MJE will not consolidate if and only if the maximized net profit of doing so is larger than in the case of consolidation. Hence, we have to compute and compare the maximized net profit in the two cases. Let us start with the case where the MJE does not consolidate the two affiliates. The after-tax profit (before subtracting the non-consolidation cost  $\gamma$ ) then reads

$$\pi_s = (1 - t_a)(\pi - s) + (1 - t_b)(\pi + s) - C(s), \quad (1)$$

where  $t_a$  and  $t_b$  represent the corporate tax rates of jurisdiction  $a$  and  $b$ , respectively. Equation (1) shows that without consolidation the two affiliates are taxed separately and the MJE may use profit shifting to increase the tax base in one jurisdiction and reduce the tax base in the jurisdiction country. The first order condition for optimal shifting is

$$C'(s) = t_a - t_b. \quad (2)$$

Hence, the MJE sets profit shifting such that the marginal concealment cost equals the gain of profit shifting represented by the tax rate differential. If jurisdiction  $a$  is

the high tax jurisdiction, the marginal concealment cost will be positive and profit shifting is from jurisdiction  $a$  to jurisdiction  $b$  ( $s > 0$ ). If jurisdiction  $b$  is the high tax jurisdiction, profit shifting will be the other way round ( $s < 0$ ). Equation (2) determines the MJE's optimal profit shifting as function of the tax rate differential, i.e.  $s = S(t_a - t_b)$  with  $S'(t_a - t_b) = 1/C'' > 0$ . Inserting into (1) gives the MJE's maximized after-tax profit

$$\pi_s^* = (2 - t_a - t_b)\pi + (t_a - t_b)S(t_a - t_b) - C[S(t_a - t_b)]. \quad (3)$$

In order to obtain the net payoff of the MNE in case of non-consolidation, we have to subtract from (3) the non-consolidation cost  $\gamma$ .

If the MJE consolidates its affiliates, profit is taxed according to the FA principle. The consolidated tax base equals  $2\pi$ . This consolidated tax base is assigned to the two jurisdictions according to a formula that usually contains the relative property, payroll and/or sales shares of the MJE in the respective jurisdiction. The formula under the German local business tax uses the payroll share as the sole apportionment factor. As we assume that the MJE already decided about investment and labor demand in its affiliates, in our model the apportionment factors are fixed.<sup>1</sup> More specifically, the share  $\alpha \in [0, 1]$  of the consolidated tax base is assigned to jurisdiction  $a$ , while jurisdiction  $b$  receives the remainder share  $1 - \alpha$ . The MJE's after-tax profit in case of consolidation can therefore be written as

$$\pi_f = 2\pi[1 - \alpha t_a - (1 - \alpha)t_b] - C(s). \quad (4)$$

Because tax bases are consolidated, there is no gain from shifting profit from one jurisdiction to the other. Thus, the MJE sets profit shifting cost minimizing, i.e.  $s = 0$  so  $C(s) = 0$ . Inserting into equation (4) yields

$$\pi_f^* = 2\pi[1 - \alpha t_a - (1 - \alpha)t_b]. \quad (5)$$

Equation (5) gives the MJE's maximized profit in the case where it decides to consolidate the two affiliates.

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<sup>1</sup>It is well known that with endogenous apportionment factors the firms' investment and labor demand decisions are distorted by consolidation and apportionment. See the studies already referred to in the Introduction. These distortions are absent in our model. However, it is straightforward to show that even with the additional distortions our main results remain true.

In order to characterize the MJE's consolidation decision we have to compare the expression for the maximized profit in equation (3) and (5), taking into account the non-consolidation cost  $\gamma$ . Hence, the MJE will not consolidate if and only if

$$\pi_s^* - \gamma > \pi_f^*, \quad (6)$$

or, equivalently,

$$\pi < \frac{(t_a - t_b)S(t_a - t_b) - C[S(t_a - t_b)] - \gamma}{(1 - 2\alpha)t_a + [1 - 2(1 - \alpha)t_b]} =: \Pi(t_a - t_b, \gamma). \quad (7)$$

This inequality states that the MJE will not consolidate if the before-tax profit  $\pi$  is lower than a threshold value. This threshold value can be understood as a function of the tax rate differential  $t_a - t_b$  and the non-consolidation cost  $\gamma$ . It is then straightforward to prove the following result.

