Corporate Tax Competition between Firms

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Abstract

Firms' tax planning decisions, similar to their other operational decisions, are made in a competitive environment. Various stakeholders observe the tax payments and evaluate these against the relevant peer group, which creates interdependencies in the tax planning activities of firms. Introducing the concept of reputational loss we show the positive interdependence in a theoretical model and test it in a spatial econometric model. Empirical evidence suggests that benchmarking takes place both within countries and within industries, however for the latter it is important to include firms in large non-EU OECD countries. Further, the analysis shows that spatial interdependence is stronger for the largest firms and if they have an average effective tax rate above the statutory tax rate.

JEL classification: H25, M40
Keywords: Corporate Taxation; Benchmarking; Tax Competition; Spatial Econometrics

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1 Introduction

One of the perpetuating forces of tax competition is based on the desire of (multinational) firms to reduce the burden of taxation on profits. This force is not only responsible for shifts of capital across borders, but also motivates the multitude of strategies that firms adopt to lower their effective tax rate (ETR).[1] However, despite the widespread belief that extensive tax planning takes place, there is rather little research concerned with the underlying determinants. In the paper, we argue that firms' tax planning decisions, similar to their other operational decisions, are made in a competitive environment. Various stakeholders of the firm can observe tax payments and evaluate these against the relevant peer group, leading to interdependencies in the tax planning activities of firms.

In this paper we capture this dynamic in a theoretical model which introduces a reputational loss. Managers have to balance the benefits of a reduced tax burden against the costs of a loss in reputation if they deviate too much from the behaviour of their peer group. This is neatly summed up in the introduction of the tax benchmarking studies done by the international accountancy firm PriceWaterhouseCoopers (2009) stating '*a current challenge for the tax professional is to identify the right balance when planning for taxes. On the one side of the balance, taxes are a significant cost to the corporation and should be controlled and managed in the quest to create shareholder value and maximise earnings per share. On the other side, the amount of tax paid by large corporations is coming under increasing scrutiny and stirring public debate.*'

This statement highlights some of the complexity of this benchmarking process. In consequence we see the concept of the reputational loss as a multi-facetted phenomenon, as various shareholders pursue conflicting interests. Shareholders are likely to prefer a low ETR, analysts might be concerned with sustainability of the ETR, while the tax authorities and critical consumers want to see the corporation pay its 'fair share' of income taxes. However, all of these stakeholders have only limited information about the firms' true situation. Therefore they evaluate the observable tax payments relative to the peer group. This leads to a yardstick-like form of competition where managers anticipate their competitors moves and optimise their own behaviour. This in turn creates a positive interdependence in the choice of tax sheltering, which

[1] Throughout the paper ETR denotes the ratio of tax paid to pre-tax profit. For a survey and discussion of early empirical evidence see Hines (1999).

we can test empirically.

Using a spatial econometric approach we find evidence for interdependence in the ETR. Our results confirm the existence of spatial interdependence between firms in the same country and between firms in the same industry. However, in the latter case, positive reaction functions are only found for developed countries. Further, we find a stronger interdependence for firms, which have an ETR above the average of their peer group.

The rest of the paper is organized as follows. Section 2 summarizes the strands of literature we build our analysis on. Section 3 provides a small theoretical model showing the spatial dependence, which is empirically tested in section 4. Section 5 concludes.

2 Previous literature

Income taxes and the avoidance thereof have been the focus of the academic discussion for some time. Hence a lot of the features we include in our model can be found in some form in earlier literature. In consequence this section aims only to summarize the most important strands of literature rather than providing a complete review of the related literature.

The earlier contributions deal with evasion of personal income tax and build on the economic analysis of crime of Becker (1968).[2] In a seminal article Allingham and Sandmo (1972) model the decision of how much taxes to evade as a function of the probability of being audited and penalized. Reinganum and Wilde (1985) analyse the auditing decisions of the tax authorities in a principal agent framework and introduce the idea that the auditing probability depends on the reported income. Although not explicitly modelled, the idea of an 'audit cutoff' implies some evaluation against the other tax payers. In a different context Shleifer (1985) introduces the concept of yardstick competition, which models the use of peer group comparison to infer the true situation of the firms. Translating these two ideas into our model, we assume that the tax authorities compare the reported income of companies with the relevant peer group in order to decide which firms will come under scrutiny. For example in the United Kingdom, the tax authorities are introducing a risk rating for the biggest corporations based on a combination of organisiational features and past tax behaviour.[3] Another aspect of HMRC as a stakeholder

[2] See Slemrod (2007) for a review of the literature on personal income tax evasion.
[3] See Freedman et al. (2008) for an discussion of this risk rating.

is that it can easily prove to be beneficial for the firm to pay more taxes today in order to be in the 'good book' and have a better stance in influencing future tax policy making.

Levenson (1999, p. 16) directly mentions a further stakeholder evaluating corporate tax behaviour, stating '[t]his reduction [in the ETR] translates to higher earnings per share and ultimately places companies in a more favorable light with analysts when compared to competitors.' Along these lines Abarbanell and Bushee (1998) and Swenson (1999) expect that a lower ETR send positive signals to the stock market.

More recent contributions, mostly by economists, find mixed evidence for a negative relationship between ETR and stock market valuation. For example, Desai and Hines (2002) analyse corporate inversions, where the headquarter is relocated to a tax haven. They find that in the longer run, these aggressive tax planning activities lead to a reduced stock price. The subsequent discussion of Slemrod (2004) concludes that corporate tax planning needs to be analysed in a larger framework including the shareholders. Crocker and Slemrod (2005) and Chen and Chu (2005) provide formal theoretical principal-agent models of corporate income tax evasion with agency costs. Desai and Dharmapala (2006a, 2006b) find evidence for this model of tax sheltering and managerial diversion. They conclude that increased corporate tax sheltering increases the firms value only in combination with good corporate governance. Otherwise the increased opportunities for diversion of profits dominate the tax saving effect.[4]

A different strand of literature aims to explain the tax paying behaviour of corporations. The earliest contributions can be found in the accounting literature.[5] Firm size is identified as an important determinant, as large firms have more resources to optimize their tax planning, which would imply a lower ETR. At the same time large corporations are expected to be audited more often, creating higher political costs of tax planning for larger firms.[6] Subsequently, more determinants of the ETR were introduced into the analysis. Wilkie (1988) discusses the importance of the profitability, Gupta and Newberry (1997) find that the asset mix and leverage matters, which is confirmed by Mills, Erickson, and Maydew (1998). Further Leblang (1998)

[4]For further evidence for this hypothesis see Desai et al (2007) and Desai and Dharmapala (2007).

[5]See Rego (2003) for a summary and discussion of this literature.

[6]See Zimmerman (1983) and Omer, Molloy, and Ziebart (1993) for a discussion and early evidence for the political cost hypothesis.

argues that firms with more multinational activity have more tax planning opportunities.[7] More recently, Graham and Tucker (2006) analyse 44 tax sheltering cases and identify firm size and profitability as determinants of firms which are using tax sheltering.

