Spatial tax competition in the EU15

K. Crabbé and H. Vandenbussche
Catholic University Leuven
preliminary version, please do not quote

January 24, 2008

Abstract

Tax competition in the European Union is fierce. Especially since the entry of the new member States, tax reforms in the "old" Europe are frequent. In this paper we formally test the presence of strategic tax setting in the old EU14 as a reaction to the tax rates in the new member states using a fiscal reaction function. We first develop a simple model of spatial tax competition that predicts an inverse relationship between distance and toughness of tax competition. Empirically we find indeed that tax competition is stronger for countries relatively closer to the low tax region of the new members like Germany and Austria than for old member States further away from the new member States such as Spain, UK and Portugal.

Keywords: Spatial tax competition, Corporate taxes
JEL classification: H25, H77, H39
Address for correspondence: Karen Crabbé, KULeuven, Naamsestraat 69, 3000 Leuven, Belgium, Ph: + 32 (0) 16 32 69 35, email: karen.crabbe@econ.kuleuven.be

1 Introduction

Decreasing tax rates is especially an European issue. Corporate taxes dropped the past 10 years by 12% in the EU versus 6% in non-EU OECD countries. Another European trend is the compensation of declining tax rates with increasing taxable income. As a result several studies conclude that tax competition in official tax rates is present, but not in terms of effective tax rates (Devereux et al. (2002) and Vandenbussche & Crabbé (2006)). This paper analyzes strategic tax setting in the 'old' EU14 as a reaction to the tax rates in the new member states. Prior research has shown that FDI is sensitive to tax rates (Mooij & Ederveen 2003). Also for Eastern European countries the corporate tax rate is an effective instrument to attract FDI (Disdier & Mayer (2004) and Bellak & Leibrecht (2005)). According to Devereux & Griffith (1998) the effective average tax rate plays a role for US multinationals in entering the European market, but they did not compare with official tax rates. In contrast, Buettner & Ruf (2005) show that German multinationals take into account the official tax rate, rather than the effective tax rate in their location decisions. Therefore, this paper will focus on statutory tax rates, rather than effective tax rates in the EU25.

Especially since the entry of the new member States, European tax competition is fierce. Some earlier studies find that European countries set their corporate tax rates interdependent (Devereux et al. (2003), Altshuler & Goodspeed (2002), Redoano (2003) and Ruiz & Gerard (2007)), but none of these studies has investigated spatial tax competition between the 'old' EU14 and the new member states. This is where the aim of this paper lies: we study to what extent geographical proximity to low tax areas like the new member states, affects corporate tax rates in the former EU14 countries[1]. We expect that tax competition will not be equally fierce between all countries. Some countries will find decreasing corporate tax rates a priority,

[1]The EU14 includes Germany, Austria, Italy, Spain, Portugal, Belgium, Luxembourg, the Netherlands, Finland, Sweden, Denmark, UK, France and Greece.

while others focus on other economic issues. The question then raises whether the geographical position of European countries vis- à-vis the new member states (low tax countries) influences the intensity of tax competition. Does the former EU14 anxiously look at tax reforms in the new, low tax, member states and adjust their taxes accordingly?

For this purpose, we first develop a spatial tax competition model with countries competing to attract a multinational. The model predicts that tax competition is more intense between geographically close countries. Second, the outcome of the theoretical model is tested using a fiscal reaction function.We test whether and which EU14 countries respond to changes in the tax rates of the new EU member states. The results indicate that distance to these new members matters for tax competition i.e. EU14 countries closer to the EU10 like Germany and Austria are more responsive than countries further away from the EU10 such as France, Belgium and the Netherlands.

The paper is organized as follows. First, section 2 shows some stylized facts of corporate taxes in Europe. Section 3 reviews the related literature on tax mimicking and section 4 develops a theoretical framework. Section 5 explains the empirical methodology and the data. Section 6 shows the results and 7 discusses the robustness checks. Finally, section 8 briefly concludes our main results.

2 Corporate taxes in Europe: stylized facts

Falling corporate tax rates is especially an European issue. Figure 1 illustrates the evolution of corporate tax rates in OECD[2] and EU countries. We observe that the tax rate in the OECD (-3%) remained more stable in comparison to the sharp decrease in tax rates of the EU25 (-10%). Within Europe, both the older EU15 countries and the 10 new member states have known a decrease of 10% in their

[2]OECD6= Australia, Canada, Japan, Mexico, New Zealand and USA

corporate tax rates. The figure also shows that during the whole period, corporate tax rates in the EU15 are higher than in the new member states.