**Proposition.** *Consolidation of the MJE ceteris paribus becomes less likely the lower the non-consolidation cost  $\gamma$ . Moreover, keeping constant  $(1 - 2\alpha)t_a + [1 - 2(1 - \alpha)t_b]$ , consolidation of the MJE ceteris paribus becomes less likely the higher the tax rate differential  $t_a - t_b$  in absolute terms.*

**Proof:** The first part of the proposition is obvious as the threshold value  $\Pi(\cdot)$  is declining in  $\gamma$ . In order to prove the second part, define  $F(t_a - t_b) := (t_a - t_b)S(t_a - t_b) - C[S(t_a - t_b)]$ . Note that  $F'(\cdot) = S(\cdot)$  according to equation (2). If  $t_a > t_b$ , then  $S(\cdot) > 0$  and  $F'(\cdot) = S(\cdot) > 0$ , i.e. increasing  $t_a - t_b$  increases  $F(\cdot)$  and, thus, the threshold value  $\Pi(\cdot)$  so that it becomes more likely that the inequality (7) is satisfied. If  $t_a < t_b$ , then  $S(\cdot) < 0$  and  $F'(\cdot) = S(\cdot) < 0$ , i.e. decreasing  $t_a - t_b$  increases  $F(\cdot)$  and  $\Pi(\cdot)$ . Hence, it becomes again more likely that inequality (7) is satisfied. ■

The above proposition shows that the MJE incentive to not consolidate is the larger the lower is the non-consolidation cost  $\gamma$  and/or the higher is the tax rate differential between the two jurisdictions. The intuition of the result with respect to the non-consolidation cost is obvious. The rationale of the effect of the tax rate differential is that with a relatively high difference between the corporate tax rates, the MJE's gain from profit shifting is relatively high as well, so the advantage of taxing the affiliates separately is relatively more important to the MJE than the non-consolidation cost.

These insights are the basis of our empirical analysis in the next section. As already mentioned above, we may interpret the recent German reform of corporate income



taxation as a decline in the non-consolidation cost  $\gamma$ . According to our model, the reform is therefore expected to increase the MJE's incentive for separate tax assessment, and this incentive is *ceteris paribus* stronger for MJEs facing a large spread in the tax rates applied to their affiliates. More loosely speaking, our theoretical model predicts that MJEs facing a large variation in the corporate tax rates across their affiliates should be characterized by a lower growth rate in the number of consolidated affiliates between 1998 and 2001, the time period in which the German reform took place. This is the hypothesis which we will test empirically in the next sections.

### 3 Data Set and Sample Statistics

Our estimations are based on a unique dataset provided by the German Federal Statistical Office. The data contains tax reports for the whole population of German corporations that are subject to local business taxation. The data is gathered directly from German tax authorities and is available for the years 1998 and 2001. In the following, we will first provide some background information concerning the German local business tax system and will afterwards describe our firm data in detail. As sketched in the introduction, the German local business tax is raised at the community level. The 12,544 German municipalities autonomously choose the local corporate business tax while the tax base definition is set at the national level.

Subject to the business tax are individual enterprises, non-incorporated and incorporated firms. Up to the 2008 reform, the former two groups benefit from tax allowances and hence face a progressive tax scheme. A firm's local business tax burden is determined by the municipality's business tax rate which is measured in local business tax points and ranges from 0 to 900 points in our data, with an average of 325 points. To calculate a firm's actual tax burden, pre-tax profits are usually multiplied by a percentage value of 5% and by the municipality's local business tax rate. For non-incorporated firms with low earnings, percentage values smaller than 5% apply. If a corporation operates affiliates in more than one community, the affiliates' pre-tax profit is calculated on the basis of a FA system. Precisely, the MJE's income is consolidated at the national level and is apportioned to the individual entities according to the relative payroll share.

Our firm data set contains information on all German corporations that are liable to the local business tax and includes variables like capital investment, payroll cost, industry, multi-jurisdictional status (multi-jurisdictional vs. uni-jurisdictional firms), legal form (incorporated vs. non-incorporated firms), taxable profit and characteristic of the firms' hosting locations. Since we are interested in investigating corporate tax effects on MJE's consolidation decision, we restrict our data to entities which operate affiliates in several communities and are henceforth subject to FA regulations. In total, our data set contains 130,672 multi-jurisdictional groups. Since we are concerned with the change in affiliate numbers between these two years we restrict attention to MJE that are reported in both periods. The resulting dataset covers 40% of the observations or 50,342 groups.<sup>2</sup>

Table 1 presents basic sample statistics for the affiliates in our data set. In 1998, the average number of affiliates which are consolidated under FA rules is calculated with 4.1 affiliates for the groups in our data set. Between 1998 and 2001 the average number of consolidated affiliates increased by 0.1077 which corresponds to a general increase in the firm size between the two observation years. Calculating the average growth rate in the number of consolidated affiliates for the same time period gives a rate of 5.47%. Besides those general trends, our theory hypothesizes that the growth rate in the number of affiliates will vary between groups depending on the opportunities for profit shifting and the importance of loss-offset. More specifically, we argue that the rate of growth in this time period should be inversely related to the spread in the local business tax rates across affiliates.