Finally, a small number of authors have addressed the impact of society on tax paying behaviour. Posner (2000) discusses the impact of social norms on income tax compliance, and Weisbach (2002) considers this idea for corporate tax compliance as well. However, he dismisses the idea that social norms are able to explain the absence of more tax avoidance and concludes with a 'undersheltering puzzle'. In contrast, we argue in this paper that social norms, or more generally pressure from the wider public, add into the reputational loss and mitigate the benefits from tax sheltering. For example the newspaper 'The Guardian' ran an investigation into the tax payments of the FTSE 100 companies and commented on the ETR of the biggest companies.[8]

Consequently, firms may increasingly face an 'outrage constraint' when deciding about their tax payments. The term 'outrage constraint' was coined by Bebchuk and Fried (2004), where they argue that managers can not get away with too high executive compensation, because shareholders and/or consumers will simply not tolerate this. Similar things are expected to occur in the case of corporate tax payments. However, given the diverse and complex nature of the stakeholders both an inexplicably high or very low ETR might lead to 'outrage'.

3 Theoretical model

Before we introduce our stylized model, a clarification about the use of our notation is apposite. Note that we use the term *potential gross profit* in an rather wide and abstract way. Given the previous discussion of the multifacetted problem of the reputational loss, the concept of a potential gross profit could be used somewhat interchangeably with the term *firm value*. The use of *firm value* implies an easier interpretation of some aspects of the reputational costs, e.g. via the channels of a lower evaluation by analysts, the loss of potential consumers or the fact of not having a good relationship with the tax authorities. In contrast, under the name *potential gross profit* the modelling of the tax sheltering is more intuitive and other aspects of the costs are easily implementable, e.g. the cost of tax audits and the tax sheltering

[7] Collins and Shackelford (1999) find only inconclusive evidence for this hypothesis.

[8] See www.theguardian.co.uk/taxgap. For further examples of political pressure from the wider public, see the publications of Citizen for tax justice (United States) or Taxjustice network (International).

costs themselves. In sum we will use the term *potential gross profit* henceforth as it leaves us with a more coherent stylized model.[9] Nevertheless the reader should bear in mind the various possible interpretations of the term.

Consider a world with two firms, denoted with the subscripts i and j. Each firm has a potential gross profit of π_i. Of this profit the firm can shelter the fraction θ_i from corporate taxes t. However, tax planning involves two types of costs. First there is the cost of tax planning itself C and secondly there is a reputational loss of L depending on its own tax planning activities relative to those of its competitors. The net profit Π_i of firm i is therefore

$$\Pi_i = (1 - t(1 - \theta_i)) \left[\pi_i - C(\theta_i) - R(\Delta\theta_{ij})\right] \tag{1}$$

where $\Delta\theta_{ij} = \theta_i - \theta_j$ and $i \neq j$.

We assume that the tax sheltering costs C are increasing and convex in θ_i. In order to provide an analytical solution to the model we choose a simple functional form with the necessary properties. More specifically we set

$$C(\theta_i) = \alpha\frac{\theta_i^2}{2} \quad \text{where } \alpha > 0. \tag{2}$$

Further the firm incurs a reputational loss depending on its tax planning in comparison to its competitor's tax planning. Again, we assume that the reputational loss is increasing and convex in the absolute difference between θ_i and θ_j and use the simple functional form of

$$R(\Delta\theta_{ij}) = \beta\frac{(\theta_i - \theta_j)^2}{2} \quad \text{where } \beta > 0. \tag{3}$$

Each firm chooses its fraction of tax sheltering in order to maximise their after tax profit. The alternative interpretation would be that a manager maximises firm value, which can be motivated by compensation linked to the stock market performance. Inserting (2) and (3) in (1) and partially deriving with respect to θ_i yields

$$\frac{\partial\Pi_i}{\partial\theta_i} = t\left[\pi_i - \alpha\frac{\theta_i^2}{2} - \beta\frac{(\theta_i - \theta_j)^2}{2}\right] + (1 - t(1 - \theta_i))\left[-\alpha\theta_i - \beta(\theta_i - \theta_j)\right] \tag{4}$$

The first term represents the marginal tax savings and the second term the marginal costs of sheltering more profits from taxation. Optimally θ_i is chosen so that these two terms equal. Solving for the optimal θ_i yields

[9] See also Moore (2008) for a different theoretical approach to tax benchmarking, where managers optimise the ETR in order to avoid being voted off by the shareholders.

$$\widetilde{\theta_i} = \frac{1}{3t(\alpha+\beta)}\Big[(\alpha+\beta)(t-1)+2\beta t\theta_j + \sqrt{[(\alpha+\beta)(t-1)+2\beta t\theta_j]^2+3t(\alpha+\beta)\left[\beta\theta_j(2-2t-t\theta_j)+2\pi_i t\right]}\Big] \quad (5)$$

Note that this reaction function only holds if $3t/3(\alpha+\beta) \neq 0$. For $t=0$ the reaction function collapses to $\widetilde{\theta_i} = \beta\theta_j/(\alpha+\beta)$ which implies an equilibrium at $\theta_i = \theta_j = 0$.

Proposition 1: *There is a positive interdependence in the tax sheltering behaviour of firms.*

Proof: Deriving the first order condition in 4 with respect to θ_i and θ_j yields

$$\begin{aligned} &-\alpha t\theta_i d\theta_i - \beta t(\theta_i-\theta_j)d\theta_i + t[-\alpha\theta_i-\beta(\theta_i-\theta_j)]d\theta_i + \\ &[1-t(1-\theta_i)](-\alpha-\beta)d\theta_i + \beta t(\theta_i-\theta_j)d\theta_j + \beta[1-t(1-\theta_i)]\,d\theta_j = 0 \end{aligned} \quad (6)$$

which can be simplified to

$$\frac{d\theta_i}{d\theta_j} = \frac{\beta[t(\theta_i-\theta_j)+1-t(1-\theta_i)]}{2\beta t(\theta_i-\theta_j)+2\alpha t\theta_i+(\alpha+\beta)[1-t(1-\theta_i)]} \quad (7)$$

This expression is unambiguously positive for if $\theta_i \geq \theta_j$. For $\theta_i < \theta_j$ this term will only be negative if either the denominator or the numerator, but not both, are negative. The numerator will be negative if the following condition is met

$$\theta_j > \frac{1-t}{t} + 2\theta_i. \quad (8)$$

The first part on this expression implies that all values of $t < 0.5$ would demand, irrespective of the competitors behaviour, more than 100 percent of tax sheltering for the numerator to become negative.

Further, rearranging (7) to

$$\frac{d\theta_i}{d\theta_j} = \frac{\beta[t(\theta_i-\theta_j)+1-t(1-\theta_i)]}{\beta[t(\theta_i-\theta_j)+1-t(1-\theta_i)]+\beta t(\theta_i-\theta_j)+\alpha[1-t(1-3\theta_i)]} \quad (9)$$

it can be shown that the denominator is smaller than the numerator if

$$\begin{aligned} \beta t(\theta_i - \theta_j) &> \alpha[1 - t(1 - 3\theta_i)] \quad \text{or} \\ \theta_j &< \frac{\beta - 3\alpha}{\beta}\theta_i - \frac{\alpha}{\beta t}(1 - t). \end{aligned} \tag{10}$$

which can not be fulfilled if θ_j needs to be larger than θ_i. In consequence the denominator is larger than the numerator which in turn can only be negative for unrealistically high tax rates.