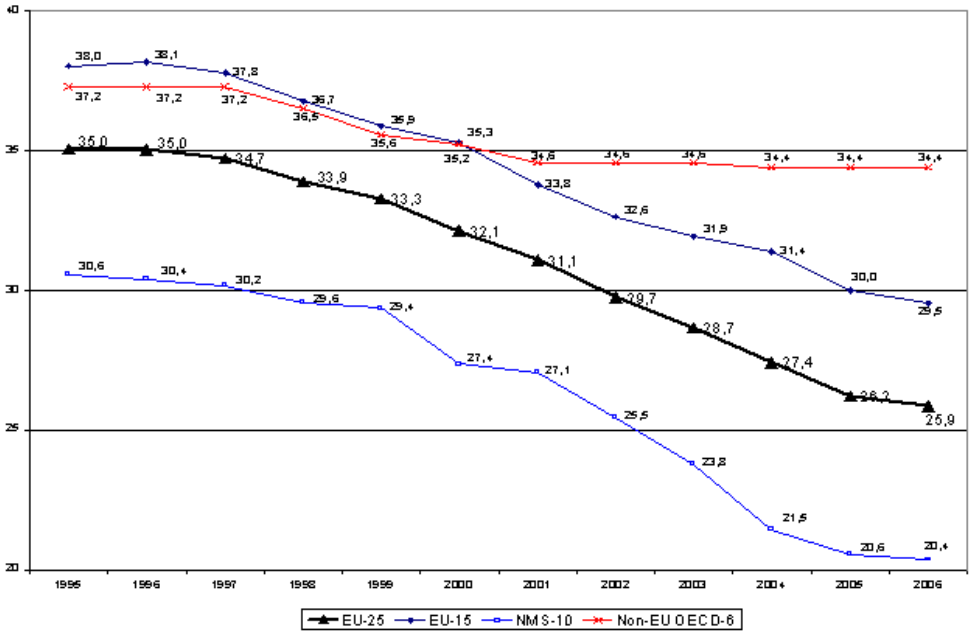

Figure 1: Evolution tax rates in OECD and EU, 1995-2006

Source: European Commission

Although traditional tax competition theories predict a downward pressure on corporate taxes when capital mobility increases (for an overview see Wilson (1999) and Bretschger & Hettich (2002)), empirical studies do not find evidence of a race to the bottom in corporate taxes (Krogstrup (2004), Baldwin & Krugman (2004), Salvatore (2002), Bénassy-Quéré et al. (2007), Desai (1999), Mendoza & Tesar (2004) and Stewart & Webb (2006)). While statutory taxes fell down in the EU, tax bases were broadened such that tax revenues on corporate incomes remained stable (Devereux et al. (2002), Buijinck et al. (2002) and Vandenbussche & Crabbé (2006)). Figure 2 reports the evolution of the average effective tax rate of the EU15 countries and the 10 new member states (EU10). In contrast to the nominal tax rate, the aggregate effective tax rate remained quite stable and even increased in the period 1993-2003. Moreover, a study by Buettner & Ruf (2005) shows that German multinationals

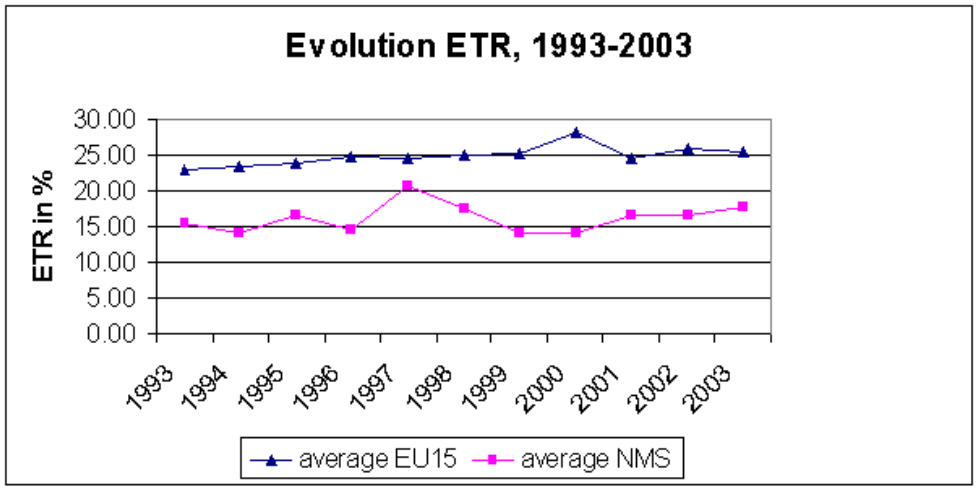

Figure 2: Evolution effective tax rates in Europe

take into account the statutory tax rate, rather than the effective tax rate in their location decisions. Therefore, we will measure taxes by the nominal tax rate instead of the effective tax rate.

In contrast to prior studies, Figure 3 splits up the EU15 countries into neighbors of the new member states and non-neighbors of the new member states. Neighbors are defined as countries with a common land or water border with one or more new EU-members, for example Austria and Italy are neighbors of Slovenia. The average nominal tax rate of the new member states and Ireland are presented separately. Figure 3 not only illustrates that the older EU15 countries have a higher tax rate than the new member states, but also that neighbors compared to non-neighbors of the new member states have known a much larger absolute decrease in their average corporate tax rate (12% versus 6%). While the average tax rate in the non-neighbors remained stable for a long period, the average tax rate in the neighbors decreased rapidly and dived under the average tax rate of the non-neighbors in 2000. These reforms could indicate that neighbors of the new member states are subject of more intense tax competition as a result of their geographical proximity to the Eastern low tax areas.

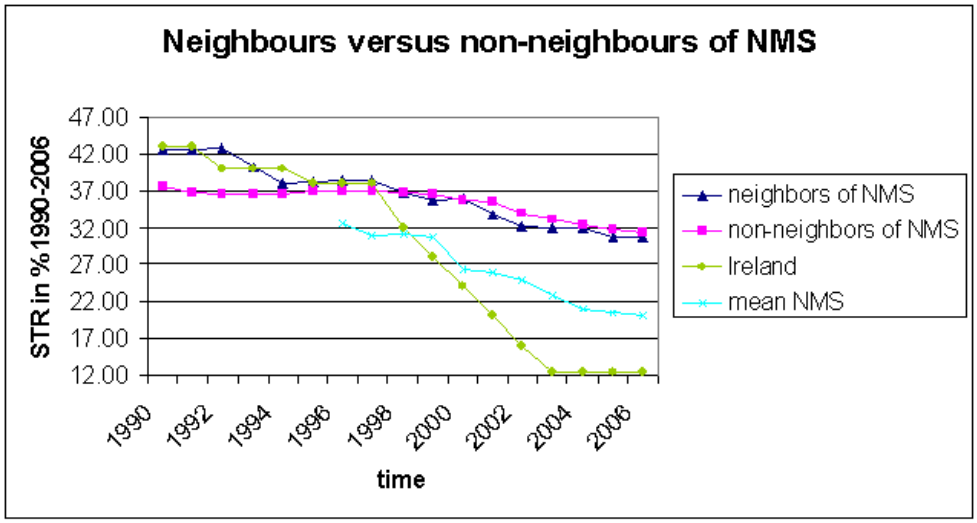

Figure 3: Neighbors versus non-neighbors of the new member states, 1993-2006

Neighbors: Germany, Austria, Denmark, Finland, Sweden, Italy and Greece; Non-neighbors: Spain, France, UK, Netherlands, Belgium, Luxembourg and Portugal

The STR is not weighted. Source: Vandenbussche & Crabbé (2006), extra data included for 2005 and 2006.

To gain more insight in the declining corporate tax rates of the neighbors and non-neighbors of the new member states, Figure 4 illustrates the corporate tax rates for the individual countries. This figure indicates that neighbors of the NMS not only have the largest decrease in corporate tax rates, but also started decreasing much faster. Almost all neighboring countries started their decrease in corporate taxes around 1992-1993, while the decrease in taxes of the non-neighbors started only around 1996-1997. Moreover, we observe that this decrease in corporate tax rates is independent of the size of the country. For example the tax rate of Germany decreased by 18.2% during the period, while the tax rate of a large non-neighbor country like France only decreased by 3.7%.

