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Corporate Taxes, Profit Shifting and the Location of Intangibles within Multinational Firms

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Abstract

Intangible assets are one major source of profit shifting opportunities due to a highly intransparent transfer pricing process. Our paper argues that multinational enterprises (MNEs) optimize their profit shifting strategy by locating shifting–relevant intangible property at affiliates with a low statutory corporate tax rate. Using panel data for European MNEs and controlling for unobserved time–constant heterogeneity between affiliates, we find that the lower a subsidiary's tax rate relative to other affiliates of the multinational group the higher is its level of intangible asset investment. This effect is statistically and economically significant, even after controlling for subsidiary size and accounting for a dynamic intangible investment pattern.

JEL classification: H25, F23, H26, C33

Keywords: corporate taxation, multinational enterprise, profit shifting, intangible assets, micro level data

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1 Introduction

In recent years, intangible assets have gained increasing importance in the corporate production process (e.g. Hall, 2001). Since access to financial capital has been substantially improved, key physical assets are less scarce (Zingales, 2000) and intangible factors related to product innovation and marketing are increasingly seen as the key to competitive success (Edmans, 2007). Hence, intangibles like patents, trademarks, customer lists and copyrights have become major determinants of firm value. This development is especially significant in multinational enterprises (MNEs).[1] While until the early 1990ies, MNEs commonly raised little or no fee from their corporate affiliates for the use of patents or trademarks, owners of these intangibles have – in line with updated legal regulations and accounting standards – started to charge for their immaterial goods and, thus, intangibles–related intra–firm trade has surged.

Since then, an increasing number of anecdotes has reported that MNEs transfer their valuable intangible property to low–tax jurisdictions. Famous examples are *Pfizer*, *Bristol–Myers Squibb* and *Microsoft* which have relocated a considerable part of their research and development (R&D) investments and patents from their home countries to Ireland (see e.g. Simpson, 2005, on Microsoft's R&D transfer). Others founded trademark holding companies in tax havens that own and administer the group's brands and licenses. E.g. *Vodafone's* intangible properties are held by an Irish subsidiary, and *Shell's* central brand management is located at a Swiss affiliate from where it charges royalties to operating subsidiaries worldwide. Moreover, an increasing number of financial consultancies advocates multinational tax planning strategies that imply the relocation of intangible property to low–tax affiliates.[2]

Governments and tax authorities have raised increasing concerns about these relocation examples (Hejazi, 2006). Since arm's length prices for firm–specific intangible goods are hard to determine (see e.g. Grubert, 2003; Desai et al., 2006), they fear that MNEs may shift profits from production affiliates in high–tax countries to the

[1] Empirical evidence links the presence of intangible property to the emergence of MNEs. Intangibles are perceived to foster FDI since they *can be easily transferred back and forth and [...] enjoy a public good nature which makes them available to additional production facilities at relatively low costs* (Markusen, 1995; Gattai, 2005).

[2] Examples are the British brand valuation consultancy *Brand Finance plc* whose client list includes world–wide operating MNEs like *British American Tabacco*, *Danone*, *Shell* or *Foster's* (Brand Finance plc, 2008) and the renowned US law firm *Morgan, Lewis & Bockius LLP* (Morgan Lewis & Bockius LLP, 2007).

intangibles–holding low–tax affiliate by overstating the true transfer price. Surprisingly though, it has, to the best of our knowledge, not yet been clarified within an empirical framework whether these relocation examples are individual cases or represent a systematic multinational investment pattern. We investigate this question using panel data on European MNEs and find evidence for a statistically significant and quantitatively relevant bias of intangible property holdings towards affiliates with a low corporate tax rate.

To receive guidance for the specification of our estimation model, the paper starts out with a short section on theoretical considerations. Conditional on the assumption that intra–firm trade of intellectual property rights establishes transfer pricing opportunities between the intangibles owner and the group's production affiliates, MNEs have an incentive to locate their intangibles at a low–tax affiliate since they may thereby establish transfer pricing channels between this tax haven and *all* other affiliates located in countries with a higher corporate tax rate. In contrast, intangibles location at one of the group's high–tax affiliates generates shifting possibilities solely between the tax haven and the intangibles–holding firm whereas other high–tax affiliates remain without shifting link to a low–tax country. Moreover, the incentive to shift profits between affiliates increases in the gains from shifting activities which are reflected by the statutory corporate tax rate differential between the intangibles–holding subsidiary and other group locations. The larger these tax rate differentials the larger are the potential shifting gains. Following this argumentation, we expect that group affiliates which exhibit a low corporate tax rate *relative to other group locations* observe a high level of intangible assets.

We test this hypothesis using a large panel dataset of multinational affiliates within the EU–25 which is available for the years 1995 to 2005. Our data is drawn from the micro database AMADEUS that provides detailed accounting information at the affiliate level and allows identification of a multinational group's ownership structure. Following our theoretical considerations, we determine the effect of an affiliate's average statutory corporate tax rate difference to other group members on its level of intangible asset investment. Controlling for unobserved time–constant heterogeneity between subsidiaries, year effects, country characteristics and affiliate size, the results confirm our expectations and point to a robust inverse relation between the subsidiary's statutory tax rate relative to other group affiliates and its intangibles holdings. The effect is statistically and economically significant and appears across a range of specification and estimation choices that address endogeneity issues and the dynamic nature of the intangible asset investment. Quantitatively, the estimations suggest that a decrease

in the average tax differential to other group affiliates by 1 percentage point raises a subsidiary's intangible property investment by around 1% on average.

This location pattern of intangible assets can moreover be linked to multinational profit shifting activities. Our theoretical rationalization for the correlation between corporate taxes and intangibles investment implies profit shifting activities to take place within the *whole* multinational group. Since most previous empirical studies on multinational shifting behavior investigate shifting activities between subsidiaries and their parent firms only, we study whether pre–tax earnings are equally relocated between multinational subsidiaries to save tax payments. The results point to significant profit shifting effects whereas shifting activities between subsidiaries quantitatively even tend to outweigh shifting activities between parent firms and subsidiaries. In a companion paper (Dischinger and Riedel, 2007), we moreover employ the same database to provide empirical evidence that profit shifting activities of MNEs are significantly larger if shifting–relevant assets are located at low–tax affiliates of the multinational group. Both aspects support our interpretation that the location of intangible assets is driven by profit shifting considerations.

The paper adds to the literature on multinational profit shifting and the investment pattern of MNEs. While the economic literature has brought forward strong evidence for quantitatively substantial profit shifting activities of MNEs (see e.g. Clausing, 2003; Devereux, 2006; Huizinga and Laeven, 2008), not much is known yet about which MNEs actually engage in profit shifting and on the dimension to which MNEs distort their internal organization and real investments in order to optimize their intra–group profit shifting possibilities. There are a few exceptions though. Grubert and Slemrod (1998) and Desai et al. (2006) for example find that parent firms with high intangible asset investments and henceforth good opportunities to engage in profit shifting activities via transfer price manipulations are most likely to invest in tax havens. Analogously, Grubert (2003) shows that R&D intensive MNEs engage in significantly larger volumes of intra–group transactions and thus create more opportunities for income shifting. Moreover, Grubert and Mutti (2007) demonstrate that after recent US corporate tax and accounting reforms, US parents' R&D investment become a weak predictor for royalty payments from foreign subsidiaries to the US parent but simultaneously strongly enlarge the earnings of group affiliates located in tax havens. They interpret their results to reflect the parents' incentive to found hybrid entities in tax havens and to reach favorable cost sharing agreements on R&D investment with them. The hybrids then sell patent licenses to high–tax production affiliates and receive the corresponding royalty payments as earnings which are then taxed at the low–tax location.