Proposition 2: *With a higher corporate tax rate firms shelter a bigger fraction of profits against taxation.*

Proof: The partial derivative of (5) with respect to t captures the direct effect of a change in the tax rate, which is given through

$$\frac{\partial \widetilde{\theta_i}}{\partial t} = \frac{1}{3t^2}\left[\frac{(\alpha+\beta)(t-1) - \beta t\theta_j}{\sqrt{[(\alpha+\beta)(t-1) + 2\beta t\theta_j]^2 + 3t(\alpha+\beta)\left[\beta\theta_j(2 - 2t - t\theta_j) + 2\pi_i t\right]}} + 1\right]. \tag{11}$$

This expression is unambiguously positive, as the denominator is positive and absolutely larger than the negative numerator. This ensures that the value of the fraction is negative, but smaller than unity which ensures that the term in the brackets is positive. This implies that each firm, ceteris paribus, increases its tax sheltering activity in response to an increase of the tax rate. Proposition 1 further states a positive response to an increase in the other firms tax sheltering activities. Hence this tax effect is intensified and unambiguously positive.

Proposition 3: *Firms with higher profits shelter a bigger fraction of profits against taxation.*

Proof: Deriving (5) with respect to the π_i yields

$$\frac{\partial \widetilde{\theta_i}}{\partial \pi_i} = \frac{t}{\sqrt{[(1-t)(\alpha+\beta) - 2\beta t\theta_j]^2 + 3t(\alpha+\beta)\left[\beta\theta_j(2 - 2t - t\theta_j) + 2\pi_i t\right]}}. \tag{12}$$

which is unambiguously positive. Therefore, all else equal, firms with larger profits shelter a bigger fraction against corporate taxes.

Under the assumption of identical cost functions for both firms, equivalent

reaction functions for firm j can be derived. Parameterizing the model, propositions 1 and 2 are illustrated Figure (1). The solid black line displays the optimal $\widetilde{\theta}$ for firm i and the grey line shows the equivalent for firm j. The dotted lines show the changed reaction functions for an increase in the statutory tax rate.

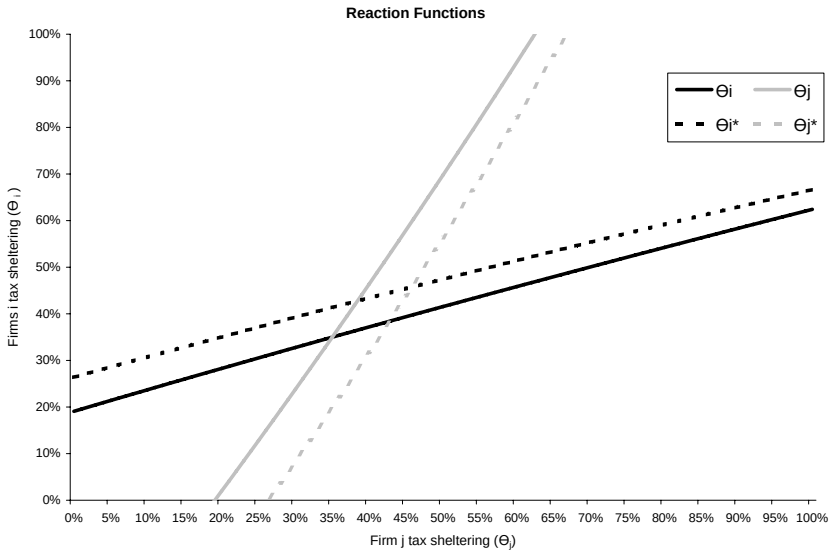

Figure 1: **Symmetric equilibrium**

An increase in the profit of a firm (π_i) would lead to a shift of the reaction function, similar to the shift of one firm because of a change in the tax rate. In contrast, a change in the cost function parameters (α or β) would rotate the reaction functions.

4 Empirical Analysis

4.1 Data

Most of the stakeholders described in the previous two subsections, have only access to publicly available data. This suggests that the correct dataset should be the published annual accounts, since it is these accounts that shareholders and analysts or the wider public will use to benchmark the company's performance. And in anticipating this, it is this ETR measure which the managers set at the optimal level. The tax authorities do have further information about how much the firms actually paid in their country, however, if they wish to compare the tax behaviour of multinational companies in other countries, they are also restricted to publicly available

data. We, therefore, use accounting data for our empirical analysis. More specifically, we use the largest available dataset of firm-level accounts, ORBIS, provided by Bureau van Dijk. As the concept of a reputational loss is more applicable to large corporations, we restrict our dataset to consolidated accounts. On top of that we restrict our sample to the largest 500 companies in each country.[10] The reflects the fact that most stakeholders focus their attention on the biggest companies, rather than on small and medium sized firms.

ORBIS usually provides a time window of the latest ten years. In order to overcome this restriction, we combine an earlier download from the October 2006 version with a download from the current version as in December 2008. In consequence we have a time window from 1993 to 2008, with a partly overlapping sample. In total we download 50,102 firms from the old version and 48,330 partly overlapping firms from the current version.

We define our dependent variable (ETR) as the ratio of the tax as reported in the accounts and the pre tax profit. This implies that the variable will be undefined when the pre tax profit is zero. Further, in the case of a loss, this ratio can be misleading. We therefore exclude all observations with a misleading outcome and set the ETR to zero, where it is undefined because of zero pre tax profit. Alternatively one could exclude all loss making companies on the grounds that they face a different optimisation problem. However this would increase the truncation of the dataset even more. We will return to the issue of the loss making companies in the sensitivity analysis.

We also include the following control variables from ORBIS. Firm size ($SIZE$) is measured as the logarithm of total assets. Profitability is measured through the return on assets (ROA), defined as earnings before interest divided through total assets. Potential interest deductibility is captured by leverage ($DEBT$), which we measure as the sum of current and noncurrent liabilities as a share of total assets.[11] We also control for capital intensity ($CAPINT$), defined as the share of tangible fixed assets in total assets, and intangibles assets ($INTANG$), defined as the share of intangible assets in total assets.

In order to avoid problems because of outliers we drop the top and bottom

[10] We use the 500 firms with the largest average total assets over the whole period of observation. To increase the balancedness of our sample we restrict our sample to 500 companies after the cleaning process described below.

[11] We include current liabilities, as the split between current and noncurrent liabilities appears to be varying across countries. See also Huizinga, Laeven and Nicodeme (2008) for a similar approach.

percentile of all variables.[12] We then use only those firms for which we have at least 4 contiguous observations on each firm, and at least ten firms per country. This leaves us with a sample of 73,784 observations in 10,031 firms, with country coverage as described in Table 1.