3 Related Literature on Fiscal Reaction Functions

Mukand & Rodrik (2005) point out that countries mimic policies of their neighbors even when this is not the best solution for their economic situation. This mimicking behavior can also be found in (corporate) tax competition. Theoretical and empirical work point out that countries or regions do not set their tax rate independently, but take into account the tax rates in related countries or regions. Countries or regions do this according to two reasons: yardstick competition and capital tax competition. The first theory poses that voters judge policy-makers on their performance by comparing tax rates of neighboring countries. Therefore, politicians, to ascertain their re-election, will 'tax mimic' their neighbors' tax rate. The second theory argues that countries compete to attract capital by setting lower tax rates. It is not always clear whether the presence of 'tax mimicking' comes from yardstick or tax competition, since the empirical method for both theories is the same (Brueckner 2003). With regard to corporate taxes, Devereux et al. (2003) argue that yardstick competition can be eliminated as a possible explanation. The reason is that corporate taxes are not a critical topic for voters to evaluate policy-makers, certainly because most voters do not even know the domestic corporate tax rate.

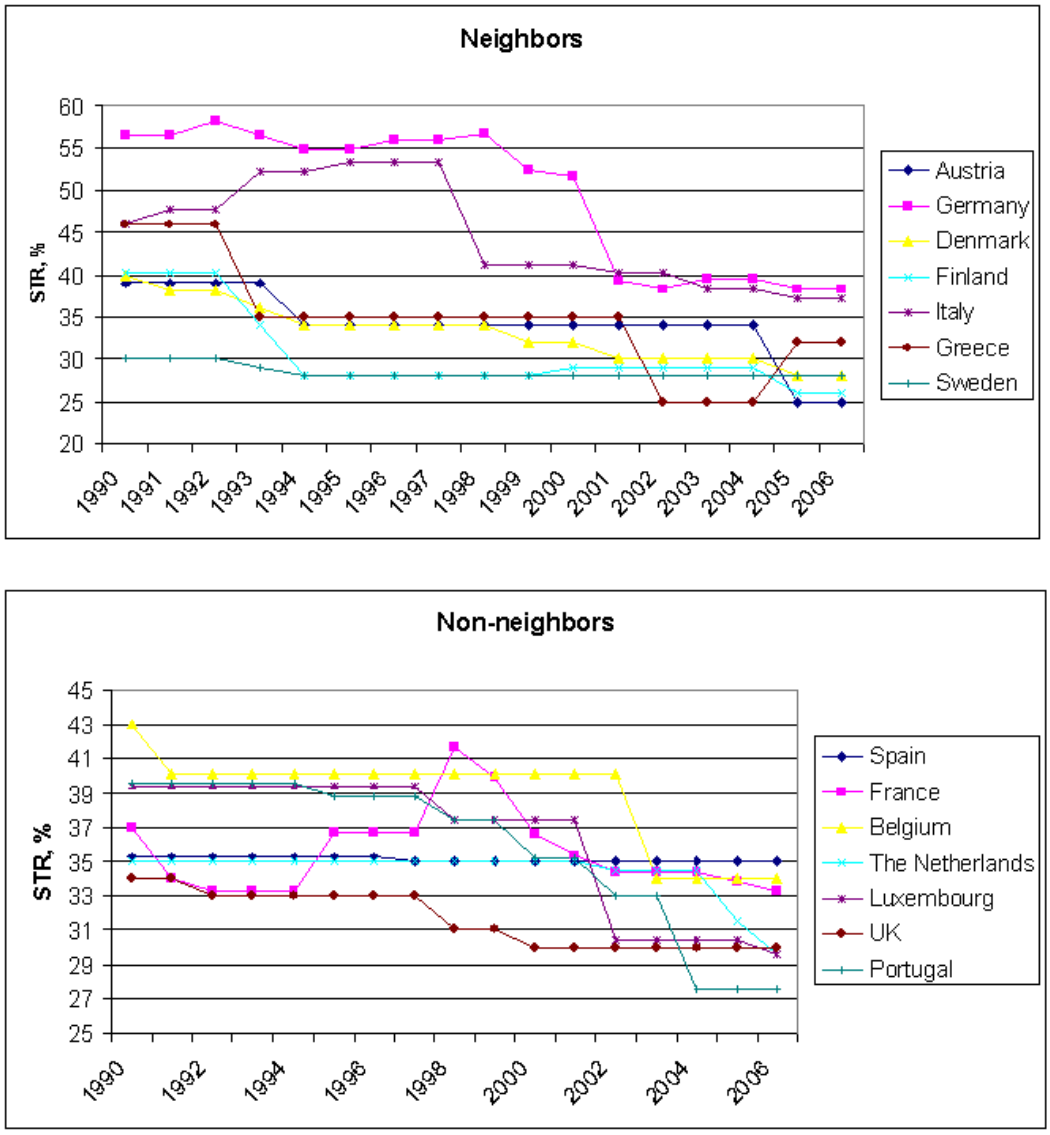

Figure 4: Evolution statutory tax rates in Europe

On the other hand, Bordignon (2007) comes to the conclusion that yardstick and fiscal competition usually work one against the other. In this paper, we can not distinguish between both forms of competition. Our goal is to study intergovernmental competition in corporate taxes in order to attract foreign investment.

Empirical studies estimate a fiscal reaction function of a certain jurisdiction which relates the tax rate of this jurisdiction to its own characteristics and to the tax rate in competing jurisdictions. When tax rates are chosen strategically, the reaction function has a nonzero slope indicating that competitors' tax rates influence the given jurisdiction's choice. The sign of the slope can be positive or negative depending on the specific parameter values. If strategic interaction is absent, the slope of the reaction function is not significantly different from zero (Brueckner & Saavedra 2001). This methodology has been used in many articles on local property, business or personal taxes (Besley & Case (1995), Bordignon et al. (2002), Heyndels & Vuchelen (1998), Brueckner (1998), Brett & Pinkse (2000), Brueckner & Saavedra (2001), Carlsen et al. (2005), Buettner (2001), Ladd (1992), Allers & Elhorst (2005), Hayashi & Boadway (2001), Allers & Elhorst (2005), etc) and government expenditure levels (Ollé (2003), Figlio et al. (1999), Revelli (2003), Case et al. (1993), Geys (2006), Baicker (2005), Werck et al. (2007), etc) across jurisdictions within one country[3].