To measure this tax rate spread, we follow two strategies. First, we calculate the variance in the business tax rate distribution within the multi-jurisdictional group. The average variance measure in local business tax points is thereby determined to

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<sup>2</sup>In general, all accounting information for firms in 1998 and 2001 may be linked to a panel. However, the cross sections are connected by the group's tax account number which may potentially change over time, mainly in the course of tax office restructuring or headquarter relocations to other jurisdictions or in larger cities even through the relocation to other quarters. Since our estimations account for the change in affiliate numbers between 1998 and 2001, our analysis includes the latter firms only. However, since the change of tax account numbers is linked to tax office restructurings and headquarter relocations, we are confident that our sample determination is arbitrary and does not follow any underlying systematic that may bias our results.

be 950.35 pointing at a considerable variation across groups. Second, we define a tax spread measure that is calculated as the ratio of the business tax rate at the 90th percentile of the group's tax distribution over the business tax rate at the 10th percentile of the group's tax distribution. The average of this measure is calculated with 1.1534 and indicates that the business tax rate at the 90th percentile of the tax distribution exceeds the tax rate at the 10th percentile by a factor of 1.15.

Our analysis will moreover control for some characteristics of a group's hosting municipalities as well as for several firm characteristics. The sample statistics for these variables are also presented in Table 1. The calculation of average hosting community characteristics is based on data from the German Statistical Office's REGIOSTAT data base. We calculate unweighted average values for the number of inhabitants, the number of employees and the average unemployment rate for affiliates of a MJE in 1998. Table 1 indicates that the multi-jurisdictional groups in our dataset are on average located in relatively large municipalities with 104,423 inhabitants, 48,516 employees and face an unemployment rate of 12.9%.

Moreover, the group's average capital stock in 1998 is calculated with 8.3 million Deutsche Mark (DM) or, approximately, 4 million Euros. The firm's pre-tax profit in turn is substantially lower and measured with 56,467 DM. Average group production is very capital intensive since the average ratio of capital stock over payroll costs amounts to 657.5. Additionally, the sample statistics indicate a considerable heterogeneity between the consolidated affiliates of multi-jurisdictional corporate groups. The ratio of the 90th over the 10th percentile of the intra-group distribution of the affiliates' relative payroll shares indicates that the relative payroll share of the affiliate at the 90th percentile is 2517 times larger than the relative payroll share of the affiliate at the 10th percentile of the distribution. A comparable picture emerges with respect to the intra-firm distribution of capital investment, pre-tax profit and the corporate capital intensity.

## 4 Identification and Estimation Methodology

Our theoretical model predicts that MJE's have an incentive to strategically manipulate the decision whether a corporate affiliate is taxed under FA regulations or not. The

model thereby suggests that especially groups with an extreme tax rate distribution should have an incentive to exclude affiliates from consolidation under FA and to assess them separately since this opens up profit shifting opportunities.

To what extent MJE's may strategically manipulate this consolidation decision depends on the costs associated with separate assessment of a corporate affiliate (the parameter  $\gamma$  in our theoretical model). First, there are legal restrictions to a separate assessment of group affiliates for tax purposes. Until recently, consolidation for business tax purposes was based on an assessment of financial, organizational, as well as economic relations between affiliates. To separate out individual affiliates under this regulation may require a reorganization of the group. Second, an important advantage of consolidation is that loss-offset is complete. If an affiliate is consolidated within a corporate group and earns a negative profit, these losses completely offset the positive profit earned by other affiliates in the calculation of the MJE's overall tax bill. In contrast, if an affiliate is not consolidated under FA regulations and observes losses, these may not offset profits earned elsewhere and hence they do not reduce the MJE's overall tax burden. To separate out individual affiliates is therefore costly as these loss-offset opportunities are limited if not impossible.

To identify the described effects, we exploit an exogenous variation in the German tax law that reduced the costs for assessing and taxing group affiliates separately from the rest of the group in the calculation of the local business tax burden. In 2001, the German government implemented a broad business tax reform. Among others, this reform substantially lowered the corporate tax rate levied at the federal level. Moreover, the reform enhanced the MJE's flexibility to make use of a loss offset without necessarily being subject to FA regulations.<sup>3</sup> Thus, affiliates which are located within German borders and belong to the same corporate group received enhanced opportunities to benefit from loss offsets for the national corporate tax calculation.