Table 1: Country coverage

OECD countries		
Country	**Firms**	**Observations**
Australia	500	3,606
Austria	55	421
Belgium	79	554
Canada	454	3,406
Czech Republic	15	95
Denmark	66	495
Finland	81	632
France	385	2,894
Germany	421	2,877
Greece	65	479
Hungary	10	71
Iceland	15	84
Ireland	445	2,423
Italy	114	847
Japan	500	3,527
Luxembourg	18	110
Mexico	85	707
Netherlands	500	4,190
New Zealand	79	575
Norway	64	464
Poland	29	185
Portugal	32	225
Spain	85	638
Sweden	149	1,079
Switzerland	244	2,032
Turkey	52	302
United Kingdom	500	4,207
United States	500	4,394

Non-OECD European countries		
Country	**Firms**	**Observations**
Latvia	10	70
Lithuania	167	1,276
Slovenia	12	84

Non-OECD Asian countries		
Country	**Firms**	**Observations**
China	500	3,979
Hongkong	131	1,095
India	494	3,350
Indonesia	115	704
Malaysia	500	3,940
Pakistan	73	506
Philippines	81	636
Russia	39	250
Singapore	300	2,272
Sri Lanka	23	171
Taiwan	160	1,136
Thailand	500	3,200
Vietnam	23	135

Other countries/Tax Havens		
Country	**Firms**	**Observations**
Argentina	24	141
Bermuda	273	2,062
Brazil	111	787
Cayman Islands	206	1,293
Chile	126	938
Costa Rica	11	70
Egypt	113	678
Israel	76	505
Jamaica	10	56
Jordan	62	404
Kuwait	25	149
Mauritius	30	232
Morocco	34	249
Oman	39	262
Saudi Arabia	50	352
South Africa	155	1,165
Tunisia	16	118

As the distinction into geographical regions in Table 1 already suggests, the spectrum of countries in our sample is very broad and it is likely to be misleading if we include all firms in the same regressions. We therefore split our sample according to this geographical breakdown. This also implies that

[12] With the exception of $SIZE$, where we only drop the smallest observations. We also eliminate all observations with a leverage bigger than unity. A complete description of the cleaning process is available from the authors upon request.

we think that firms do not compare themselves - nor are they compared to each other by various stakeholders - to firms in completely different geographical regions.

Table 2: Descriptive statistics

OECD (28 countries/41,519 observations)					
Variable	**Minimum**	**Median**	**Maximum**	**Average**	**Std. Dev.**
ETR	-0.75	0.30	1.80	0.29	0.19
$SIZE$	7.02	13.47	20.49	13.41	2.09
ROA	-0.73	0.08	0.42	0.09	0.08
$CAPINT$	0.00	0.29	1.00	0.33	0.25
$INTANG$	0.00	0.02	0.96	0.09	0.15
$DEBT$	0.00	0.58	1.00	0.56	0.20
European Union (21 countries/23,852 observations)					
Variable	**Minimum**	**Median**	**Maximum**	**Average**	**Std. Dev.**
ETR	-0.75	0.29	1.80	0.28	0.19
$SIZE$	7.05	12.99	20.42	12.97	2.05
ROA	-0.69	0.07	0.42	0.08	0.07
$CAPINT$	0.00	0.28	1.00	0.33	0.25
$INTANG$	0.00	0.02	0.89	0.09	0.13
$DEBT$	0.00	0.61	1.00	0.58	0.20
Asia (13 countries/21,374 observations)					
Variable	**Minimum**	**Median**	**Maximum**	**Average**	**Std. Dev.**
ETR	-0.71	0.21	1.80	0.21	0.17
$SIZE$	7.00	11.88	18.89	11.99	1.57
ROA	-0.72	0.08	0.42	0.09	0.07
$CAPINT$	0.00	0.35	0.99	0.36	0.23
$INTANG$	0.00	0.00	0.97	0.02	0.06
$DEBT$	0.00	0.48	1.00	0.47	0.20
Other countries/Tax havens (17 countries/9,461 observations)					
Variable	**Minimum**	**Median**	**Maximum**	**Average**	**Std. Dev.**
ETR	-0.74	0.15	1.80	0.17	0.17
$SIZE$	7.42	11.87	18.69	12.03	1.69
ROA	-0.67	0.10	0.42	0.11	0.09
$CAPINT$	0.00	0.27	0.99	0.31	0.24
$INTANG$	0.00	0.00	0.91	0.03	0.07
$DEBT$	0.00	0.45	1.00	0.44	0.21

Table 2 provides descriptive statistics for the various geographical groups. Not surprisingly firms are rather similar in the partly overlapping OECD and the EU subsample. However there is a clear distinction between these two subsamples and the two other subsamples. Most notably the firms in the developed countries have a higher average ETR of approximately 29 percent, in contrast to Asian firms with an average ETR of only 21 percent.[13] Firms domiciled in Latin America, the Middle East or tax haven countries have an

[13]We will use the term developed countries as a label for the combined sample of OECD and non-OECD EU countries.

even lower ETR, with an average of only 17 percent.

In terms of other characteristics, the firms in the developed countries are larger on average, which is mostly due to the fact that the restriction to the 500 largest companies is more binding for these subsamples.[14] Furthermore firms in the OECD and EU have a larger share of intangibles, appear to have a large return on assets and have a larger average share of debt of approximately 58 percent. In comparison, firms headquartered in tax haven countries have only 44 percent of debt on average.

4.2 Empirical strategy

To test for the existence of spatial interdependence we specify a spatial autoregressive (SAR) model that can estimate the relationship between an individual firm's ETR and that of its competitors. In equation (13) the individual firm's $ETR_{i,t}$ is a function of its competitors' ETRs.

$$ETR_{i,t} = \rho \sum_{i \neq j} \omega^{c}_{ij,t} ETR_{j,t} + \beta X_{i,t} + \gamma \tau_{k,t} + \mu_i + \varepsilon_{i,t} \tag{13}$$

Competitors' ETRs are contained in $\sum_{i \neq j} \omega^{c}_{ij,t} ETR_{j,t}$ and $\omega^{c}_{i,j,t}$ selects the appropriate competitors for each firm i in each period t from the vector of all firms' ETRs ($ETR_{j,t}$). The set of competitors c varies by year and across firms (we discuss the selection of competitors later). This matrix is often referred to in the literature as the 'weighting' or 'connectivity' matrix. It will have a positive value if the current firm is related to another, and zero otherwise. The size of the positive value will reflect the strength of the relationship between the firms. This allows us to specify a relationship between the current firm's ETR and competitors' ETRs. The estimate of the parameter ρ will tell us the sign, size and significance of competitors' ETRs in determining the firm's ETR. We also include a set of firm-level control variables $X_{i,t}$ consistent with the literature discussed in Section 2, the statutory corporate tax rate $\tau_{k,t}$ in country k, along with a set of firm fixed effects μ_i.

Specifying the weighting matrix: In this study, we would like to choose the competitor firms which represent the most likely benchmark set of firms that shareholders will use. This requires some judgement as there is no obvious best way to choose competitors. For this reason, we specify a number of alternative weighting matrices which we can trial.

[14] Descriptive statistics for the unrestricted sample are available from the authors upon request.