Devereux et al. (2003) analyze strategic tax competition in 21 OECD countries in the period 1982-1999. They find that countries strategically compete over the statutory tax rate and EATR[4] and that countries with relatively high effective tax rates react more strongly to tax rates in other countries. A second study examining strategic tax competition between countries and the first using only EU countries is Altshuler & Goodspeed (2002). They find that EU countries strategically compete with geographically close countries using corporate tax revenues over GDP, but not

[3]See Brueckner (2003) for an overview of empirical studies on strategic interaction

[4]EATR= effective average tax rate calculated using the forward looking method, see Devereux et al. (2002).

using personal income tax revenues. They also conclude that since the US tax reform of 1986, European countries compete to a lesser extent with the US in corporate tax rates. A second study using exclusively European countries is Redoano (2003). She shows that tax competition mainly occurs between geographically close countries using statutory tax rates for 13 European countries during the period 1980-1995. Finally, Ruiz & Gerard (2007) find empirical evidence of limited 'tax mimicking' between neighboring EU15 countries using statutory and effective tax rates during the period 1989-2001. They argue that possible converging tax rates in the EU15 can explain their weaker result of spatial tax competition.

This paper will extend the limited number of studies using fiscal reaction functions on exclusively European Union countries. In particular, the impact of changes in the tax rates of the new member states (EU10) on the tax rates of the EU14 will be the focus. Furthermore, different definitions of neighbors will be used to gain insights in the spatial tax competition process in the EU25 during the period 1993-2006.

4 Theory

A first step in illustrating which role distance to a peripheral region or country has in tax competition is to set up a theoretical framework. In our model two countries A and B are located on a fixed distance x from each other as illustrated in Figure 5.

Country A and B compete for the location of a single firm, a multinational that does not compete with the domestic firms[5] and has its home base outside the countries considered in the model. This multinational will set up in only one of the countries and sell to the other country by exporting. The locations are symmetric in the sense that set up costs and marginal production costs are assumed to be the same,

[5]The assumption that the MNE is a monopoly with a competitive fringe and so does not compete with domestic firms is needed to keep the model tractable analytically, without changing the qualitative implications of the model.

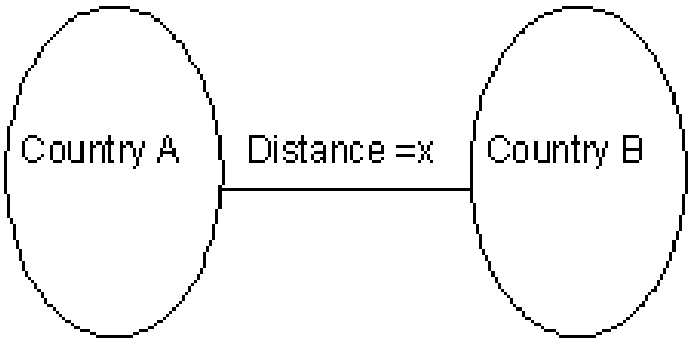

Figure 5: Spatial tax competition: a theoretical framework

therefore in comparing location A and B they will not affect the location decision of the multinational and can be dropped from the analysis. To export to the other country, the multinational will have to pay a transportation cost c which is related to the distance x between the countries.

A final assumption is that country A is a more developed country in terms of infrastructure, technology, etc. While country B is less attractive for production, we call it a peripheral country. This assumption is translated in a larger market size for country A than for country B ($M >> m$). The order of events in the model is as follows.

- Stage 1: Government A and B will set their profit tax rate simultaneously[6].
- Stage 2: the multinational makes its location decision.
- Stage 3: the multinational sells and exports an equilibrium output that maximizes its profits.

[6]We acknowledge that there might be a time inconsistency problem, but we assume here that both countries commit to the tax rate they have set in stage 1 (Haufler & Wooton 2003).

We solve the model backwards, introducing additional formal notation as required[7]. In stage 3, the multinational (MNE) sells and exports a certain output to maximize its profits. Using the inverse demand functions of both countries A and B

$$\begin{aligned} P_A &= (M - Q_A) \\ P_B &= (m - Q_B), \end{aligned} \tag{1}$$

where P_A and P_B are the prices and Q_A and Q_B the domestic outputs, the after-tax profit of the multinational is:

$$\begin{aligned} \pi_A &= ((M - Q_A)Q_A + (m - Q_{AB})Q_{AB} - cxQ_{AB})(1 - t_A) \\ \pi_B &= [(m - Q_B)Q_B + (M - Q_{BA})Q_{BA} - cxQ_{BA}](1 - t_B) \end{aligned} \tag{2}$$

where Q_{AB} and Q_{BA} are the exported outputs, t_A (t_B) is the corporate tax rate of country A (B) and $0< t_A(t_B) <1$.

Maximizing these after-tax profits leads us to the equilibrium outputs in A and B respectively:

$$\begin{aligned} A : Q_A^* &= \frac{M}{2} \; and \; Q_{AB}^* = \frac{m - cx}{2} \\ B : Q_B^* &= \frac{m}{2} \; and \; Q_{BA}^* = \frac{M - cx}{2} \end{aligned} \tag{3}$$

In order for the outputs to be positive, the following conditions must be true: $M > cx$ and $m > cx$. Using these equilibrium outputs in equation (2) gives the equilibrium after-tax profits in A and B respectively:

$$\begin{aligned} \pi_A^* &= \frac{M^2 + (m - cx)^2}{4}(1 - t_A) \\ \pi_B^* &= \frac{m^2 + (M - cx)^2}{4}(1 - t_B) \end{aligned} \tag{4}$$

The second stage of the model deals with the MNE's location decision. The multinational will be indifferent in its location preference when its after-tax profit in

[7]The detailed computations are described in the Appendix.

country A equals the after-tax profit it could earn in country B. This is when the tax rate of country A equals

$$\begin{aligned} \pi_A^* &= \pi_B^* \\ \Rightarrow t_A^{Indiff} &= -(1-t_B)(\frac{m^2+(M-cx)^2}{M^2+(m-cx)^2})+1 \\ &= \frac{2cx(M-m)+t_B(m^2+(M-cx)^2)}{M^2+(m-cx)^2} \end{aligned} \tag{5}$$

For this tax rate, the multinational is indifferent between country A and B. The 'indifference' tax rate is among others a function of the tax rate of the other country, market size of both countries, transport cost and distance x.