Thus, several existing studies indicate that multinational profit shifting activities are related to the presence of intangible property holdings. For example, capital investment in low–tax countries and the dimension of intra–group transactions are linked to an MNE's ownership of immaterial assets. Our paper goes one step further and argues that the location of these intangibles across the subsidiaries of a multinational group is itself a choice variable of the MNE. To the best of our knowledge, we are the first to show in a systematic econometric approach that MNEs distort the location of their shifting–relevant intangibles towards low–tax affiliates in the multinational group to optimize their profit shifting opportunities.

The remainder of the paper is structured as follows. Section 2 presents a short motivation of the hypothesis tested in our empirical model. In Section 3, we describe our data base and the sample construction. Section 4 states the basic estimation methodology. The estimation results are presented in Section 5. Finally, Section 6 concludes.

2 Profit Shifting and Intangible Asset Location

Our paper's purpose is to empirically investigate whether corporate taxation distorts the location of intangible assets within a corporate group to facilitate profit shifting activities as suggested by growing anecdotic evidence (see Introduction). For a better understanding, we will in the following shortly sketch the rationale behind the relocation of intangible property to low–tax countries.

It is widely acknowledged that a large fraction of MNEs in industrialized economies is horizontally organized with production locations in several countries (e.g. Markusen, 2002). The manufacturing of the final output good thereby often requires a set of intangible inputs (e.g. patents, brands or management services). For simplicity reasons, consider a MNE which uses one intangible input good only. The intangible intermediate is thereby usually created and administered by only one of the multinational affiliates (cf. footnote 1). Since the intermediate good is traded within the multinational group, it enables the MNE to shift profits between the intermediate holding affiliate and all other (production) locations by distorting the intangible good's intra–firm transfer price. In line with this argumentation, recent empirical evidence indicates that profit shifting activities are related to the existence of intangible assets within an MNE (e.g. Grubert, 2003) since arm's length prices for firm–specific intellectual property rights are especially hard to determine for national tax authorities.

Thus, immaterial goods enhance the MNE's profit shifting possibilities. In addition,

the location of these intangibles across affiliates is itself a choice variable for the MNE and can further improve the group's shifting opportunities. Therefore, the MNE can decide at which of the corporate affiliates intangible investments should be located. Among others, corporate taxes and profit shifting considerations plausibly matter for this decision. Intuitively, holding intangibles at a low–tax affiliate generates a profit shifting link between the intangibles–holding tax haven affiliate and *all* other group members. Thus, profit may be shifted from each high–tax affiliate to the intangibles–holding company in the low–tax country. In contrast, if the intangibles were located at one of the high–tax affiliates, the MNE would gain only *one* profit shifting link to the tax haven affiliate while all other affiliates in high–tax countries would lack shifting opportunities to a low–tax country. Obviously, this provides a strong incentive to locate intangible assets at affiliates with a relatively low corporate tax rate.[3]

In addition, it is well known that the gains from shifting profits between affiliates of a multinational group are determined by the difference between their statutory corporate tax rates. The larger this difference the more the MNE profits from relocating one unit of earnings from the high–tax to the low–tax affiliate. This implies that the location of intangible assets becomes more attractive the lower an affiliate's tax rate compared to other locations of the same multinational group.

Following these considerations, MNEs thus have an incentive to locate intangible property at affiliates with a relatively small corporate tax rate compared to other group locations which is in line with recent examples of multinational intangibles relocations to low–tax countries.

[3]In the simultaneous case of an extreme earnings distribution across affiliates and several subsidiaries being located in low–tax countries, scenarios can be constructed in which it might pay for the MNE to locate its intangibles at a high–tax affiliate (with large earnings) and shift profits from there to several low–tax locations. However, even under this specific scenario we do not consider intangibles location at a high–tax country to be a very likely outcome. Tax authorities' screening intensity in most OECD countries depends on an affiliate's declared pre–tax profit (most authorities employ the so–called *transaction based net margin method* which compares the net margin of a respective affiliate to the net margin of similar (non–affiliated) firms of the same branch). Formally, this is captured by tax evasion models in the tradition of Reinganum and Wilde (1985). Shifting larger amounts of profit via *several* channels to low–tax affiliates would imply a drastic reduction in the intangibles–holding affiliate's declared profit. This would surge the MNE's detection risk for the shifting activities and tend to make enhanced shifting volumes and consequently the intangibles location at a high–tax affiliate unattractive.

3 Data Set

Our empirical analysis employs the commercial database AMADEUS which is compiled by Bureau van Dijk. The version of the database available to us contains detailed information on firm structure and accounting of 1.6 million national and multinational corporations in 38 European countries from 1993 to 2006, but is unbalanced in structure.[4] We focus on the EU–25 and on the time period of 1995 – 2005 as these countries and years are sufficiently represented by the database. The observational units of our analysis are multinational subsidiaries within the EU–25.[5] Since our analysis also requires data on the subsidiary's parent company (e.g. the number and location of the parent's subsidiaries), we investigate only subsidiaries whose parents are likewise located within the EU–25 and on which information is available in the AMADEUS database.

Moreover, our analysis accounts only for subsidiaries whose foreign parent is an industrial corporation and owns at least *three* subsidiaries (by more than 90% of the ownership shares). The latter assumption ensures that the MNEs in our sample exhibit a sufficient size so that strategical allocation of intangibles for profit shifting purposes may emerge. In addition, we restrict the sample to multinational groups that actually own immaterial assets, i.e. either the parent or at least one of its subsidiaries has to hold intangibles. Last, we drop MNEs which observe a negative profit at *all* group affiliates throughout the sample period since they are then not subject to positive tax payments and profit shifting considerations are henceforth irrelevant.

Our sample contains firms from all EU–25 countries despite Cyprus and Malta. The country statistics are presented in Table 1 of the Appendix. The intangibles measure is the balance sheet item *intangible fixed assets*.[6] Since many firms in the database report no information on this variable, our panel data consists of 45,575 observations from 6,732 multinational subsidiaries for the years 1995 – 2005. Hence, we observe each

[4]Note that tax authorities (e.g. Germany and France) and tax consultants (e.g. Deloitte Touche Tohmatsu) are equally known to rely on the AMADEUS database to apply the *transaction based net margin method* (cf. footnote 3).

[5]Our criteria of being a multinational enterprise is the existence of a *foreign* immediate shareholder (parent) which holds at least 90% of the affiliate's ownership shares. The data restriction to firms which are owned by 90% or more ensures that the potential location of profit and intangibles at this subsidiary is relevant for the multinational group.

[6]All balance sheet and profit & loss account items in our analysis are exported from AMADEUS in unconsolidated values.

affiliate for 6.8 years on average.

The AMADEUS data has the drawback that information on the ownership structure is available for the last reported date only which is the year 2004 for most observations in our sample. Thus, in the context of our panel study, there exists some scope for misclassifications of *parent–subsidiary–connections* since the ownership structure may have changed over the sample period. However, in line with previous studies, we are not too concerned about this issue since the described misclassifications introduce noise to our estimations that will bias our results towards zero (see e.g. Budd et al., 2005).