The weights in the weighting matrix are designed to select the most important competitors for each firm. To this end we define a dummy variable δ_{ij}^c which takes a positive value if the competitor is in the same reference group c and zero otherwise. Specifically we use three different sets of reference groups, all firms in the same country, all firms in the same NACE 2-digit industry and all firms in the same industry *or* within the same country. In the first two cases δ_{ij}^c is unity if the competitor is in the same country or industry respectively. In the the third specification of the weighting matrix the dummy is unity if the competitor is either in the same country or in the same industry. If the competitor is both in the same industry and the same country, the dummy is added up and takes the value two.

Further, we think it is unrealistic that companies are compared or are comparing themselves to hundreds of competitors. Therefore we also include a dummy $\kappa_{ij,t}^c$ which is set equal to unity if the competitor is similar in size. Namely we allow the 20 companies closest in size to have a positive weight in the weighting matrix. This sparse design of the weighting matrix also has the benefit that the weighted competitors tax rates have more cross section variation which helps to distinguish their impact from a common shock or pure time effect. This is especially important as we have a large cross section of firms.[15] We finally allocate each competitor a specific weight, which is defined as a quadratic inverse distance between the size of the current firm and the competitor in question. The inverse distance measure ensures that similarly sized firms get greatest weight and the quadratic form allows firms to be similar in size if they are larger or smaller than the current firm.[16] Formally, the weights are defined as

$$\omega_{ij,t}^c = \delta_{ij}^c \kappa_{ij,t}^c |SIZE_{i,t} - SIZE_{j,t}|^{-0.2}. \tag{14}$$

We further normalise the weights to sum to unity.[17]

4.2.1 Econometric issues

Estimation of equation (13) using OLS will yield biased and inconsistent estimates of α because the weighted competitors' ETRs will be correlated with each firm's error term ε_{it}. Correcting for this spatial endogeneity problem has been approached in a number of ways.[18] We follow a standard approach as

[15] See Overesch and Rincke (2009) for a discussion this problem.

[16] We also did run the regressions without the size weighting and the results are qualitatively similar. The full set of results is available from the authors upon request.

[17] See Anselin (1988) for a discussion about row standardization.

[18] See Brueckner (2003) for a discussion of this issue.

proposed by Kelejian and Robinson (1993) and Kelejian and Prucha (1998)[19] and use a 2 stage least squares procedure in which spatially lagged explanatory variables are used to instrument for the spatially lagged dependent variables.

A further issue arising with our empirical specification is that some of the control variables are endogenous. This is most obvious for our measure of the profitability (ROA) as a measure of the pre tax profit is used in both the dependent and independent variable. We therefore also instrument for profitability (ROA) using the market power of the company and the industry concentration. For the market power we use market share and market share squared, where market share is defined as the operating revenues of the companies in the year t as a fraction of the sum of operating revenues of all firms within the same country in the year t. For industry concentration we use the Herfindahl-Hirschmann Index, defined as the sum of the squared market shares within country and 2-digit NACE industry.[20]

4.3 Baseline Results

Following the definition of δ_{ij}^{c} we use Equation (14) to construct three weighting matrices. First, we include all firms in the weighting matrix with their domicile in the same country. Our rationale for this weighting matrix is that, competition may take place among, for example, FTSE 100 companies irrespective of their industry. Secondly we include all firms that operate in the same industry. This captures the idea, that firms are evaluated against similar companies across borders, which is in line with the benchmarking studies PWC is conducting. And finally we combine the first two weighting matrices and include companies within the same industry or country, which an increased weight if both criteria are fulfilled.

We run the regression as specified in equation (13) for each subsample with three different measures of the competitors ETRs. Table 3 reports the results. The first line represents the reaction to the ETRs of competitors within the same country. In line with the theoretical prediction of proposition 1 the coefficient is significantly positive for all but the tax haven subsample.[21] The latter is relatively unsurprising since firms that locate their headquarter in a tax haven country are less likely to be concerned with reputational loss due to

[19] See also Anselin et al. (2008).

[20] See Cowling and Waterson (1976) or Machin and Van Reenen (1993) for evidence on the connection between market share, industry concentration and profitability.

[21] Note that we have some problems with the quality of instruments especially in the Asian subsample. Using different clustering would alleviate the problem, but for consistency reasons we use the same clustering for all specifications.

Table 3: Baseline results (up to 500 firms per country) with symmetric responses

	OECD countries			European Union			non-OECD Asian countries			Tax Havens/Other countries		
Competitors ETR	0.266			0.398			0.560			0.160		
same country	(0.082) **			(0.121) **			(0.147) **			(0.627)		
Competitors ETR		0.182			0.018			0.624			0.042	
same industry		(0.083) *			(0.147)			(0.217) **			(0.220)	
Competitors ETR			0.381			0.245			0.559			0.053
same country *or* industry			(0.098) **			(0.153)			(0.193) **			(0.494)
$ROA_{i,t}$	-0.286	-0.313	-0.360	-0.040	-0.266	-0.118	-0.469	-0.325	-0.376	-0.069	-0.249	-0.343
	(0.159)	(0.136) *	(0.125) **	(0.133)	(0.166)	(0.132)	(0.184) *	(0.159) *	(0.137) **	(0.151)	(0.195)	(0.165)*
$SIZE_{i,t}$	-0.013	-0.015	-0.012	-0.010	-0.021	-0.014	0.003	0.008	0.004	0.015	0.016	0.015
	(0.003) **	(0.003) **	(0.003) **	(0.004) *	(0.004) **	(0.005) **	(0.003)	(0.003) **	(0.004)	(0.010)	(0.005)**	(0.007)*
$CAPINT_{i,t}$	0.007	0.011	0.004	0.025	0.025	0.025	-0.027	-0.018	-0.028	-0.003	-0.014	0.013
	(0.013)	(0.013)	(0.013)	(0.016)	(0.016)	(0.016)	(0.017)	(0.018)	(0.017)	(0.028)	(0.027)	(0.028)
$INTANG_{i,t}$	0.038	0.035	0.031	0.086	0.070	0.080	0.009	0.002	0.013	-0.018	-0.043	-0.048
	(0.020)	(0.019)	(0.018)	(0.024) **	(0.025) **	(0.023) **	(0.042)	(0.039)	(0.040)	(0.054)	(0.055)	(0.055)
$DEBT_{i,t}$	0.119	0.124	0.114	0.113	0.123	0.117	0.043	0.056	0.052	0.060	0.059	0.061
	(0.015) **	(0.014) **	(0.014) **	(0.018) **	(0.018) **	(0.018) **	(0.016) **	(0.016) **	(0.015) **	(0.022) **	(0.018)**	(0.020)**
$\tau_{k,t}$	0.156	0.222	0.124	0.073	0.143	0.110	0.176	0.440	0.226	0.003	-0.003	-0.024
	(0.066) *	(0.057) **	(0.065)	(0.056)	(0.053) **	(0.059)	(0.125)	(0.105) **	(0.132)	(0.048)	(0.045)	(0.053)
F-statistic first stage	19.066	20.913	35.051	38.389	16.949	25.441	10.459	15.054	13.523	3.031	8.134	4.204
Stock and Yogo (2005) tests	passed[a]	passed[a]	passed	passed	passed[a]	passed[a]	not passed	not passed	not passed	not passed	not passed	not passed
Hansen statistic	6.465	13.828	14.440	8.701	11.052	9.209	2.196	3.100	5.133	12.003	6.693	5.179
p-value	0.373	0.032	0.025	0.191	0.089	0.162	0.901	0.796	0.527	0.062	0.350	0.521
Observations	41,467	41,432	41,498	23,809	23,752	23,826	21,366	21,283	21,372	8,891	8,841	8,905
Firms	5,542	5,539	5,541	3,238	3,236	3,237	2,939	2,937	2,939	1,273	1,273	1,274