As a consequence, country A has two options in the first stage where both countries set their tax rates simultaneously. Country A can set its tax rate below or above t_A^{Indiff} and both options will result in a different welfare function. We assume that the welfare function consists of consumer surplus (CS), and tax revenue from taxing the firm's profit. As in Haufler & Wooton (2003) the home base of our multinational is outside country A and B so that after-tax profits will be shifted abroad and do not enter the welfare function[8] The welfare function (W) in general can thus be written as follows

$$W_i = CS_i + t_i \frac{\pi_i^*}{1-t_i} \tag{6}$$

If country A chooses option 1 and sets a tax rate lower than t_A^{Indiff}, then the multinational will find country A more attractive and will locate in A. Country A will receive tax incomes from taxing the firm's profit. On the other hand, if country A chooses to set its tax rate above t_A^* (option 2), then the firm will find country B a better location. As a consequence, country A looses its tax income and consumer surplus in this option will be lower than in the first option due to transport costs (see Appendix for a proof).

[8]Including the firm's after-tax profits into the welfare function would not change our basic result, on the contrary it would strengthen the outcome. But it makes the algebra simpler.

This argument can be summarized as follows

$$\begin{aligned} t_A < t_A^* \quad &\Rightarrow \quad W_{A1} = CS_1 + t_A \frac{\pi_A *}{1 - t_A} \\ OR & \\ t_A > t_A^* \quad &\Rightarrow \quad W_{A2} = CS_2 \end{aligned} \tag{7}$$

Since welfare under option 1 is higher than under option 2, country A will set its tax rate below t_A^{Indiff}. The same result is achieved when we maximize the welfare in option 1. Maximizing this welfare shows that the optimal tax rate should be as large as possible.

$$\frac{\delta W_A}{\delta t_A} = \frac{M^2 + (M - cx)^2}{4} \tag{8}$$

This indicates that the optimal tax rate for country A should be as close as possible to t_A^{Indiff} or in other words, country A will set its tax rate a fraction ξ below the tax rate where the firm is indifferent between locations, t_A^{Indiff}:

$$t_A^* = \frac{2cx(M - m) + t_B(m^2 + (M - cx)^2)}{M^2 + (m - cx)^2} - \xi. \tag{9}$$

The same story holds for country B such that

$$t_B^* = \frac{2cx(m - M) + t_A(M^2 + (m - cx)^2)}{m^2 + (M - cx)^2} - \xi \tag{10}$$

From the above equation (9), we see that the tax rate of country A will always be positive if $M > m$, which is an assumption of the model. The tax rate for country B can be negative even under this assumption of $M > m$, which implies that country B would be willing to subsidize the multinational to make it locate in its country. Moreover, there is a positive relation between the market size and the tax rate, indicating that larger countries can set higher tax rates (see proof in appendix). Furthermore, equations (9) and (10) show that both tax rates are strategic complements ($\frac{\delta t_A^*}{\delta t_B^*} > 0$): a higher tax in country B will lead country A to set a higher tax rate as well. This indicates that if country B increases its tax rate, country A can also set a higher tax rate without inducing the firm to move to country B. But it also works the other way around, if country B decreases its tax rate, country A must set a lower tax rate in order not to lose the multinational.

This brings us to the main question in this paper, namely what happens if country A would be located closer or further away from the peripheral country B. In other words what would happen to the tax rate of A if distance x between the countries was smaller?

$$\frac{\partial t_A}{\partial x} = 2c(1 - t_B)(M^2 + m^2 - c^2x^2)(M - m) > 0 \tag{11}$$

Equation (11) implies that the tax rate of country A is a positive function in distance. This indicates that countries closer to the peripheral country B will set lower taxes, which is a very intuitive result. Take for example Germany, adjacent to a new member state Poland, and the UK, not neighboring a new member state. A multinational willing to invest in Germany will reconsider this strategy and rather set up in Poland due to among others lower labor costs and taxes. Since Germany is a neighbor, transport costs will be low. But if the multinational initially wants to invest in the UK, setting up a production center in Poland will be less obvious. The outcome of the theoretical model can be summarized in the following proposition.

PROPOSITION: EU14 countries closer to the new member states experience more tax competition.

5 Methodology and Data

To test this theoretical proposition empirically, a fiscal reaction function for the EU14 countries is estimated. As explained in section 3, a fiscal reaction function has a nonzero slope when countries strategically react to tax rates in other countries. We investigate the reaction of the EU14 on the new member states (NMS) for the period 1993-2006.

$$
\begin{aligned}
TAX_{i_{EU14},t} &= \beta_1 TAX_{i_{EU14},t-1} + \beta_2(\sum_{i \neq j} w_{ij} TAX_{j_{NMS},t}) \\
&\quad + \beta_3 X_{i,t} + \alpha_i + \varepsilon_{it}
\end{aligned} \tag{12}
$$

In the above expression (12), the dependent variable TAX is the statutory tax rate of country i in the EU14[9] at time t[10]. On the right hand side, the model includes the lagged dependent TAX variable, the weighted tax rate of the 10 new member states[11] $(w_{ij} TAX_{jNMS}, t)$, a set of country control variables (X)[12] such as population density, GDP per capita and the lagged personal income tax rate[13], country fixed effects (α_i) and time dummies (δ_t).

The weighted tax rates of the new member states is our main variable of interest. This variable is the weighted sum of the statutory corporate tax rates of the new EU10 member states:

$$
\begin{aligned}
(wTAX)_{it} &= \sum_{j \neq i} w_{ij} TAX_{jt} \\
\forall i : \sum_j w_{ij} &= 1
\end{aligned} \tag{13}
$$

For the weight, different measures from the theory will be used. According to Besley & Case (1995), spatial models typically use geographical weights for 2 reasons. First, geographic neighbors are likely to experience similar shocks and therefore neighbors' tax rates are more informative than tax rates in far away districts. A second reason

[9] EU14= Belgium, Netherlands, Luxembourg, Germany, France, Spain, Portugal, UK, Denmark, Sweden, Finland, Austria, Italy and Greece

[10] All data on corporate tax rates are collected from KPMG (2006)'s tax surveys and were available for 1993-2006.

[11] Poland, Slovakia, Czech Republic, Slovenia, Hungary, Lithuania, Latvia, Estonia, Malta and Cyprus

[12] The control variables, population density and GDP per capita are collected from the world development indicators (WDI), while the personal income tax rate is available in the OECD database until 2004

[13] personal income tax rate is lagged by one period since this variable is possible endogenous

is that information about policy decisions in nearby countries spreads quicker. The main weighing scheme that we will use is the inverse distance between the capital cities of countries of the EU14 and the new member states. The data on distance is collected from the CEPII database. Distance is measured as the distance between capital cities following the great circle formula, which uses latitudes and longitudes of the cities and incorporates the internal distance of the country based on areas (Head & Mayer 2002)[14].