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<sup>3</sup>This effect of the 2001 reform arises due to the interaction between the federal corporation tax and the local business tax. Prior to 2001 the consolidation regulations were basically the same for both purposes of the federal corporation tax as well as for the local business tax. In 2001, however, consolidation requirements for purposes of the federal corporation tax were lowered. This opens up the opportunity to stay consolidated for purposes of the corporation tax without necessarily being consolidated for purposes of the business tax. Thus, MJE's would enjoy the advantages of full loss offset for the corporation tax, even if they would separate firms for purposes of the local business tax.

From 2001 on, the MJE's are thus rather well hedged against profitability shocks at different German group affiliates by the enhanced loss offset possibilities at the national level. This in turn reduces the MJE's costs to strategically assess some of their affiliates separately from the rest of the group in the context of the local business tax. Thus, on the one hand side the MJE is hedged against the possibility that the respective affiliate earns a loss since this may offset profits earned at other group members at least for the calculation of the national corporate tax burden. On the other hand, it may enjoy tax savings from separate assessment of the affiliate for the local business tax if the local tax rate strongly deviates from other group members' tax since this implies lucrative profit shifting opportunities.

Since we obtain data on the structure of German multi-jurisdictional groups in 1998 and 2001, we would therefore presume that the MJE's react to the reduced costs for separate assessment of affiliates with respect to the local business tax rate. Since separate assessment is predicted to be especially profitable for groups that observe a wide spread in the intra-group tax distribution, we would presume that these groups tend to exclude more of their affiliates from profit consolidation and thus they should observe a lower growth rate in affiliate numbers than corporate groups with a low intra-firm variation in corporate tax rates. Precisely, we estimate the following equation

$$\hat{n}_i = \beta_0 + \beta_1 v_i + \beta_2 \log n_i + \beta_3 x_i + \epsilon_i \quad (8)$$

whereas  $\hat{n}_i$  is the growth rate in the number of affiliates that are consolidated under FA regulations from 1998 to 2001 for the MJE  $i$ . As stated above, we are mainly interested in determining the effect of the intra-firm corporate tax rate distribution in 1998  $v_i$  on the development of the number of consolidated affiliate from 1998 to 2001. We thereby employ two measures to capture the tax rate distribution within a corporate group. First, we simply calculate the tax-rate variance within the group. In a second step, we additionally construct a measure that comprises the ratio of the business tax rate at the 90<sup>th</sup> percentile of the intra-firm tax distribution to the corporate tax rate at the 10<sup>th</sup> percentile of the intra-firm corporate tax distribution. Our model predicts that the larger the spread in the tax rates across affiliates the larger possible profit shifting gains from assessing affiliates separately. Hence, we presume  $\beta_1 < 0$ .

Moreover, we account for several group characteristics in 1998. Thus, we include the number of affiliates  $n_i$  that are consolidated under FA regulations in 1998. Additionally,

we account for 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 a group's capital investment in 1998 and a group's profitability 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 code and dummies for different legal forms (individual firms, non-incorporated firms and incorporated firms).

Moreover, we control for the firm's capital intensity and average characteristics of the MJE's hosting communities like the number of inhabitants, the number of employees and the unemployment rate in 1998. Especially the latter two variables shall capture economic differences in the MJEs' hosting communities that might drive a change in the growth rate of affiliate numbers and may just correlate with our tax variance measure. Last, it seems reasonable to control for variations in other firm characteristics across subsidiaries to make sure that our estimated effect can really be ascribed to variations in the tax rate distributions. Thus, we include control variables in our estimation equation that determine the variation in the affiliates' relative payroll share across subsidiaries in 1998, the variation in capital investment and pre-tax profit and the variation in the capital intensity.

Our baseline regression estimates equation (8) based on OLS methodology. However, since the change in the number of consolidated affiliates is small for all groups in our sample<sup>4</sup>, we additionally apply a model based on a categorical dependent variable. Given the dependent variable's distribution, a categorical model may be more appropriate and fit the data better than the linear regression. Thus, we reestimate our estimation equation using an ordered probit model where we categorize the change in affiliate numbers in the categories, 'affiliate number decreased' (= 1), 'affiliate number stayed constant' (= 2) and 'affiliate number increased' (= 3).

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<sup>4</sup>More than 50% of the groups in our sample do not observe a change in the number of consolidated affiliates between 1998 and 2001 and less than 10% of the groups observe a change in the number of consolidated affiliates by more than 1.

## 5 Results

Table 2 presents the results of our baseline regression. Specification (1) regresses the growth rate of consolidated affiliate numbers on the group’s tax variance and on the number of consolidated group affiliates in 1998. As predicted by theory the tax variance exerts a significantly negative influence on the affiliate growth. 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 affiliate numbers by 20%.