Notes: All regressions include firm-level fixed effects. Standard error in brackets. ** significant at the 1 percent level, * significant at the 5 percent level. Estimated using the GMM option of the xtivreg2 stata procedure, provided by Schaffer (2007). F-statistic first stage refers to the Stock and Yogo (2005) weak identification test statistics.
[a] passed only at the 10 % maximal IV size. Clustered at the firm level.

their tax payments.

The second line presents the results for benchmarking within 2-digit-NACE industries and regardless of the location of the headquarter. While the coefficient is still significantly positive for the OECD countries and the firms in the Asian subsample, we have some difficulty finding valid instruments. Intuitively, weighted industry-averages of ETRs are more difficult to instrument through industry weighted averages of the explanatory variables, if there is significant variation in these variables across countries.[22] Strikingly, the coefficient is completely insignificant for the European Union headquartered firms, which implies that there is no interaction in the effective tax rates across industries in the European Union. Given the large overlap with the OECD subsample, where we can observe some evidence for tax benchmarking, this appears counterintuitive at first. There is, however, a potential simple explanation for the insignificance of the coefficient in the European Union subsample. If the benchmarking within the industry does involve the industry leader - which incidentally is very often located in the United States or Japan - the set of potential competitors might be too small, if only the European Union countries are included.

The third line displays the reaction functions between firms within the same country *or* the same for the 2-digit-NACE industries. This is basically a combination of the two first weighting matrices with the added benefit that it overcomes border problems. If we estimate the reactions functions of firms within the same country we are in fact estimating a number of independent systems, because the reaction functions do not spill across country borders. In contrast, the spatial model with competitors in the same industry *or* country allows for influences across borders. Intuitively one would expect coefficients to lie somewhere between the coefficients for benchmarking only within the country or only within the industries. While this is the case for the European Union subsample the coefficient is actually larger and more significant for the OECD subsample. This result highlights once more the fact that industry benchmarking appear to be driven by important firms in the largest OECD countries. Similarly, there are significant coefficients for the country-industry weighted competitors ETRs for the Asian subsample, again, with the caveat of weak instruments. In this case, the results based on a combined weighting matrix display a slightly lower and less significant coefficient, which could

[22]This problem can be even more aggravated if the country coverage is not stable over time (e.g. if new countries like the Eastern European countries enter the sample), which implies a change in the set of competitors.

indicate that a number of firms in this subsample compare themselves to competitors within the same country, while a different number of firms mainly compare themselves within their industry.

Profitability, measured through the return on assets ($ROA_{i,t}$) exhibits the expected (significantly) negative sign for all subsamples. Given that the $ROA_{i,t}$ is also instrumented, namely through market share of the firms and the industry concentration, the same caveats concerning the quality of instruments apply. However, there is a further important issue potentially driving the results. It is now a widely held belief that firms aim to control and smooth the income stream. Given the nature of our measure of the ETR, i.e. tax charges in the accounts defined as the the share of pre tax profit, any form of earnings management is expected to influence the ETR and in consequence the spatial interdependence. In fact there appears to be a spatial interdependence in the earnings management decision as well. The extent to which this influences our results depends amongst other factors on the ability of the firms to separately manage book and tax income.[23]

The firm size variable turns out significant for most specifications. Interestingly enough, larger firms appear to have a lower ETR in the developed countries while they seem to have a higher ETR in Asian, other emerging or tax haven countries. Linking this back to the literature suggests that the political costs hypothesis is more applicable for emerging markets. In developed countries large companies appear to be able to use their size for better tax planning. The leverage of firms exhibits a significantly positive coefficient for all specifications, which is counterintuitive at first sight. A possible explanation is the inclusion of firm specific fixed effects. This implies that the coefficients describe the effect of changes rather than in levels. Therefore one could interpret the positive coefficients in the way that firms with increasing ETRs and low initial debt levels, increase their debt share to benefit from more deductible interests in the future. Similarly, in the developed countries the the share of intangibles ($INTANG_{i,t}$) bears a significantly positive sign, which could mirror changes in firm behaviour, e.g. increasingly using intangible assets to facilitate profit shifting in the future in combination with a currently increasing tax burden.

In most specifications the coefficient for the statutory corporate tax rate

[23]We are grateful to Dhammika Dharmapala for pointing us in this direction. While this is an important topic which should be pursued in further research, it is clearly beyond the scope of the current paper.

($\tau_{k,t}$) in the headquarter country is positive and significant. At first sight this is in contradiction with proposition 2 which stipulates an increase in tax sheltering in reaction of a higher statutory tax rate. However, the inclusion of firm specific fixed effects implies that the coefficient of $\tau_{k,t}$ describes the effect of a change in the statutory tax rate on the effective tax rate. Abstracting from changes in the corporate tax base, this would hint at a coefficient of one.[24] Coefficients significantly lower than unity have two likely explanations. First, the tax rate cut (increase) has been accompanied by a tax base broadening (narrowing). Secondly, this could also be indirect evidence of tax sheltering activities insofar as companies decide to include a greater (smaller) proportion of their profits in the taxable profits as a reaction to reduced (increased) statutory tax rates. Therefore, the positive coefficient, significantly lower than unity, is consistent with the predictions in proposition 2.

4.4 Sensitivity Analysis - Further Results

Allowing for asymmetric reactions to competitors: We stress the multifaceted nature of the concept of a reputational loss. It is therefore likely that managers do not follow competitors' ETRs upwards and downwards in the same measure. In fact, the specification of the theoretical model even suggests a stronger downward adjustment for firms with ETRs above their peer group, as the tax saving effect and the reduction of the reputational loss work in the same direction then. Therefore, we want to investigate the possibility of asymmetric responses to the benchmark ETR. Given that the relative tax position of a firm, i.e. whether its ETR is higher or lower than the average of the relevant peer group, is the result of the spatial interdependence so far, this distinction is endogenous and can not be used to estimate asymmetric reaction functions. To avoid this problem, we use the statutory corporate tax rate as the threshold value. Intuitively, this seems to be a critical value, as it appears to be difficult for anyone to argue that a firm is not paying its fair share of taxes if it has an ETR equal or higher than the statutory tax rate. Following the line of argument above we would expect a larger coefficient for the competitors ETR if the firm itself has an ETR higher than the statutory tax rate.