In addition, six other weighing schemes will be used to gain insight in the EU14 tax competition game. The most widely used definition of neighbors is contiguity. In this definition the weight w_{ij} equals 1 if country i has a common land or water border with country j and 0 otherwise. A third spatial weight is based on the idea that also neighbors of second order can be affected by changes in the corporate tax rates of the EU10 countries. In this case, w_{ij} equals 1 if country i is has a common border with an adjacent neighbor of country j and 0 otherwise. The fifth weight is the share of trade (export + import) with country j in GDP of country i[15]. Finally, the sixth weighing scheme is based on the inverse distance between GDP per capita and is constructed as follows[16]:

$$\frac{1/(GDP_{i,t} - GDP_{j,t})}{\sum_j 1/(GDP_{i,t} - GDP_{j,t})} \tag{14}$$

Note that these last two weights, trade share and GDP per capita are allowed to be time variant[17]. All weights are normalized so that their sum equals 1.

By estimating this model (12) several econometric issues pop up. First, including a lagged dependent variable in a fixed effects model will lead to correlation since

[14]Other studies use more sophisticated measures of distance (Davis & Weinstein 2003). But for our research question, distance between capital cities is a good indicator of distance between countries.

[15]Trade data is collected from IMF database and GDP data is collected from Eurostat

[16]Data on GDP per capita is collected from Eurostat.

[17]Except for Redoano (2003) previous studies used weights based on the average of a variable over time.

fixed effects are time invariant (Woolridge 2003). A possible solution is to estimate equation (12) in first differences in order to get rid of this correlation. Taking first differences will lead to correlation between the lagged dependent variable in differences and the error term in differences, thus the lagged dependent variable in differences should be instrumented with lags of 2 or more periods. Second, our variable of interest, the weighted tax rate of the NMS, could be endogenous: tax rates of the EU14 will influence the tax rates of the new member states as well. To solve this problem, the instrumental variables method (2SLS) is frequently applied in the fiscal reaction literature (Brueckner (2003), Altshuler & Goodspeed (2002), Redoano (2003), Heyndels & Vuchelen (1998), Brett & Pinkse (2000), Carlsen et al. (2005), Ollé (2003), Figlio et al. (1999), Revelli (2002), Ladd (1992), Buettner (2003), Geys (2006), Baicker (2005), Werck et al. (2007) and Allers & Elhorst (2005)). Table 1 gradually introduces the final estimation procedure of the reaction function (12).

The first column in Table 1 estimates equation (12) using OLS and country fixed effects. The second column uses an autoregressive fixed effects model to include the autocorrelation of the EU14 tax rates. As explained above, an OLS estimation procedure is not correct since the weighted tax rates of the NMS are endogenous. Therefore, column (3) estimates a fixed effects model and instruments the endogenous variable, $WTax_{NMS,t}$. As a consequence the new estimation procedure will be:

$$\begin{aligned} First\ stage: \quad & \sum_{i \neq j} w_{ij} TAX_{j_{NMS},t} = \alpha_1 \sum_{i \neq j} w_{ij} X_{j_{NMS}} + \alpha_2 X_{i_{EU14}} + \rho_{jt} \quad (15) \\ Second\ stage: \quad & TAX_{i_{EU14},t} = \beta_2 (\sum_{i \neq j} w_{ij} \hat{TAX}_{j_{NMS},t}) \\ & + \beta_3 X_{i_{EU14},t} + \alpha_{i_{EU14}} + \varepsilon_{it} \end{aligned}$$

Finally, column (4) will include a lagged dependent variable. Taking into account that this is correlated with the fixed effects, we will take first differences and instrument the lagged dependent variable in differences with lags of 2 or more periods. In

symbols, our final estimation procedure is:

$$First\ stage: \quad \Delta \sum_{i \neq j} w_{ij} TAX_{j_{NMS},t} = \alpha_1 \Delta \sum_{i \neq j} w_{ij} X_{j_{NMS},t} + \alpha_2 \Delta X_{i_{EU14},t} + \Delta \rho_{jt} \tag{16}$$

$$Second\ stage: \quad \Delta TAX_{i_{EU14},t} = \beta_1 \Delta TAX_{i_{EU14},t-1} + \beta_2 \Delta X_{i_{EU14},t} + \beta_3 \Delta (\sum_{i \neq j} w_{ij} \hat{TAX}_{j_{NMS},t}) + \Delta \varepsilon_{it} \tag{17}$$

The result shows that a decrease by 10% in the tax rates of the new member states (EU10), will induce a reduction of 18% in the tax rates of the EU14 countries that are on a close distance to the new member states. The p-value of the sargan test is larger than 0.1 and thus implies that our instruments are valid.

6 Results

This section reports the results of different specifications of (16) in comparison with the benchmark regression in Table 1, column (4).

Column (1) in Table 2 includes Ireland in the aggregated distance weighted tax rates, $WTax_{NMS,t}$. The coefficient is still positive significant, but is much lower than before. A possible reason for this weaker result is that only UK is a close neighbor of Ireland. To gain more insight in the reaction function of the EU14, columns (2) and (3) split up the sample in direct neighbors (Italy, Germany, Austria, Finland, Sweden, Denmark and Greece) and non-neighbors (Belgium, Luxembourg, Netherlands, France, UK, Portugal and Spain) of the new member states (NMS). The estimations indicate that only the neighbors react to the tax rate of the new member states and that these neighbors do not react to tax rates of the NMS' non-neighbors.

Since Finland, Austria and Sweden only joined the European Union in 1995, column (5) estimates equation (16) for the period 1995-2006. Also for this shorter

Table 1: Model construction

dep var.=tax$_{EU14}$	(1) xtreg	(2) xtregar	(3) xtivreg, fe	(4) IV, lag, fe
Tax$_{i,t-1}$				-0.09
				(0.13)
WTax$_{NMS,t}$	0.79***	0.16	0.97***	1.83***
	(0.1)	(0.14)	(0.17)	(0.86)
Income tax$_{i,t-1}$	-0.06	0.05	-0.04	-0.41
	(0.14)	(0.21)	(0.14)	(0.31)
GDP per capita$_{i,t}$	0.001***	-0.0004	0.001***	0.002**
	(0.0002)	(0.0005)	(0.0004)	(0.001)
Population density$_{i,t}$	0.11	-0.27	0.15	0.38
	(0.09)	(0.24)	(0.1)	(0.35)
Constant	-20.65	82.66***	-39.92*	0.68
	(16.59)	(8.37)	(22.53)	(0.82)
Obs	169	156	169	156
R squared	0.43	0.04	0.42	
Sargan test (pvalues)				0.8