Table 2 in the appendix displays the sample statistics. The mean of the intangible asset variable is calculated with 3.4 million US dollars at the subsidiary level (however with a huge standard deviation of 117 million) and with 64.8 million at the parent level (again with a large standard deviation of 785 million). We moreover define a variable *binary intangible assets* which takes on the value 1 if a subsidiary owns intangible assets and 0 otherwise. The sample average is measured to be 0.5519 and hence 55.2% of the subsidiaries in our sample hold intangible property. In addition, the affiliates in our data belong to multinational groups with on average 81.4 subsidiaries that are owned by at least 90% of the ownership shares. This rather high mean value is thereby driven by a few very large MNEs, as the median of the subsidiary number distribution is calculated with 26. Furthermore, on average, a subsidiary holds total assets amounting to 105.2 million US dollars and fixed assets of 62.5 million, employs 220 workers, observes an operating revenue of 82.2 million US dollars and earns a profit/loss before taxation of 3.5 million US dollars.

We additionally merge data on the statutory corporate tax rate at the subsidiary and parent location, as well as basic country characteristics like GDP per capita (as a proxy for the degree of development), population (as a proxy for the market size) and the unemployment rate (as a proxy for the economic situation of a country).[7] For the affiliates in our sample, the statutory corporate tax rate spreads from 10.0% to 56.8% whereas the mean is calculated with 33.3% on the subsidiary level and with 36.2% on the parent level. Our theoretical considerations presuppose that the level of intangible assets is inversely related to an affiliate's corporate tax rate relative to other group members. We therefore define the *average tax difference to all other affiliates*

[7]The statutory tax rate data for the EU–25 is taken from the European Commission (2006). Our analysis will moreover rely on tax rates for group affiliates outside the EU as will be explained below. This data is obtained from the tax consultancy firm KPMG International (2006). Country data for GDP per capita, population size and unemployment rate are taken from the European Statistical Office (Eurostat).

which is the unweighted average statutory corporate tax rate difference between a subsidiary and all other affiliates of the corporate group (including the parent) that are owned by at least 90% of the ownership shares. This tax difference spreads from -38.2% to 28.7% with a mean of -0.7%. Although our subsidiary sample comprises European firms only, the calculation of the *average tax difference to all other affiliates* accounts for information on the worldwide structure of the corporate group which is generally available with the AMADEUS data. However, for non–European subsidiaries, mostly this information comprises only the subsidiaries' names, hosting countries and ownership shares but no accounting information. Therefore, an appropriate weighting procedure for our tax difference variable is not feasible and we employ an unweighted average tax measure.[8]

Last, the descriptive statistics strongly confirm the increasing importance of intangible property in corporate production over the last decade. Figures 1 and 2 in the Appendix report the average level of intangible asset investment at subsidiaries and parents in our sample between 1995 and 2005. While the average parent firm owns substantially more intangible property than the average subsidiary, the mean value steeply rises for all affiliates which is in line with previous findings in the literature (e.g. Hall, 2001).

4 Econometric Approach

We employ different methodological approaches to test the hypothesis formulated in Section 2. The following paragraphs present our baseline model as well as various robustness checks that account for alternative specifications, endogeneity issues and a dynamic model of intangible asset investment.

[8]We experimented with size–weighted equivalents of this average tax difference variable. Since the application of a weighting scheme is only sensible if we observe information on the subsidiaries' size variable for all or at least the vast majority of the group affiliates, this leads to a drastic reduction in sample size as the information on affiliate accounts is often not available for as sufficient number of group subsidiaries. Nevertheless, we found the application of weighted tax measures to lead to qualitatively comparable results which are available from the authors upon request.

4.1 Baseline Model

In our baseline regression, we estimate an OLS model of the following form

$$\log(y_{it}) = \beta_1 + \beta_2 \tau_{it} + \beta_3 X_{it} + \rho_t + \phi_i + \epsilon_{it} \tag{1}$$

with y_{it} =(*intangible assets* +1). Since the distribution of intangible asset investment of subsidiary i at time t is considerably skewed, we employ the logarithm of intangible assets as dependent variable. Furthermore, a considerable fraction (44.8%) of the subsidiaries in our dataset does not hold any intangible assets at all and thus, we follow previous studies (e.g. Plassmann and Tideman, 2001; Alesina et al., 2002; Hilary and Lennox, 2005; Weichenrieder, 2008) and add a small constant (= 1) to our intangibles variable to avoid that zero–observations are excluded from the estimation. The explanatory variable of central interest is τ_{it} which stands for the *average tax difference to all other affiliates* of subsidiary i at time t, as defined in Section 3. According to our considerations in Section 2, we expect that the investment in intangible property decreases in the subsidiary's tax rate relative to other group affiliates and thus $\beta_2 < 0$.

Moreover, X_{it} comprises a vector of time–varying country control characteristics like GDP per capita, population size and the unemployment rate. These macro controls are included to ensure that the results are not driven by an unobserved correlation between a country's wealth, market size and economic situation (as proxied by the above variables) with corporate taxes and intangible investment. The variables will enter in logarithmic form although this is neither qualitatively nor quantitatively decisive for our results. Furthermore, a full set of year dummies ρ_t is included to capture shocks over time common to all subsidiaries. ϵ_{it} describes the error term. We add subsidiary fixed effects to control for non–observable, time–constant firm–specific characteristics ϕ_i. Using fixed–effects is reasonable and necessary in our analysis since a firm's status of holding intangible assets vs. non–holding intangibles is likely to be driven by internal firm–specific factors which are impossible to be captured by observable control variables available in our data set. The fixed–effects model is also preferred to a random–effects approach by a Hausman–Test.

Starting from this baseline approach, we investigate the sensitivity of our results to alternative model specifications.

4.2 Robustness Check I: Binary Dependent Variable

In a first sensitivity check, we take into account that 44.8% of the subsidiaries in our data do not exhibit any intangible property holdings at all. This data structure indicates it to be a relevant multinational choice whether or not to locate intangible property at an affiliate at all and that a binary choice model might fit the data well. Thus, the sensitivity check comprises a model of the following form

$$b_{it} = \gamma_1 + \gamma_2 \tau_{it} + \gamma_3 X_{it} + \rho_t + \phi_i + v_{it} \tag{2}$$

whereas b_{it} represents the binary intangible assets variable that takes on the value 1 if a subsidiary owns intangible property and the value 0 otherwise. The explanatory variables are specified analogously to equation (1). Again the regression includes time–constant affiliate fixed effects and year dummies. In a first step, we determine the coefficient estimates for equation (2) based on maximum–likelihood techniques by estimating a fixed–effect logit model. The model thereby critically relies on the assumption that the error term v_{it} follows a logistic distribution. As an additional check to our results, we thus reestimate equation (2) in a linear probability framework based on the standard OLS assumptions.

4.3 Robustness Check II: Size Control

In a second sensitivity check, we extend our baseline estimation and additionally control for affiliate size. Conditioning intangible asset investments on affiliate size may be decisive since otherwise our tax measure might reflect the widely–tested negative impact of corporate taxation on subsidiary size only. It is well–known that low corporate tax rates foster affiliate investment and vice versa. If large affiliates also tend to hold high investments in intangible property, the corporate tax effect determined in our baseline estimation may be contaminated by the underlying negative relation between corporate taxes and affiliate size.