In Specification (2) we additionally account for industry dummies to capture industry specific differences in the development of affiliate numbers. The coefficient estimates for the tax variance variable and the affiliate number in 1998 are neither qualitatively nor quantitatively affected. In Specification (4) we moreover include a dummy variable for integrated corporate groups whereas integrated means that the group does not only comprise a corporate headquarter and dependent affiliates, but equally includes independent subsidiaries. The coefficient estimate for the integrated group variable is positive and marginally statistically significant, suggesting that the number of consolidated affiliates grows faster in integrated groups.

Specifications (4) to (6) add additional controls for the group’s size, productivity and capital intensity. Intuitively, larger corporate groups (measured in capital endowment) observe a higher growth rate of affiliate numbers. Moreover, Specification (5) shows that the larger the group profit the larger the growth rate in affiliate numbers. In contrast, the group’s capital intensity decreases the growth rate in affiliate numbers. The inclusion of these control characteristics for the corporate group turn the coefficient estimate for the number of consolidated affiliates in 1998 negative and statistically significant suggesting that corporations with a larger number of affiliates grow at a lower rate. Most importantly, however, the inclusion of the additional controls leaves the coefficient estimate for the tax variance variable stable and statistically significant.

Moreover, to hedge against our results being driven by an unobserved correlation between the intra-group tax rate variance and the locations’ economic and social situation, we add several additional controls for the group’s average hosting jurisdictions’ characteristics in Specification (7). Precisely, we account for the number of inhabitants, the number of employees and the unemployment rate. Only the coefficient estimate for the average employment variable suggests a marginally significant positive influence on

the affiliate growth rate, the coefficient estimates for the other control variables remain statistically insignificant. Again the coefficient for the group's tax variance remains robust against the inclusion, now suggesting that an increase in the tax variance measure by one standard deviation reduces the affiliate growth by 22.4%.

Last, we account for the fact that the local business tax is not the only firm characteristic that varies across affiliates but that these may well be very heterogeneous in their characteristics of which some (like the affiliate's size) may correlate with the corporate tax distribution as well as with the growth rate in affiliate numbers. Thus, Specification (8) accounts for the spread of other affiliate characteristics within the corporate group to make sure that the coefficient estimate for the tax variable does not capture influences of other characteristics on the growth rate of affiliate numbers that just correlate with the spread in the corporate tax variable. The coefficient estimate for the variance in the capital investment measure thereby suggests that variance in affiliate size exerts a statistically significant positive effect on the growth rate of the number of consolidated affiliates. This may for example reflect that groups that comprise affiliates which are heterogeneous in size in 1998 have a higher tendency to found other (small) affiliates. In turn, the coefficient estimate for the variance in affiliate profits exhibits a statistically significant negative effect. This suggests that with a strong profitability variation between affiliates in 1998, the MJE may have an incentive to shut down the relatively unprofitable subsidiaries. This directly translates in a reduction in the growth rate of affiliate numbers. Moreover, a larger spread in the affiliates' capital intensity may reflect that the profit which is shared according to the affiliates' relative payroll share does not fully reflect the actual profit and earnings capacity of single affiliates which may render FA very unattractive and hence may provide an incentive to take affiliates out of the group of consolidated locations. Most importantly, however, the coefficient estimate for the tax variable 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%.

So far we have calculated the spread in the business tax rates within the group on the basis of a tax variance measure. To check if our results are robust against the definition of other spread measures, we reestimate the Specifications in Table 2 employing the



ratio of the 90th over the 10th percentile of a group’s tax rate distribution. The larger this tax measure, the higher is the spread in the tax rate distribution within the corporate group in 1998 and the lower we expect the growth rate in affiliate numbers to be. This presumption is strongly confirmed by the estimation results presented in Table 3. The coefficient estimate for the tax spread measure is negative and statistically significant at the 1% level suggesting that an increase in the tax spread measure by one standard deviation reduces the growth rate of the number of consolidated affiliates by 15.0%. Specifications (2) to (8) show that this result is robust against the inclusion of the control variables named above which also carry the expected signs. The coefficient estimate in Specification (8) indicates that an increase in the tax spread measure by one standard deviation reduces the growth rate of affiliate numbers by 20.7%. The estimated effect is hence quantitatively close to the effect found on the basis of the tax variance measure.