Standard errors are in parentheses. The instruments used for $WTax_{NMS,t}$: the proportion of the population younger than 14 years, population density and the number of active residents. note:***,** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

period, the positive reaction is still significant. In general, tax competition models predict that tax rates are jointly determined and hence indicate endogeneity of $WTax_{NMS,t}$. But it seems very plausible that the government in each country sets its tax as a best response to taxes of the new member states in the previous period . Therefore, column (5) includes a lagged term of $WTax_{NMS,t}$. We observe that the simultaneous reaction is not significant anymore, while the lagged reaction is positive and significant. Although a Wald test can not reject that coefficients of both variables are equal, this would suggest that EU14 countries react to taxes of the new member states in the previous period. Finally, column (6) uses a different set of instrumental variables for $WTax_{NMS,t}$, namely institutional variables such as measures of enterprise reforms, trade liberalization and competition policy[18]. The result shows that EU14 countries react positive and significantly to taxes in the new member states and the Sargan test confirms the validity of the instruments.

7 Robustness checks

Table 4 reports some robustness checks of the previous results. Instead of estimating the reaction of the EU14 to the aggregate taxes of the NMS, column (1) splits up the NMS in smaller groups of countries: the Baltic states (Estonia, Lithuania and Latvia), Ireland and the 5 largest NMS (Slovenia, Slovakia, Czech Republic, Poland and Hungary). Cyprus and Malta are left out since these countries are very small and have almost no neighbors. Only the coefficient of the group of the 5 largest NMS (Slovenia, Slovakia, Czech Republic, Poland and Hungary) is positive and significant, implying that the EU14 reacts mainly to these 5 new member states.

Secondly, column (2) to (5) test other weights of the NMS' taxes. First column (2) uses a dummy equal to 1 if country i is an adjacent neighbor of a NMS, while in column (2) the weight is a dummy equal to 1 if country i has a common border with an adjacent neighbor of a NMS. None of these weighted tax rates are significant.

[18]These institutional variables are collected from the EBRD reports

Table 2: Estimation results

dep var.=tax$_{EU14}$	(1) Ireland	(2) Neighb.	(3) Non-neighb.	(4) '95-'06	(5) lag	(6) instit.
Tax$_{i,t-1}$	-0.04	-0.14	-0.06	-0.09	-0.07	-0.12
	(0.09)	(0.22)	(0.15)	(0.13)	(0.13)	(0.14)
WTax$_{NMS,t}$		1.99*	0.17	1.8**	0.3	1.62*
		(1.22)	(0.34)	(0.86)	(0.34)	(0.94)
WTax$_{NMS+Ireland,t}$	0.01*					
	(0.01)					
WTax$_{non-neighbors,t}$		-1.2				
		(1.03)				
WTax$_{neighbors,t}$			1.44			
			(1.7)			
WTax$_{NMS,t-1}$					1.08*	
					(0.61)	
Income tax$_{i,t-1}$	-0.15	-0.23	0.09	-0.41	-0.36	-0.35
	(0.2)	(0.49)	(0.23)	(0.82)	(0.33)	(0.31)
GDP per capita$_{i,t}$	0.001	0.003	0.0003	0.002*	0.002**	0.001*
	(0.001)	(002)	(0.001)	(0.001)	(0.001)	(0.001)
Population density$_{i,t}$	0.37	3.57	-0.02	0.38	0.34	0.32
	(0.29)	(3.23)	(0.19)	(0.35)	(0.37)	(0.34)
Constant	-0.18	-1.35	-0.08	0.68	-1.5**	0.57
	(0.5)	(1.54)	(0.61)	(0.82)	(0.66)	(0.99)
Obs	156	56	72	156	156	143
Sargan test (pvalues)	0.06	0.8	0.19	0.8	0.6	0.31

Standard errors are in parentheses. The instruments used for $WTax_{NMS,t}$: the proportion of the population younger than 14 years, population density and the number of active residents. In column (6) the instruments for $WTax_{NMS,t}$ are an indicator of enterprise reforms, trade liberalization and competition policy. note:***,** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

Possibly these types of weights are too roughly defined. Moreover, we could not find valid instruments for this variable as the Sargan p-values point out. In column (3) the weight is the share of trade with country j in GDP of country i. The argument is that EU14 countries might react more to taxes of their trading partners. The coefficient is positive and significant, indicating that EU14 countries react to taxes of the NMS in particular if these NMS are their trading partners. But the coefficient is very small. In column (5) we test whether EU14 countries compete over taxes having countries with similar economic characteristics. The result is positive, but not significant, which could imply that a geographical neighbor is more important than economic similarity in the fiscal reaction of EU14 countries to NMS[19].

Finally, the last column uses the effective tax rate of the NMS instead of the official tax rate. This reaction function is not significant which would imply that EU14 countries do not take into account the effective tax rates of NMS in setting their own effective tax rate. These results are in contrast to Devereux et al. (2003) who find no significant competition in STRs for OECD countries but they do find competition in effective tax rates. A possible reason for this difference is that they use a different method to calculate effective tax rates [20]. Moreover, we have observed (see Figure 2) that effective tax rates in Europe are quite stable. Tax reforms in Europe are characterized with decreasing tax rates, but an increasing taxable basis and thus stable effective tax rates. Therefore, we did not expect any result from effective tax rates.

[19] Redoano (2003) also did not find significant tax competition between economically similar (GDP per capita) EU13 countries

[20] They calculate the ETR by the method of Devereux et al. (2002). For a complete overview of ETR calculations see Nicodème (2001).