Table 4 presents some of the results, if we allow for asymmetric responses.[25]

[24] This logic is only applicable to firms operating only in their headquarter country. However, in reality one would still expect a coefficient somewhat different from one, because the corporate tax base is likely to change as a result of the ordinary commercial activities of the firm.

[25] In contrast to the baseline regressions we do not report the regression results for the tax

Table 4: Results (up to 500 firms per country) with asymmetric responses

	OECD countries				EU countries				non-OECD Asian countries			
	$ETR_{i,t} < \tau_{k,t}$		$ETRi, t > \tau_{k,t}$		$ETRi, t < \tau_{k,t}$		$ETRi, t > \tau_{k,t}$		$ETRi, t < \tau_{k,t}$		$ETRi, t > \tau_{k,t}$	
Competitors ETR	0.100		0.314		0.145		0.368		0.410		0.012	
same country	(0.080)		(0.131) *		(0.109)		(0.167) *		(0.114) **		(0.368)	
Competitors ETR		0.140		0.310		0.065		0.311		0.412		0.099
same industry *or* industry		(0.087)		(0.158) *		(0.169)		(0.181)		(0.149) **		(0.459)
$ROA_{i,t}$	0.549	0.351	-0.684	-0.818	0.736	0.648	-0.381	-0.611	-0.020	0.174	-1.116	-1.081
	(0.244) *	(0.148) *	(0.143) **	(0.134) **	(0.195) **	(0.142) **	(0.132) **	(0.140) **	(0.134)	(0.109)	(0.342)**	(0.274)**
$SIZE_{i,t}$	-0.001	-0.001	-0.016	-0.020	-0.002	-0.003	-0.016	-0.022	0.011	0.011	-0.016	-0.016
	(0.002)	(0.003)	(0.004) **	(0.004) **	(0.005)	(0.004)	(0.006) **	(0.005) **	(0.003) **	(0.003) **	(0.006)**	(0.006)*
$CAPINT_{i,t}$	0.002	0.001	0.034	0.028	0.009	0.005	0.056	0.046	-0.027	-0.026	-0.044	-0.043
	(0.012)	(0.012)	(0.024)	(0.024)	(0.016)	(0.016)	(0.033)	(0.032)	(0.015)	(0.015)	(0.038)	(0.038)
$INTANG_{i,t}$	0.004	-0.007	0.070	0.064	0.047	0.035	0.103	0.092	-0.020	-0.011	-0.012	-0.008
	(0.025)	(0.020)	(0.024) **	(0.022) **	(0.032)	(0.029)	(0.030) **	(0.029) **	(0.027)	(0.026)	(0.080)	(0.079)
$DEBT_{i,t}$	0.033	0.021	0.109	0.107	0.026	0.027	0.133	0.133	0.001	0.013	0.019	0.021
	(0.018)	(0.014)	(0.020) **	(0.020) **	(0.018)	(0.018)	(0.024) **	(0.024) **	(0.012)	(0.011)	(0.034)	(0.032)
$\tau_{k,t}$	0.489	0.458	0.715	0.701	0.380	0.394	0.662	0.652	0.221	0.214	1.223	1.162
	(0.076) **	(0.067) **	(0.089) **	(0.094) **	(0.054) **	(0.056) **	(0.094) **	(0.100) **	(0.090) **	(0.098) **	(0.319)**	(0.360)**
F-statistic first stage	5.201	11.560	26.191	18.282	11.386	9.522	26.386	22.380	8.312	10.405	4.524	2.995
Stock and Yogo (2005) tests	not passed	not passed	passed	passed[a]	not passed	not passed	passed	passed[a]	not passed	not passed	not passed	not passed
Hansen statistic	2.660	4.886	5.493	11.359	4.813	9.498	3.401	5.812	13.281	13.425	3.411	2.609
p-value	0.850	0.559	0.482	0.078	0.568	0.147	0.757	0.445	0.039	0.037	0.756	0.856
Observations	24,158	24,168	16,122	16,147	13,120	13,126	10,001	10,014	15,553	15,558	5,146	5,147
Firms	4,539	4,539	3,611	3,615	2,553	2,553	2,275	2,277	2,699	2,699	1,347	1,347

Notes: All regressions include firm-level fixed effects. Standard error in brackets. ** significant at the 1 percent level, * significant at the 5 percent level. Estimated using the GMM option of the xtivreg2 stata procedure, provided by Schaffer (2007). F-statistic first stage refers to the Stock and Yogo (2005) weak identification test statistics.
[a] passed only at the 10 % maximal IV size. Clustered at the firm level.

The table is organized as follows. In each subsample the first two columns represent the regression with firms that exhibit an ETR lower than the statutory corporate tax rate. The third and fourth column then present the same results for the firms with a higher ETR.

Starting with the first two and the fifth and sixth columns one can clearly see, that the positive reaction to the competitors ETR is not evident if the firm itself has an ETR lower than the corporate tax rate. Only for the Asian subsample the firms with an ETR below the statutory tax rate still positively react to their competitors effective tax rate. This is probably largely due to the fact that around three quarter of the firms have an ETR lower than the statutory corporate tax rate, but at the same time even this fact does tell something about the nature of the benchmarking in these countries. In contrast to the developed countries, there appear to be more downward pressure for firms in the emerging Asian markets.

The sign for the profitability variable turns significantly positive for the firms with a low ETR while the coefficient remains negative and increases in size for those firms with a high ETR. This suggests that in the group of firms with a low ETR the first stage regression is potentially dominated by large negative outliers, i.e. loss making companies. Given the difficulties that arise from potential loss carry forwards we will discuss the issue of losses in a subsequent robustness check.

The other two variables which show significantly different signs depending on which subset of firms we are looking at are $SIZE$ and the statutory corporate tax rate τ. While the size of the firm turns out to be significantly negative for the firms with a higher ETR it is insignificant for the other firms. Relating this to the two competing theories about the impact of firm size on the tax burden, one can conjecture, that the political cost hypothesis holds true in the sense, that it prevents the largest companies from lowering their tax burden too far. At the same time the largest companies can exploit some of their resources in order to avoid very large ETRs, reflected in the significantly negative sign of the coefficient for $SIZE$ for the subset of firms with higher ETRs. The corporate statutory tax rate displays a larger coefficient for firms with a higher ETR. Following the line of argument introduced above, this reflects the more aggressive tax planning by firms with a lower effective tax rate.

haven subsample or for the industry-only weighted competitors tax rates. We are happy to provide the interested reader with a full set of results, but exclude them here simply for reasons of space.