To circumvent this issue, we include the subsidiary's total capital investment as control variable.[9] This may, however, give rise to obvious reverse causality problems since intangible assets may well determine an affiliate's volume of total capital investment. We therefore employ the levels estimator proposed by Anderson and Hsiao (1982) which suggests to control for time constant affiliate effects by taking the first differences of

[9] Our results are robust against the use of alternative proxies for subsidiary size, e.g. the subsidiaries' operating revenue.

the estimation equation and to instrument for the difference in the endogenous variable (here: total assets) by employing lagged *levels* of this variable.[10] Thus, we use a two-stage instrumental variables approach (2SLS) to estimate the following model

$$\Delta \log(y_{it}) = \beta_2 \Delta \tau_{it} + \beta_3 \Delta X_{it} + \beta_4 \Delta log(a_{it}) + \Delta \rho_t + \Delta \epsilon_{it} \tag{3}$$

whereas y_{it}, τ_{it}, X_{it} and ϵ_{it} correspond to the variables defined in Section 4.1 and a_{it} stands for the total asset investment of subsidiary i at time t. Moreover, Δ indicates the first difference operator. Our result tables will report the F–statistic for the relevance of the instruments at the first stage of the regression model and a Sargan/Hansen test of overidentifying restrictions which tests for the validity of the instruments employed, i.e. for their exogeneity with respect to the error term $\Delta \epsilon_{it}$.

4.4 Robustness Check III: Dynamic Model

Last, our estimation approach so far did not take into account that relocating intangible property within the MNE might be associated with considerable positive adjustment costs. For example, relocating corporate R&D units and the associated patent rights from one affiliate to another is associated with a move of workers and tangible assets and henceforth implies relocation costs. Thus, we expect a subsidiary's intangibles holdings in previous periods to be a predictor for intangible assets investment today and include the first lag of a subsidiary's intangible asset investment $y_{i,t-1}$ as additional explanatory variable in our estimation equation.

The well–known *dynamic panel bias* implies that including the first lag of the dependent variable as additional control in a fixed–effects framework leads to biased coefficient estimates because the lagged dependent variable is endogenous to the fixed effects in the error term. Thus, we follow Arellano and Bond (1991) who build on the Anderson and Hsiao (1982) framework applied in Section 4.3 and suggest to estimate a first–difference generalized method of moments (GMM) model and instrument for the first difference in the lagged dependent variable by deeper lags of the *level* of the

[10] With panel data on more than two time periods, it is not equivalent to apply a fixed effect and first–differencing approach respectively. Both models give unbiased and consistent estimates although the relative efficiency of the estimators may differ, depending on the model structure. Precisely, the fixed effect estimator is less sensitive against the violation of strict exogeneity of the regressors while the first–differencing estimator is less sensitive against the violation of serially uncorrelated error terms. In the result section, we will discuss the relation between the fixed–effects and first–differencing results.

dependent variable.[11] The estimation equation then takes on the following form

$$\Delta \log(y_{it}) = \beta_1 \Delta \log(y_{i,t-1}) + \beta_2 \Delta \tau_{it} + \beta_3 \Delta X_{it} + \beta_4 \Delta log(a_{it}) + \Delta \rho_t + \Delta \epsilon_{it}. \quad (4)$$

The variable definitions correspond to the ones in previous sections. Because the model is estimated in first–differences, the equation will be characterized by the presence of first–order serial correlation. However, the validity of the GMM estimator relies on the absence of second–order serial correlation. The Arellano and Bond (1991) tests for second–order serial correlation will be reported at the bottom of the result tables. Again, we check for the exogeneity of the instrument set by employing a Sargan/Hansen test.

5 Empirical Results

This section presents our empirical results. Throughout all regressions, the observational units of our analysis are the multinational subsidiaries as explained in Sections 3 and 4. Additionally, in all upcoming estimations, a full set of year dummy variables is included and heteroscedasticity robust standard errors adjusted for firm clusters are calculated and displayed in the tables in parentheses. Section 4.1 presents our baseline results. Section 5.2 displays the results to our robustness checks. Finally, Section 5.3 discusses the link between our evidence and profit shifting activities within MNEs.

5.1 Baseline Estimation

Table 3 in the appendix presents our baseline estimation. Following the methodology described in Section 4, specification (1) regresses the logarithm of a subsidiary's intangible asset investment on the firm's statutory corporate tax rate, while controlling for fixed firm and year effects. In line with our theoretical considerations, we find a statistically significant negative influence that suggests high corporate tax rates at an affiliate to be associated with low intangible asset investment and vice versa. The effect is robust against the inclusion of time–varying country control characteristics in specification (2).

However, the subsidiaries' statutory tax rate may be an imprecise measure for tax incentives on intangible asset location since our hypothesis predicts intangibles to be

[11] Note that the difference in the lagged dependent variable correlates with the differenced error term. However, deeper lags (starting from the second lag) of the dependent variable (in levels) are available as valid instruments as they are orthogonal to the error term.

located in countries with a low tax rate *relative to all other affiliates* of the corporate group. This is accounted for in specifications (3) and (4) which regress the level of intangible assets on the *average tax difference to all other affiliates*. The results indicate that the average statutory corporate tax rate difference between a subsidiary and other group members exerts a highly significant negative impact on the subsidiary's intangibles holdings. Quantitatively, the estimations suggest that a decrease in the *average tax difference to all other affiliates* by 1 percentage point raises the subsidiary's level of intangible assets by 1.6% (cf. column (4)).

5.2 Robustness Checks

As a first test for robustness, we rerun all our specifications with the additional inclusion of a full set of 110 one–digit NACE code industry–year dummies (not reported). This add–on does not change any of our qualitative and quantitative results.

In another general sensitivity check we reestimate our regression model employing the statutory corporate tax rate difference between a subsidiary *and its parent* as explanatory variable (instead of the average tax difference to all other group affiliates, including the parent). It might be interesting to explain subsidiary intangible investment by comparing tax rates at the parent and the subsidiary level since a large fraction of intangible property is still held by parent firms (see Figures 1 and 2) and corporate structures indicate the parents to be the *traditional* owners and administrators of intangibles since they usually host the MNEs' central management and administration departments. Therefore, regressing intangible asset investment on the tax difference to the parent captures the incentive to relocate intangibles from the parent to the considered subsidiary for tax purposes. We hence reestimate all specifications presented in this paper (including the upcoming robustness checks) using the tax difference to the parent as the relevant tax measure. This modification leads to the same qualitative results as the model accounting for the tax structure of the whole MNE.[12]

5.2.1 Binary Dependent Variable

In a second step, we estimate equation (2) and thus focus on the binary multinational choice whether to locate intangible property at a certain affiliate or not. The results are displayed in Table 4. Specifications (1) and (2) thereby present maximum–likelihood estimations of a fixed–effect logit model. The dependent variable is the *binary intangible*

[12]The results are available from the authors upon request.

assets measure defined above. Since the logit estimation controls for subsidiary fixed effects, many subsidiaries drop out of the estimation since they observe no variation in the status of intangibles–holding vs. non–holding during the observation period. Nevertheless, the estimations still comprises an adequate number of about 2,200 firms for which information is available for 7.5 years on average.

In specification (1), we regress the binary variable on the subsidiary's *statutory tax rate*. The coefficient estimate is negative and highly significant and thus confirms the presumption that a subsidiary's probability of holding intangible property decreases in the location's statutory tax rate. Moreover, specification (2) reestimates the relation using the *average tax difference to all other affiliates* as explanatory tax variable. Again, we find a negative effect on intangibles holdings which is statistically significant at the 5% level. Thus, the lower a subsidiary's statutory corporate tax rate compared to all other affiliates of the same multinational group (including the parent), the higher is its probability of holding intangible assets.[13]

Nevertheless, the estimation of the fixed–effect logit model critically depends on the assumption of a logistic distribution of the error term. Thus, as a sensitivity check, we moreover estimate a linear probability model with subsidiary fixed effects. The application of an OLS framework thereby has the additional advantage that we make use of all information in our dataset and do not preclude the sample to subsidiaries which observe a change over the sample period in the status of intangibles–holding vs. non–holding. The results are displayed in specifications (3) and (4) of Table 4 and are qualitatively equal to the results of the logit model. Ceteris paribus, a reduction of the unweighted *average tax difference to all other affiliates* by 10 percentage points is suggested to rise the subsidiary's probability of holding intangible assets by 1.97 percentage points on average (cf. column (4)). As the mean probability of holding intangibles is 55.2%, this corresponds to an average increase of 3.6%.