As pointed out in Section (3), the distributional pattern of the change in affiliate numbers between 1998 and 2001 suggests that an estimation model based on a categorical dependent variable may fit the data rather well. We therefore specify an ordered probit model whereas the endogeneous variable comprises three categories as described in the Section (3) on data and sample statistics. The results are presented in Table 4. Specifications (1) to (8) resemble the estimations presented in Tables 2 and 3. We again find the same picture in the sense that the tax spread measure exerts a statistically significant negative impact on the change in affiliate numbers. The control variables equally carry the expected signs and the Pseudo R-squared suggests that the model indeed fits the data better than the linear specification. In a second step, we additionally experiment with alternative categorizations of the dependent variable (e.g. the use of five categories) whereas our results revealed to be robust against these specification adjustments. The results of these estimations are available from the authors upon request.

Concluding, we find evidence in line with our theoretical prediction. Thus, MJE’s which observe a large spread in the intra-firm tax rate distribution are shown to have a lower growth rate in the number of consolidated affiliates than MJE’s with a low tax variation across affiliates. This corresponds to the presumption that former groups can generate larger profit shifting gains under non-consolidation and thus reduce their

affiliate numbers more strongly in response to the legal change in 2001.

## 6 Conclusion

Our paper provides empirical evidence that MJE's which are taxed according to FA regulations strategically exclude affiliates from consolidation under a FA regime. We make use of an exogenous variation in the German tax law which came into effect in January 2001 and reduced the costs of excluding affiliates from the basis of consolidation under the German local business tax system. Our theoretical model thereby predicts that MJE's which observe a large tax rate spread within the corporate group should have a higher incentive to exclude affiliates from the basis of consolidation than MJE's with a low tax spread since they may benefit from large shifting gains in the case of non-consolidation. We test this theoretical presumption on a unique data set that comprises accounting information for the whole population of German firms in 1998 and 2001. Our estimation results confirm our theoretical presumptions and suggest that an increase in the tax spread within a corporate group by one standard deviation reduces the growth rate of the number of consolidated affiliates by around 20%. This finding is stable for a large set of specifications and robustness checks.

Our paper thus provides indirect evidence that MJE's tend to strategically exclude affiliates from consolidation under FA 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 main purpose of the FA system which is to abolish profit shifting activities. Thus, as a direct policy implication our paper suggests that the design of FA regimes should attach large costs to excluding affiliates from the basis of consolidation. Otherwise MJE's tend to leave affiliates in tax-havens unconsolidated and therefore engage in profit shifting activities despite the existence of a FA system.

## References

- Büttner, T. (2003), 'Tax Base Effects and Fiscal Externalities of Local Capital Taxation: Evidence from a Panel of German Jurisdictions', *Journal of Urban Economics* 54, 110-128.
- Desai, M. A., C. F. Foley and J. R. Hines Jr. (2004), 'The Costs of Shared Ownership: Evidence

- From International Joint Ventures', *Journal of Financial Economics* 73(2), 323-374.
- Devereux, M. P. (2006), 'The Impact of Taxation on the Location of Capital, Firms and Profit: A Survey of Empirical Evidence', *mimeo*.
- Goolsbee, A. and E. L. Maydew (2000), 'Coveting thy Neighbor's Manufacturing: The dilemma of state income apportionment', *Journal of Public Economics* 75, 125-143.
- Gordon, R. and J. D. Wilson (1986), 'An Examination of Multijurisdictional Corporate Income Taxation under Formula Apportionment', *Econometrica* 54, 1357-1373.
- Kind, J. K., K. H. Midelfart and G. Schjelderup(2005), 'Corporate Tax Systems, Multinational Entreprises, and Economic Integration', *Journal of International Economics* 65, 507-521.
- 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.
- Nielsen, S. B., P. Raimondos-Møller and G. Schjelderup (2002), 'Tax Spillovers under Separate Accounting and Formula Apportionment', *mimeo*.
- Riedel, N. and M. Runkel (2007), 'Company Tax Reform with a Water's Edge', *Journal of Public Economics* 91, 1533-1554.