Stronger interaction between largest companies: We think that the concept of a reputational loss, as we want to define it in this paper, is more applicable to large corporations. There are a number of reasons for this. For instance, corporations small enough not to be included in the leading stock indices of their country are more likely to fall under the radar of critical assessment. This holds in particular true for campaigns by NGOs fighting against tax evasion/avoidance, but also for the scrutiny of tax authorities where the natural starting place for auditing is also the pre-defined list of the biggest corporations (e.g. FTSE 100 in the United Kingdom, or the DAX in Germany). To test, whether the interaction in the tax behaviour between these particularly publicly exposed firms is stronger, we rerun the regressions with a reduced sample, including only the top 200 companies per country.[26]

The left half of table 5 displays the results for the developed countries, i.e. the OECD and the EU subsample if we restrict the sample to up to 200 companies per country.[27] Similar to the previous robustness check we report the estimates for benchmarking within the country and within country *or* industry. Comparing the results with the baseline results in Table 3 one can see that the coefficients for the competitors ETR are somewhat larger and highly significant. The test statistics for the instruments are also improved, indicating that the model is correctly specified. Consistent with all the previous results the influence of the ETR within the same industry seems to be stronger only in the OECD subsample. Therefore one can conclude again that the benchmarking within the same industry needs to include the main firms in large non-EU OECD countries.

The potential role of loss making companies: Firms with a negative taxable profit usually do not receive an immediate tax rebate but can carry these tax losses forward to reduce future tax burdens. Therefore they face a potentially different optimisation problem, as they are, at least from a legal perspective, entitled to a lower effective tax rate. Unfortunately we do not have the necessary information about the stock of loss carry forwards, to properly account for this factor. But the right half of Table 5 shows the results where we exclude all the companies with a non positive ETR from both the set of

[26] It is possible that benchmarking between these companies might be difficult as they are difficult to compare to each other. In consequence the benchmarking and therefore the strategic interaction could also be very important for the not so large companies, albeit for somewhat different reasons. We tested this idea using only the firms 201 to 500 per country. However, we find no evidence for strategic interaction analysing these firms.

[27] Again the results for the other subsamples are suppressed because of space considerations and available from the authors upon request.

Table 5: Results for the 200 biggest corporations per country/tax paying corporations only (symmetric responses)

	up to 200 firms per country				**only firms with positive** ETR			
	OECD countries		European Union		OECD countries		European Union	
Competitors ETR	0.337		0.543		0.312		0.383	
same country	(0.132) **		(0.149) **		(0.083) **		(0.090) **	
Competitors ETR		0.463		0.510		0.321		0.305
same industry *or* country		(0.123) **		(0.148)		(0.092) **		(0.112) **
$ROA_{i,t}$	-0.371	-0.486	0.103	-0.001	-0.311	-0.348	-0.191	-0.384
	(0.152) **	(0.137) **	(0.141)	(0.144) *	(0.139) **	(0.109) **	(0.157)	(0.148) **
$SIZE_{i,t}$	-0.014	-0.013	-0.006	-0.008	-0.015	-0.016	-0.013 **	-0.016
	(0.004) **	(0.004) **	(0.004)	(0.005) **	(0.003) **	(0.003) **	(0.004)	(0.004) **
$CAPINT_{i,t}$	0.010	0.007	0.027	0.028	0.013	0.014	0.032	0.030
	(0.017)	(0.017)	(0.019)	(0.019)	(0.012)	(0.012)	(0.015) *	(0.015) *
$INTANG_{i,t}$	0.014	0.003	0.074	0.071	0.049	0.046	0.073	0.062
	(0.024)	(0.023)	(0.027) **	(0.026) **	(0.018) **	(0.016) **	(0.022) **	(0.022) **
$DEBT_{i,t}$	0.120	0.113	0.088	0.088	0.141	0.139	0.134	0.130
	(0.019) **	(0.019) **	(0.021) **	(0.021) **	(0.013) **	(0.013) **	(0.015) **	(0.016) **
$\tau_{k,t}$	0.174	0.135	0.080	0.090	0.185	0.192	0.133	0.159
	(0.086) *	(0.078)	(0.064)	(0.062) **	(0.053) **	(0.052) **	(0.055) **	(0.058) **
F-statistic first stage	39.224	44.499	24.653	20.249	25.039	43.898	18.506	23.752
Stock and Yogo (2005) tests	passed	passed	passed[a]	passed[a]	passed[a]	passed	passed[a]	passed[a]
Hansen statistic	5.515	11.484	7.143	21.254	8.938	21.343	9.694	9.603
p-value	0.480	0.074	0.308	0.088	0.177	0.002	0.138	0.142
Observations	23,622	23,664	14,785	14,814	37,862	37,900	22,003	22,027
Firms	3,093	3,093	1,987	1,987	5,275	5,275	3,161	3,161

Notes: All regressions include firm-level fixed effects. Standard error in brackets. ** significant at the 1 percent level, * significant at the 5 percent level. Estimated using the GMM option of the xtivreg2 stata procedure, provided by Schaffer (2007). F-statistic first stage refers to the Stock and Yogo (2005) weak identification test statistics. [a] passed only at the 10 % maximal IV size. Clustered at the firm level.

observations and also on the potential set of competitors. This implies that all observations with either a negative pre tax profit or a non positive tax payment are dropped.[28] As expected the results remain relatively unaffected by the exclusion of these companies. Comparing the results to the baseline results in Table 3 shows that the coefficients are similar in size and slightly more significant. This is very much in line with our expectations, since this robustness check is in fact excluding those companies for which our theory least applies.

5 Conclusion

In this paper we argue that firms' tax planning decisions are made in a competitive environment. Stakeholders with various and partly competing objectives observe tax payments and evaluate these against the relevant peer group. As an example, tax authorities are interested in an adequate tax payment, while shareholders probably would prefer to have lower tax payments in order to increase the potential dividend payments. Deviation from the behaviour of comparable firms therefore triggers some sort of reputational loss. Firms anticipate this benchmarking and incorporate the consequences into their tax planning strategy which creates interdependencies in the ETRs of firms.

We aim to capture this influence in a theoretical model which introduces a reputational loss. We see the concept of the reputational loss as a multi-facetted phenomenon, as various stakeholders pursue conflicting interests. In consequence, managers have to balance the benefits of a reduced tax burden against the costs of a loss in reputation if they deviate too much from the behaviour of their peer group. Anticipating this managers incorporate their peer groups tax planning into their own decision process. This in turn creates a positive interdependence, which we can test empirically.

Using a spatial econometric approach we find evidence for interdependence in the ETR. In general, the positive spatial interdependence between the ETRs of firms is significant between firms in the same country. This evidence holds by and large for companies in the OECD, in the European Union and in Asian countries. There is also evidence for strategic interaction within the same industry, however, this is only apparent if firms in large non-EU OECD

[28] An alternative approach would be to (partly) collapse the panel into a cross section, which would mitigate the time dimension issue of the loss carry forward. In fact we have collapsed the firm data into four points of time and rerun the regression on this sample. The results change only quantitatively and similar conclusion can be drawn.

countries are included. This could be interpreted as evidence of the importance of industry leaders in tax benchmarking. Firms with a high ETR respond stronger to their peer groups ETR, which is in line with our theoretical predictions since in this case the reduction of the reputational loss coincides with a reduction of the tax burden.

Further, it appears to be the case that the benchmarking is most important for the largest firms since they are at the centre of both the public debate and the scrutiny of the tax authorities. Further it seems reasonable to assume that the largest companies would engage in sophisticated tax planning as they have the biggest tax departments. In conclusion, this paper argues that especially the largest firms, who were so far expected to be most able to optimize their tax affairs, are constrained in their tax planning through potential reputational losses.

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