5.2.2 Control for Subsidiary Size

As a third robustness check, we will determine whether our estimated corporate tax effect on intangible asset investment is robust against the inclusion of a control variable for subsidiary size. Precisely, we will condition the intangible property holdings on the subsidiary's total capital investment. To account for potential reverse causality with

[13]The coefficient estimates of a logit estimation cannot be interpreted quantitatively. Moreover, applying a logit model with fixed effects makes the calculation of marginal effects impracticable as it requires specifying a distribution for the fixed effects.

respect to total and intangible investment levels as described in Section 4.3, we estimate the equation in first differences and employ the lagged levels of total investment as instruments for the current difference in total asset (Anderson and Hsiao, 1982).

To do so, we first compare the coefficient estimates from a first–differencing approach to the fixed effects model and reestimate specifications (2) and (4) of Table 3 using first differences instead of fixed effects. The results are displayed in columns (1) and (2) of Table 5. While the qualitative effect of both, the *statutory tax rate* and the *average tax difference to all other affiliates*, on the level of intangible asset investment remains unchanged, the coefficient estimates are substantially smaller than for the fixed effect regressions. Precisely, the estimates drop by around 50% in absolute terms to -1.17 and -0.92, respectively. Since we consider unobserved heterogeneity in the subsidiary characteristics to be a major issue in our regression context, we generally presume the fixed effects approach to deliver the more efficient estimates. Nevertheless, since the qualitative results are independent of the model employed and first–differencing delivers smaller coefficient estimates than the fixed effect approach, we feel confident that a qualitative and quantitative interpretation of the first–differencing model's coefficient estimates (as a *lower* bound) is valid.

In specifications (3) and (4), we add the level of a subsidiary's *total assets* as size control whereas we treat the variable as exogenous with respect to the error term. The inclusion of this additional control leaves the coefficient estimates of our tax variables quantitatively almost unaffected and indicates that the estimated tax effects on intangible asset investment are not contaminated by an underlying correlation between corporate taxes and affiliate size. The coefficient estimate of *total assets* is positive and statistically significant suggesting that larger affiliates tend to hold more intangible property. However, the specifications do not control for potential reverse causality and henceforth the coefficient estimates may clearly be biased.

In specifications (5) and (6), we address this endogeneity problem and instrument the first difference of *total assets* with lagged levels of the variable.[14] This modification of the estimation model only slightly affects the coefficient estimates for our tax measures which remain statistically significant. Interestingly though, instrumenting for total asset investments erases the positive effect of affiliate size on intangible asset holdings now suggesting that intangible asset investment is independent of affiliate size. More-

[14]Precisely, we employ the second to fourth lag of the logarithm of total asset investment as instruments. We consider this to be an appropriate model specification since with the Anderson and Hsiao (1982) estimator, the gained information from including additional lags as instruments has to be weighted against the loss in sample size due to missing values implied by including additional lags.

over, the usual test statistics claim our specification to be valid since the F–test for the instruments at the first stage is highly significant indicating our instruments to be relevant. Furthermore, the null–hypothesis of the Sargan/Hansen test is accepted stating that the instruments are uncorrelated with the error term and henceforth valid.

5.2.3 Dynamic Estimation

As a last sensitivity check, we determine the relation between corporate taxes and intangible asset investment in a *dynamic* model as explained in Section 4.4 which additionally accounts for positive adjustment and relocation costs of intangible property. Employing the one–step linear GMM estimator in first differences proposed by Arellano and Bond (1991), we confirm the dynamic nature of intangible asset investment as lagged intangible property holdings indeed show a significant impact on current intangibles investments.

Our corporate tax effects on intangible asset investment are, however, almost unaffected by the inclusion of the lagged dependent variable and quantitatively correspond to the estimations in the non–dynamic case presented in Table 5. Specifications (1) and (2) of Table 6 document a negative and significant effect of the subsidiary's statutory corporate tax rate and the tax difference variable on intangible asset investment. Following Arellano and Bond (1991) we instrument the endogenous differenced lag of intangible assets investments with the second and all deeper lags of the level of intangible assets as explained in Section 4.4.[15] In specification (3) and (4), we again include subsidiary total asset investment as size control whereas, likewise, we treat the variable as endogenous and thus also instrument it with the second and all deeper lags of its level. The results show the same picture as the previous subsection. While the coefficient estimates for the corporate tax measures are unaffected by the inclusion of the size control and remain statistically significant and of quantitatively relevant size, the total asset variable itself does not exert any statistically significant effect on intangible asset holdings. In specification (5) and (6), we additionally include the second lag of

[15]Note that with the Arellano and Bond (1991) estimator, we do not face the trade–off of the Anderson and Hsiao (1982) estimator that the gained information from including additional lags as instruments has to be weighted against the loss in sample size due to missing values. This applies since the Arellano and Bond (1991) methodology sets missing values to 0 and still derives a meaningful set of moments conditions. Nevertheless, we additionally reestimated the specifications of Table 6 in an Anderson and Hsiao (1982) framework and found qualitative and quantitative comparable results. Here, the F–statistic of the first–stage regression also indicates a strong relevance of our instrument set used.

the intangible asset variable to control for a deeper dynamic effect. This second lag shows no significant effect on intangible investment and does not affect our qualitative tax result.

Summing up, the lower the statutory corporate tax rate of a subsidiary relative to all other affiliates of the multinational group, the higher is its level of intangible assets. Moreover, the test statistics confirm our specification to be valid. The Arellano and Bond (1991) test accepts the null–hypothesis that there is no second order autocorrelation in the error term and likewise the Sargan/Hansen test of overidentifying restrictions accepts the null–hypothesis that the set of instruments is exogenous to the error term.

5.3 Link to Profit Shifting

The previous subsections presented evidence that intangible assets are distorted towards affiliates with a low corporate tax rate. Our theoretical motivation predicts this distortion to root in the optimization of profit shifting opportunities within the multinational group. Thus, in the next paragraph, we will discuss to what extend our results can indeed be linked to profit shifting activities of MNEs.

First, relocation of intangible property to low–tax countries for profit shifting purposes directly implies that profit is shifted within the whole multinational group and profit relocation is not restricted to the parent–subsidiary–channel. Since empirical evidence on profit shifting has so far, however, largely focus on the investigation of shifting between parent firms and their subsidiaries (see e.g. Collins et al., 1998, or Dischinger, 2007), we determine to what extent profit shifting activities take place within the *whole* multinational group. Methodologically, we follow the standard approach and give indirect evidence on profit shifting activities by regressing the subsidiary's unconsolidated pre–tax profit on a tax measure that captures the profit shifting incentives. Simultaneously, the regressions control for the number of employees (as a proxy for labor), the level of fixed assets (as a proxy for capital) and hosting country characteristics whereas all firm variables are calculated per operating revenue (sales) to control for economies of scale and are transformed in logarithmic form.[16] The estimation results

[16]Following the existing empirical literature, we restrict our analysis to subsidiaries with a positive profit by estimating the equation in logarithmic form. Therefore, and due to a limited availability of the required firm variables, the sample size shrinks to about 24,000 observations. In line with previous papers, the estimations do not explicitly control for potential reverse causality problems between the input factors and affiliate profitability. Robustness checks on this assumption did, however, turn out

are presented in Table 7 in the Appendix.