**Table 1: Descriptive Statistics**

<u>Variable</u>	<u>Mean</u>	<u>Standard Deviation</u>
<b>Affiliate Numbers</b>		
Difference Number of Affiliates 2001-1998	0.1077	11.3994
Growth Rate Number of Affiliates 2001-1998	0.0547	0.6298
Number of Affiliates 1998	4.1330	49.2584
<b>Tax Spread Measures</b>		
Tax Variance 1998 (in Local Business Tax Points)	950.3482	1631.7570
90 <sup>th</sup> / 10 <sup>th</sup> Percentile, Tax Rate	1.1534	0.1627
<b>Other Jurisdictional Characteristics</b>		
Inhabitants 1998	104,423.8	152,840.5
Employment 1998	48,516.4	78,396.7
Unemployment Rate 1998	0.1295	0.0456
<b>Group Characteristics</b>		
Capital Investment 1998 (in 1,000 DM*)	8,363.0	414,000.0
Pre-tax Profit 1998 (in 1,000 DM*)	56.5	1,791.9
Capital Intensity 1998	657.5	84,672.4
90 <sup>th</sup> / 10 <sup>th</sup> Percentile, Relative Wages 1998	2617.2	277,360.5
90 <sup>th</sup> / 10 <sup>th</sup> Percentile, Capital Investment 1998	1140.0	110,603.4
90 <sup>th</sup> / 10 <sup>th</sup> Percentile, Pre-tax Profit 1998	37.7	709.7
90 <sup>th</sup> / 10 <sup>th</sup> Percentile, Capital Intensity 1998	591.2	175,942.9

\* DM is the abbreviation for 'Deutsche Mark', i.e. the German currency prior to the introduction of the Euro. The exchange rate Deutsche Mark to Euro is approximately 2:1.

Table 2: Dependent Variable: Growth Rate Affiliate Number

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tax Variance/10,000	-0.0583*** (0.0153)	-0.0608*** (0.0162)	-0.0726*** (0.0172)	-0.0403*** (0.0161)	-0.0530*** (0.0190)	-0.0567*** (0.0195)	-0.0751*** (0.0244)	-0.0766*** (0.0235)
Log Affiliate Number 1998	-0.0003 (0.0002)	-0.0003 (0.0002)	-0.0005 (0.0003)	-0.0007*** (0.0001)	-0.0542*** (0.0079)	-0.0624*** (0.0085)	-0.0626*** (0.0084)	-0.0591*** (0.0092)
Integrated Group			0.0406* (0.0224)	0.0467* (0.0250)	0.0509 (0.1421)	0.0416 (0.0370)	0.0411 (0.1955)	0.0385 (0.0371)
Log Capital Investment 1998				0.0123*** (0.0015)	0.0059*** (0.0016)	0.0176*** (0.0028)	0.0175*** (0.0028)	0.0172*** (0.0032)
Log Pre-tax Profit 1998					0.0117*** (0.0021)	0.0074*** (0.0021)	0.0070*** (0.0020)	0.0068*** (0.0020)
Log Capital Intensity 1998						-0.0153*** (0.0027)	-0.0148*** (0.0027)	-0.0144*** (0.0030)
Log Inhabitants 1998							-0.0179 (0.0112)	-0.0156 (0.0111)
Log Employment 1998							0.0189* (0.0101)	0.0171* (0.0100)
Unemployment Rate 1998							-0.0769 (0.0799)	-0.0842 (0.0796)

Table 2, continued: Dependent Variable: Growth Rate Affiliate Number

<u>Variable</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>	<u>(5)</u>	<u>(6)</u>	<u>(7)</u>	<u>(8)</u>
Variance Relative Wages 1998								-0.0088 (0.0716)
Variance Capital Investment 1998 / $10^{15}$								0.0014*** (0.0003)
Variance Pre-tax Profit 1998 / $10^{15}$								-9.58** (3.98)
Variance Capital Intensity 1998 / 1000								-0.0302*** (0.0125)
Industry Dummies		✓	✓	✓	✓	✓	✓	✓
Legal Form Dummies			✓	✓	✓	✓	✓	✓
Number of Observations	52,342	52,342	52,342	50,448	32,407	31,740	31,727	31,687
R Squared	0.0002	0.0022	0.0034	0.0080	0.0085	0.0093	0.0094	0.0114

Robust standard errors in parentheses. \*\*\* / \*\* / \* indicates statistical significance at the 1% / 5% / 10% level.

Table 3: Dependent Variable: Growth Rate Affiliate Number

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
90 <sup>th</sup> / 10 <sup>th</sup> Percentile, Tax	-0.0504*** (0.0155)	-0.0474*** (0.0163)	-0.0558*** (0.0170)	-0.0544*** (0.0168)	-0.0581*** (0.0225)	-0.0622*** (0.0229)	-0.0778*** (0.0273)	-0.0690*** (0.0259)
Log Affiliate Number 1998	-0.0365*** (0.0049)	-0.0409*** (0.0002)	-0.0558*** (0.0063)	-0.0673*** (0.0067)	-0.0507*** (0.0074)	-0.0587*** (0.0081)	-0.0581*** (0.0079)	-0.0540*** (0.0067)
Integrated Group			0.0786*** (0.0243)	0.0467* (0.0250)	0.0507 (0.0369)	0.0414 (0.0371)	0.0408 (0.0369)	0.0440 (0.0372)
Log Capital Investment 1998				0.0124*** (0.0015)	0.0060*** (0.0016)	0.0177*** (0.0028)	0.0177*** (0.0028)	0.0143*** (0.0029)
Log Pre-tax Profit 1998					0.0116*** (0.0021)	0.0073*** (0.0021)	0.0070*** (0.0020)	0.0089*** (0.0019)
Log Capital Intensity 1998						-0.0153*** (0.0027)	-0.0149*** (0.0027)	-0.0121*** (0.0022)
Log Inhabitants 1998							-0.0196* (0.0114)	-0.0091 (0.0086)
Log Employment 1998							0.0201** (0.0103)	0.0124 (0.0077)
Unemployment Rate 1998							-0.0626 (0.0784)	0.0411 (0.0646)