The regressions employ three tax measures to absorb profit shifting activities: the subsidiary's *statutory tax rate* in regressions (1) and (2), the *tax difference to (the) parent* (to capture profit shifting incentives between subsidiary and parent firm) in regressions (3) and (4), and the *average tax difference to all other affiliates* (to capture profit shifting incentives within the whole MNE) in regressions (5) and (6).[17] In all specifications, the coefficient estimates for the tax measures exhibit the expected negative sign and are statistically significant at the 1% level. Thus, subsidiaries with a low tax rate (compared to the parent firm and to all other group affiliates, respectively) tend to observe a higher pre–tax profitability which provides indirect evidence for profit shifting activities. Applying our preferred shifting measure, the *average tax difference to all other affiliates*, thereby yields a more than twofold larger coefficient estimate than the *tax difference to parent*. This suggests that profit shifting activities indeed take place within the whole multinational group and are not restricted to the parent–subsidiary channel.

However, this evidence does, strictly speaking, not provide a clear–cut link between intangibles location and shifting activities. To do so requires a rather complex analysis that investigates whether MNEs with a high fraction of intangible assets at low–tax affiliates indeed exhibit larger profit shifting volumes. But, since the affiliates' intangibles holdings are endogenous and correlated with the tax differentials, a proper analysis goes beyond the scope of our work and is referred to a companion paper (Dischinger and Riedel, 2007).[18]

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to have no significant effect on our results.

[17] A recent paper by Huizinga and Laeven (2008) equally uses the average tax difference to other affiliates to test for profit shifting activities within the MNE. The authors find comparable results.

[18] In Dischinger and Riedel (2007), we handle the endogeneity problem by exploiting the observation that parent firms tend to be a major location for shifting–relevant intangible assets. Precisely, they exhibit an over–proportional fraction of the group's intangible assets (see Figures 1 and 2) and usually likewise comprise central management and administration units that provide services for affiliates of the whole multinational group. Headquarters are moreover largely immobile in an international context and usually remain in the country where the corporation was originally founded. Thus, the parent location may be considered exogenous. In line with our theoretical presumptions, the paper finds that profit shifting activities are significantly larger if the multinational headquarters, and thus a high fraction of shifting–relevant assets, are located in a low–tax country.

6 Conclusions

The last years have witnessed an increasing importance of intangible assets (patents, copyrights, brands, etc.) in the corporate production process of MNEs (see Figures 1 and 2). Anecdotal evidence thereby suggests that these intangibles are often located at low–tax affiliates. For example, *Nestle*, *Vodafone* and *British American Tabacco* have created brand management units in countries with a relatively low corporate tax rate that charge royalties to operating subsidiaries worldwide. Since intangible assets are often firm–specific goods, arm's length prices can hardly be determined by national tax authorities and, henceforth, MNEs may overstate the transfer price for the intermediate immaterial good and thus shift profits from high–tax production affiliates to the intangibles–holding affiliate in the low–tax country.

To the best of our knowledge, our paper provides the first systematic empirical evidence that the location of intangible assets within MNEs is indeed distorted towards low–tax affiliates. Based on a rich data set for European MNEs during the years 1995 to 2005, we show that the lower the statutory corporate tax rate of a subsidiary relative to all other affiliates of the multinational group, the higher is the level of intangible assets at this location. This result turns out to be robust against various specifications and robustness checks. Thus, the evidence suggests that MNEs exploit the enhanced importance of intellectual property in the production process by distorting its location within the corporate group to optimize their tax planning strategies.

These behavioral adjustments have profound consequences for international corporate tax competition. First, the relocation of intangible assets to tax havens facilitates income shifting and enlarges the streams of multinational profit transferred to countries with a low tax rate. This increases the governmental incentive to lower its corporate tax rate and aggravates the race–to–the–bottom in corporate taxes. Second, it is important to stress that the creation and administration of intangible assets is related to *real* corporate activity. To relocate patents and trademark rights to low–tax countries, MNEs have to transfer part of their R&D departments and their administration and marketing units with them. Obviously, these multinational service units comprise high–skilled workers who represent part of the decisive corporate human capital (see e.g. Bresnahan et al., 2002). Thus, countries which attract intangible investment by lowering their corporate tax rate do not only gain shifty pre–tax profits but may also win additional jobs and knowledge capital that may spill over and increase the productivity of local firms. According to this, the gains from lowering the corporate tax rate surge along a second line and enforce tax competition behavior.

Currently, the regulations on intangibles relocation within MNEs are rather lax in many OECD countries. For example, rules with respect to cost sharing agreements between multinational affiliates are favorable in the US (see Grubert and Mutti, 2007) and thus tend to foster the shift of patent rights from US multinational R&D departments to R&D units at low–tax affiliates.[19] Our results thus suggest that profit shifting activities may be effectively restricted by implementing adequate multilateral regulations for the transfer of intangible assets within the MNE – analogously to e.g. the OECD guidelines on transfer pricing that regulate prices for intra–firm trade to be set according to the arm's length principle. First unilateral attempts to restrict intangible asset relocations within MNEs were brought forward by the German government which currently promotes a major tax reform. In the course of the reform, it is planed that a considerable fraction of future earnings streams of (intangible) assets originally developed in Germany and transferred to foreign affiliates at a later point in time remain to be taxable in Germany. The reform is expected to pass the German parliament in autumn 2008. Other countries are anticipated to follow with the introduction of similar regulations. In the light of our paper, this development should be appreciated.

[19]Under the current US regulations, US multinationals have an incentive to develop patents jointly in R&D units at the US parent and at low–tax affiliates and to sell them from the low–tax subsidiary to other production affiliates in high–tax countries since the profit of these transactions has not to be re–transfered to the US parent.

7 Appendix

Figure 1: Parent Level Intangible Assets over Time
(Mean of all observations per year, in thousand US dollars, current prices)

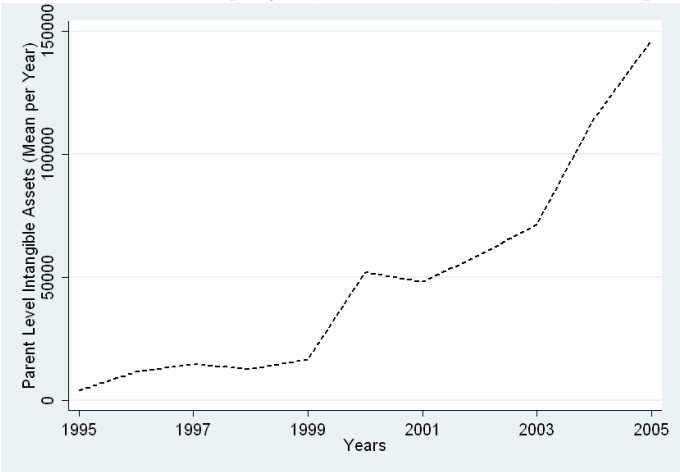

Figure 2: Subsidiary Level Intangible Assets over Time
(Mean of all observations per year, in thousand US dollars, current prices)

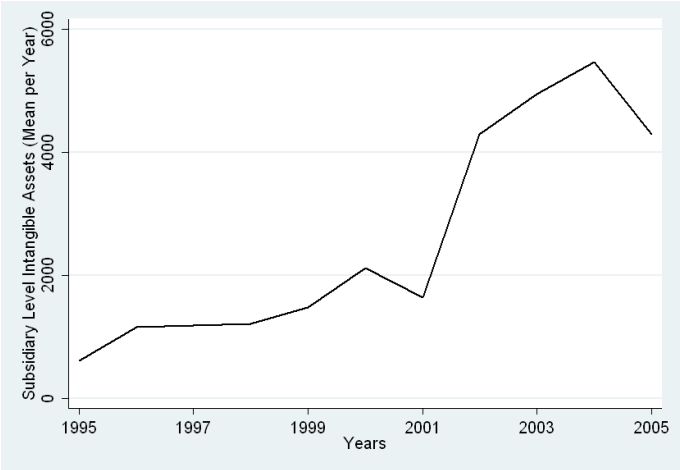

Table 1: Country Statistics	
Country	*Subsidiaries*
Austria	86
Belgium	462
Czech Republic	214
Denmark	409
Estonia	123
Finland	307
France	809
Germany	309
Great Britain	949
Greece	60
Hungary	97
Ireland	107
Italy	492
Latvia	54
Lithuania	33
Luxembourg	31
Netherlands	530
Poland	391
Portugal	105
Slovakia	45
Slovenia	7
Spain	665
Sweden	447
Sum	6,732

Table 2: Descriptive Statistics					
Variable	*Obs.*	*Mean*	*Std. Dev.*	*Min.*	*Max.*
Subsidiary Level:					
Statutory Corporate Tax Rate	45,575	.3333	.0632	.1	.5676
Avg. Tax Diff. to All Other Aff.▲	43,813	-.0070	.0634	-.3817	.2865
Tax Difference to Parent▼	43,813	-.0286	.0853	-.4676	.317
Intangible Assets★	45,575	3,420	116,636	0	1.03e+07
Binary Intangible Assets♦	45,575	.5519	.4973	0	1
Total Assets★	45,575	105,206	900,066	2	7.75e+07
Profit/Loss before Taxation★	44,719	3,532	56,286	-3,930,011	3,926,446
Number of Employees	40,551	219.6	903.5	1	41,186
Fixed Assets★	45,134	62,470	724,873	1	7.74e+07
Operating Revenue★	44,583	82,179	439,198	0	2.25e+07
Parent Level:					
Statutory Corporate Tax Rate	45,575	.3624	.0725	.1	.5676
Intangible Assets★	36,223	64,845	784,666	0	1.98e+07
Number of Subsidiaries■	45,575	81.4	135.6	3	752
Country Level:					
GDP per Capita (in Euro)	45,575	21,877	8,333	1,517	60,311
Population (per thousand)	45,575	34,588	24,274	406	82,537
Unemployment Rate	45,217	.0863	.0365	.021	.199

Notes:
▲ The *Average Tax Difference to All Other Affiliates* is calculated as: statutory corporate tax rate of the considered subsidiary minus the unweighted average statutory corporate tax rate of all other group members, comprising subsidiaries (owned with at least 90% of the ownership shares) and the parent firm.
▼ The *Tax Difference to Parent* is calculated as: statutory corporate tax rate of the subsidiary minus statutory corporate tax rate of the parent.
★ In thousands of US dollars, current prices.
♦ *Binary Intangible Assets* takes on the value 1 if a subsidiary owns intangible assets and takes on the value 0 if a subsidiary does not own any intangibles.
■ Subsidiaries owned with $\geq 90\%$ of the ownership shares. Median is calculated with 26.

Table 3: Baseline Estimation: Subsidiary's Level of Intangibles

OLS Fixed–Effects, Panel 1995–2005

Dependent Variable: Log Intangible Assets

Explanatory Variables:	*(1)*	*(2)*	*(3)*	*(4)*
Statutory Tax Rate	-2.440***	-1.968***		
	(.6366)	(.6635)		
Avg. Tax Difference to All Other Affiliates			-2.041***	-1.598***
			(.5638)	(.5804)
Log GDP per Capita		-.2115		-.2167
		(.2178)		(.2240)
Log Population		-2.446		-3.006*
		(1.592)		(1.617)
Log Unemployment Rate		.1238		.1227
		(.0906)		(.0934)
Number of Observations	45,575	45,217	43,813	43,467
Number of Firms	6,732	6,732	6,473	6,473
Adjusted R^2	.7627	.7638	.7618	.7630

Notes: Heteroscedasticity robust standard errors adjusted for firm clusters in parentheses. *, **, *** indicates significance at the 10%, 5%, 1% level. The observational units are multinational subsidiaries that exhibit a foreign parent which owns at least 90% of the ownership shares. Additionally, to be included in the estimation, at least one affiliate of a corporate group has to own intangible assets and at least one has to make positive profits. The dependent variable is the natural logarithm (log) of the level of intangible assets; we add a small constant to the initial level to avoid losing observations with zero intangibles by taking the logarithm. An OLS model with fixed firm effects is estimated. The variable *Average Tax Difference to All Other Affiliates* is defined as the unweighted average statutory tax rate difference between the considered subsidiary and all other affiliates of the corporate group including the parent. All regressions include year dummy variables. Adjusted R^2 values are calculated from a dummy variables regression equivalent to the fixed–effects model.

Table 4: Robustness Check I: Binary Dependent Variable
Logit & OLS Fixed–Effects, Panel 1995–2005
Dependent Variable: Binary Intangible Assets

Explanatory Variables:	*(1)*	*(2)*	*(3)*	*(4)*
Statutory Tax Rate	-3.935***		-.3352***	
	(1.126)		(.1035)	
Avg. Tax Difference to All Other Affiliates		-2.557**		-.1972**
		(1.083)		(.1010)
GDP per Capita	1.868	3.907**	-.0008	.1581
	(1.917)	(1.904)	(.1347)	(.1315)
Population	-22.31***	-21.34***	-1.580***	-1.492**
	(7.321)	(7.464)	(.6186)	(.6358)
Unemployment Rate	-.0452	1.266	-.1267	-.0176
	(2.568)	(2.577)	(.1782)	(.1811)
Number of Observations	16,817	16,245	45,198	43,448
Number of Firms	2,254	2,178	6,732	6,473
Model	Logit FE	Logit FE	OLS FE	OLS FE
Pseudo R^2 (Logit), Adjusted R^2 (OLS)	.0233	.0229	.7224	.7209

Notes: Heteroscedasticity robust standard errors adjusted for firm clusters in parentheses. *, **, *** indicates significance at the 10%, 5%, 1% level. The observational units are multinational subsidiaries that exhibit a foreign parent which owns at least 90% of the ownership shares. Additionally, to be included in the estimation, at least one affiliate of the corporate group has to own intangible assets and at least one has to make positive profits. The dependent binary variable is set to 1 if a subsidiary owns intangible assets and is 0 if not. In (1) – (2), a logit model with fixed firm effects (FE) is estimated while in (3) – (4) a linear OLS model with fixed firm effects is applied. The variable *Average Tax Difference to All Other Affiliates* is defined as the unweighted average statutory tax rate difference between the considered subsidiary and all other affiliates of the corporate group including the parent. All regressions include year dummy variables. Adjusted R^2 values are calculated from a dummy variables regression equivalent to the fixed–effects model.