**Table 3, continued: Dependent Variable: Growth Rate Affiliate Number**

<u>Variable</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>	<u>(5)</u>	<u>(6)</u>	<u>(7)</u>	<u>(8)</u>
Variance Relative Wages 1998								-0.0029 (0.0031)
Variance Capital Investment 1998								0.0032 (0.0033)
Variance Pre-tax Profit 1998								-0.0002 (0.0002)
Variance Capital Intensity 1998								-0.0027 (0.0028)
Industry Dummies		√		√	√	√	√	√
Legal Form Dummies			√	√	√	√	√	√
Number of Observations	52,340	52,340	52,340	50,446	32,405	31,738	31,725	31,138
R Squared	0.0019	0.0041	0.0065	0.0081	0.0085	0.0093	0.0095	0.0138

Robust standard errors in parentheses. \*\*\* / \*\* / \* indicates statistical significance at the 1% / 5% / 10% level.



**Table 4: Ordered Probit; Dependent Variable: Categories for Changes in Affiliate Number**

<u>Variable</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>	<u>(5)</u>	<u>(6)</u>	<u>(7)</u>	<u>(8)</u>
90 <sup>th</sup> / 10 <sup>th</sup> Percentile, Tax	-0.2912*** (0.0377)	-0.2587*** (0.0379)	-0.2782*** (0.0379)	-0.2823*** (0.0388)	-0.3359*** (0.0486)	-0.3443*** (0.0491)	-0.3746*** (0.0533)	-0.3185*** (0.0544)
Log Affiliate Number 1998	-0.1611*** (0.0128)	-0.1737*** (0.0131)	-0.1993*** (0.0138)	-0.2333*** (0.0145)	-0.1517*** (0.0176)	-0.1695*** (0.0180)	-0.1669*** (0.0181)	-0.1513*** (0.0185)
Integrated Group			0.1262*** (0.0301)	0.0351 (0.0309)	-0.0119 (0.0391)	-0.0349 (0.0393)	-0.0378 (0.0393)	-0.0447 (0.0399)
Log Capital Investment 1998			0.0352*** (0.0025)	0.0206*** (0.0034)	0.0206*** (0.0034)	0.0477*** (0.0055)	0.0476*** (0.0056)	0.0444*** (0.0056)
Log Pre-tax Profit 1998					0.0393*** (0.0040)	0.0292*** (0.0044)	0.0284*** (0.0045)	0.0290*** (0.0046)
Log Capital Intensity 1998						-0.0361*** (0.0058)	-0.0349*** (0.0059)	-0.0294*** (0.0059)
Log Inhabitants 1998							-0.0056 (0.0231)	-0.0042 (0.0234)
Log Employment 1998							0.0134 (0.0198)	0.0120 (0.0200)
Unemployment Rate 1998							-0.2304 (0.1529)	-0.1957 (0.1550)

Table 4, continued: Dependent Variable: Categories for Change in the Affiliate Number

<u>Variable</u>	<u>(1)</u>	<u>(2)</u>	<u>(3)</u>	<u>(4)</u>	<u>(5)</u>	<u>(6)</u>	<u>(7)</u>	<u>(8)</u>
Variance Relative Wages 1998								-0.0007 (0.0008)
Variance Capital Investment 1998								0.0014 (0.0008)
Variance Pre-tax Profit 1998								-0.0007*** (0.0003)
Variance Capital Intensity 1998								-0.0012 (0.0007)
Industry Dummies		√	√	√	√	√	√	√
Legal Form Dummies			√	√	√	√	√	√
Number of Observations	52,340	52,340	52,340	50,446	32,405	31,738	31,725	31,138
Pseudo R Squared	0.0079	0.0106	0.0122	0.0145	0.0126	0.0134	0.0135	0.0127

Robust standard errors in parentheses. \*\*\* / \*\* / \* indicates statistical significance at the 1% / 5% / 10% level.