Table 5: Robustness Check II: Control for Subsidiary Size
OLS & IV First Differences, Panel 1995–2005
Dependent Variable: Log Intangible Assets

Explanatory Variables:	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Statutory Tax Rate	-1.166***		-1.044**		-1.845**	
			(.4393)		(.8993)	
Avg. Tax Difference to		-.9235**		-.8164**		-1.292*
All Other Affiliates		(.4006)		(.3976)		(.7648)
Log GDP per Capita	.3442**	.3620**	-.0308	-.0131	.2658	.2741
	(.1689)	(.1729)	(.1678)	(.1717)	(.3125)	(.3215)
Log Population	-1.311	-1.639	-1.341	-1.497	-3.709*	-4.637**
	(1.527)	(1.540)	(1.459)	(1.473)	(1.946)	(1.966)
Log Unemployment Rate	.2004**	.2047**	.1955**	.2011**	.1363	.1383
	(.0826)	(.0839)	(.0812)	(.0825)	(.1175)	(.1192)
Log Total Assets			.5056***	.5052***	-.0441	-.0388
			(.0299)	(.0305)	(.1841)	(.1876)
Number of Observations	37,242	35,800	37,214	35,773	19,436	18,659
Number of Firms	6,498	6,251	6,498	6,251	4,881	4,693
Model	OLS FD	OLS FD	OLS FD	OLS FD	IV FD	IV FD
1st–stage F–Test of excl. instruments (F–statistic)					48.54	46.13
Hansen J–Test (P–value)					.3461	.1836

Notes: Heteroscedasticity robust standard errors adjusted for firm clusters in parentheses. *, **, *** indicates significance at the 10%, 5%, 1% level. The observational units are multinational subsidiaries that exhibit a foreign parent which owns at least 90% of the ownership shares. Additionally, to be included in the estimation, at least one affiliate of the corporate group has to own intangible assets and at least one has to make positive profits. The dependent variable is the natural logarithm (log) of the level of intangible assets; we add a small constant to the initial level to avoid losing observations with zero intangibles by taking the logarithm. In (1) – (4), an OLS model in first differences (FD) with no constant is estimated. In (5) – (6), a first–differenced instrumental variables (IV) approach in two stages (2SLS) with no constant is applied, with the 1st difference of *Log Total Assets* being instrumented with the 2nd – 4th lag of the level of *Log Total Assets* (cf. Anderson and Hsiao, 1982). The variable *Average Tax Difference to All Other Affiliates* is defined as the unweighted average statutory tax rate difference between the considered subsidiary and all other affiliates of the corporate group including the parent. All regressions include year dummy variables. Note, time–constant heterogeneity between subsidiaries is controlled for by first differencing.

Table 6: Robustness Check III: Dynamic Estimation

Difference GMM, Panel 1995–2005

Dependent Variable: Log Intangible Assets

Explanatory Variables:	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
1st Lag of Log Intang. Ass.	.8515***	.8519***	.8421***	.8423***	.8351***	.8288***
	(.0241)	(.0246)	(.0217)	(.0222)	(.0255)	(.0260)
2nd Lag of Log Intang. Ass.					.0018	.0035
					(.0133)	(.0135)
Statutory Tax Rate	-1.349**		-1.300**		-1.711**	
	(.5976)		(.6018)		(.8077)	
Avg. Tax Difference to		-1.123**		-1.125**		-1.237*
All Other Affiliates		(.5802)		(.5769)		(.7191)
Log GDP per Capita	.0607	.1905	-.0394	.0872	.0795	.1195
	(.1541)	(.1428)	(.2036)	(.2062)	(.3304)	(.3398)
Log Population	-2.284*	-2.182*	-2.354*	-2.226*	-1.655	-1.785
	(1.280)	(1.333)	(1.238)	(1.291)	(1.529)	(1.538)
Log Unemployment Rate	.1899*	.1892*	.1827*	.1805*	.1896	.1879
	(.1060)	(.1071)	(.1049)	(.1060)	(.1202)	(.1225)
Log Total Assets			.0582	.0534	-.0241	-.0297
			(.0962)	(.0986)	(.1257)	(.1301)
Number of Observations	30,164	28,984	30,148	28,969	24,046	23,095
Number of Firms	5,893	5,671	5,890	5,668	5,357	5,155
Number of Instruments	22	22	31	31	30	30
Arellano–Bond–Test for AR(2) (P–value)	.356	.296	.349	.290	.887	.805
Hansen–Test (P–value)	.432	.501	.459	.441	.243	.242

Notes: Standard errors robust against heteroscedasticity and autocorrelation within firms are reported in parentheses. *, **, *** indicates significance at the 10%, 5%, 1% level. The observational units are multinational subsidiaries that exhibit a foreign parent which owns at least 90% of the ownership shares. Additionally, to be included in the estimation, at least one affiliate of the corporate group has to own intangibles and at least one has to make positive profits. The dependent variable is the logarithm (log) of the level of intangible assets; we add a small constant to the initial level to avoid losing observations with zero intangibles by taking the logarithm. A one–step linear GMM dynamic panel–data estimation in first differences with no constant is applied. Following Arellano and Bond (1991), we instrument the 1st difference of the *1st Lag of Log Intangible Assets* with the 2nd and all deeper lags of the level of *Log Intangible Assets*. In (3) – (6), we additionally instrument the 1st difference of *Log Total Assets* with the 2nd and all deeper lags of *Log Total Assets* levels. The variable *Average Tax Difference to All Other Affiliates* is defined as the unweighted average statutory tax rate difference between the considered subsidiary and all other affiliates of the corporate group including the parent. All regressions include year dummy variables. Note, time–constant heterogeneity between subsidiaries is controlled for by first differencing.

Table 7: Profit Shifting Evidence
OLS Fixed–Effects, Panel 1995–2005
Dependent Variable: Log Profit before Taxation (per Sales)

Explanatory Variables:	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Statutory Tax Rate	-1.888***	-2.093***				
	(.3414)	(.3595)				
Tax Difference to Parent			-.5464***	-.7181***		
			(.2205)	(.2283)		
Avg. Tax Difference to All Other Affiliates					-1.251***	-1.669***
					(.3376)	(.3562)
Log Number Employees (per Sales)	.1195***	.1208***	.1168***	.1208***	.1162***	.1217***
	(.0316)	(.0322)	(.0317)	(.0322)	(.0325)	(.0330)
Log Fixed Assets (per Sales)	.0587***	.0604***	.0597***	.0612***	.0572***	.0581***
	(.0183)	(.0183)	(.0184)	(.0184)	(.0189)	(.0188)
Log GDP per Capita		.1654*		.3048***		.3126***
		(.1002)		(.0975)		(.0998)
Log Population		.5233		.5752		.7901
		(.9057)		(.9232)		(.9298)
Log Unempl. Rate		-.1372*		-.0767		-.1211*
		(.0724)		(.0719)		(.0740)
Number of Observations	24,446	24,327	24,446	24,327	23,497	23,383
Number of Firms	5,056	5,056	5,056	5,056	4,862	4,862
Adjusted R^2	.6897	.6914	.6890	.6907	.6901	.6919

Notes: Heteroscedasticity robust standard errors adjusted for firm clusters in parentheses. *, **, *** indicates significance at the 10%, 5%, 1% level. The observational units are multinational subsidiaries that exhibit a foreign parent which owns at least 90% of the ownership shares. Additionally, to be included in the estimation, at least one affiliate of the corporate group has to own intangible assets. All subsidiaries in the sample exhibit positive profits. The dependent variable is the natural logarithm (log) of the subsidiary's unconsolidated pre–tax profit calculated per operating revenue. An OLS model with fixed firm effects is estimated. The variable *Tax Difference to Parent* is defined as the statutory corporate tax rate of the considered subsidiary minus the statutory corporate tax rate of the subsidiary's parent. The variable *Average Tax Difference to All Other Affiliates* is defined as the unweighted average statutory tax rate difference between the considered subsidiary and all other affiliates including the parent. All regressions include year dummy variables. Adjusted R^2 values are calculated from a dummy variables regression equivalent to the fixed–effects model.

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