Table 3: Robustness Checks

dep var.=tax_{EU14}	(1)	(2) FON	(3) SON	(4) trade	(5) GDP	(6) etr
$\text{Tax}_{i,t-1}$	-0.04	-0.03	-0.02	-0.13	-0.09	-0.03
	(0.1)	(0.08)	(0.08)	(0.13)	(0.21)	(0.08)
$\text{WTax}_{SI,SV,CZ,PO,HU,t}$	0.01**	0.04	0.05			
	(0.005)	(0.05)	(0.03)			
$\text{WTax}_{baltic,t}$	0.01	0.07	-0.06			
	(0.01)	(0.06)	(0.06)			
$\text{WTax}_{Ireland,t}$	49.05	0.01	0.03			
	(92.73)	(0.03)	(0.11)			
$\text{W}_{export_{ij,t}}\text{Tax}_{NMS,t}$				0.04**		
				(0.02)		
$\text{W}_{\frac{1/(GDP_{i,t}-GDP_{j,t})}{\sum_j 1/(GDP_{i,t}-GDP_{j,t})}}\text{Tax}_{NMS,t}$					4.23	
					(3.75)	
$\text{W}_{distance}\text{ETR}_{NMS,t}$						0.08
						(0.07)
Income $\text{tax}_{i,t-1}$	-0.02	-0.18	0.01	-0.09	-1.13	-0.03
	(0.2)	(0.17)	(0.17)	(0.21)	(1.11)	(0.16)
GDP per $\text{capita}_{i,t}$	0.001**	0.001**	0.001*	0.002*		0.001
	(0.001)	(0.001)	(0.001)	(0.001)		(0.004)
Population $\text{density}_{i,t}$	0.13	0.02	0.06	0.07	0.96	0.08
	(0.23)	(0.21)	(0.24)	(0.28)	(0.9)	(0.2)
Constant	-0.56	-0.95***	-0.89***	-0.4	2.86	-0.81***
	(0.36)	(0.27)	(0.29)	(0.52)	(3.13)	(0.26)
Obs	156	156	156	104	143	156
Sargan test (pvalues)	0.001	0.002	0.002	0.13	0.29	0.02

Standard errors are in parentheses. Column (1) splits $WTax_{NMS,t}$ up into smaller groups of countries and instruments with lags. Column (2) weights the taxes of NMS by a dummy equal to 1 if country i is an adjacent neighbor of a NMS, while column (3) uses a dummy equal to 1 if country i is a second order neighbor of a NMS. The weight in column (3) is the share of trade (export+import) from country i to the NMS in GDP of i. In column (4) the taxes of NMS are weighted with the distance in GDP per capita between both countries. Finally, column (5) uses the distance weighted effective tax rates (etr) of the NMS. All weighted variables, $WTax_{NMS,t}$ are instrumented with their lag. note:***,** and * denote significance level of estimates at respectively

8 Conclusion

During the past decade corporate tax rates decreased greatly in the 'old EU14. Especially, Germany and Italy experienced the largest decrease in their tax rates. Not surprisingly, both countries are neighbors of the 'new' EU10. This paper analyzes strategic tax setting in the 'old' EU14 as a reaction to the tax rates in the new member states. To our knowledge, this is the first paper studying the impact of the new EU member states on tax rates of the old Europe.

First, a spatial competition model is developed to predict the role of distance in tax competition. In this model a multinational makes its location decision between two countries taking into account the corporate tax rates, market size and transport cost. The outcome of the model suggests that tax competition is more intense between geographically close countries. Second, this result is empirically verified for the EU14 during the period 1993-2006 using a fiscal reaction function. Estimations show that only neighbors of the new member states seem to react to low taxes of these new members. Moreover, we observe that neighbors of the new member states react far less to changes in the tax rate of other EU14 countries. To put it differently, the corporate tax rate of a country like Germany or Denmark seems to respond to changes in the tax rate of the new member states like Czech Republic, but will respond much less to the tax rate of for example Belgium. When using other definitions of neighbors we only find weak spatial tax competition among trading partners.

The resulting spatial dimension of tax competition in this paper will also have implications for transfer pricing. Since we find that neighbors of Eastern Europe are subject to more intense tax competition, tax differences between these countries will become smaller. As a consequence smaller tax differences are likely to induce less profit shifting towards Eastern Europe. In addition, smaller tax differentials will also stimulate decentralization choices of multinationals as pointed out by Nielsen et al. (2007).

References

Allers, M. & Elhorst, P. (2005). Tax mimicking and yardstick competition among local governments in the netherlands. *International tax and public finance*, 12, pp 493.

Altshuler, R. & Goodspeed, T. (2002). Follow the leader? evidence on european and us tax competition. *Rutgers University working papers*, (200226), pp 24.

Baicker, K. (2005). The spillover effects of state spending. *Journal of public economics*, 89, pp 529.

Baldwin, R. & Krugman, P. (2004). Agglomeration, integration and tax harmonization. *European economic review*, 48(1), pp 1.

Bellak, C. & Leibrecht, M. (2005). Do low corporate income tax rates attract fdi? evidence from eight central- and east european countries. *GEP Discussion Paper*, 2005/43.

Bénassy-Quéré, A., Gobalraja, N. & Trannoy, A. (2007). Tax and public input competition. *Economic policy*, p. 385.

Besley, T. & Case, A. (1995). Incumbent behavior: vote seeking, tax setting and yardstick competition. *American Economic Review*, (85), pp 25.

Bordignon, M. (2007). Exit and voice. yardstick versus fiscal competition across governments. *CESifo working paper*, (2069), pp 20.

Bordignon, M., Cerniglia, F. & Revelli, F. (2002). In search for yardstick competition: property tax rates and electoral behavior in italian cities. *working paper*, p. 37.

Bretschger, L. & Hettich, F. (2002). Globalisation, capital mobility and tax competition: theory and evidence for oecd countries. *European Journal of political economy*, 18, pp 695.

Brett, C. & Pinkse, J. (2000). The determinants of municipal tax rates in british columbia. *Canadian Journal of Economics*, 33(3), pp 695.

Brueckner, J. (1998). Testing for strategic interaction among local governments: the case of growth controls. *Journal of Urban Economics*, 44, pp 438.

Brueckner, J. (2003). Strategic interaction among governments: An overview of empirical studies. *International Regional Sience Review*, 26(2), pp 175.

Brueckner, J. & Saavedra, L. (2001). Do local governments engage in strategic property-tax competition?. *National Tax Journal*, 54(2), pp 203.

Buettner, T. (2001). Local business taxation and competition for capital. *Regional Science and Urban Economics*, 31, pp 215.

Buettner, T. (2003). Tax base effects and fiscal externalities of local capital taxation: evidence from a panel of german jurisdictions. *Journal of Urban Economics*, 54, pp 110.

Buettner, T. & Ruf, M. (2005). Tax incentives and the location of fdi: evidence from a panel of german multinationals. *Discussion paper Deutsche Bundesbank*, (17).

Buijinck, W., Janssen, B. & Schols, Y. (2002). Evidence of the effect of domicile on corporate average effective tax rates in the european union. *Journal of International Accounting, Auditing & Taxation*, 11, pp 115.

Carlsen, F., Langset, B. & Rattsø, J. (2005). The relationship between firm mobility and tax level: empirical evidence of fiscal competition between local governments. *Discussion papers*, (424), pp 25.

Case, A., Hines, J. & Rosen, H. (1993). Budget spillovers and fiscal policy interdependence. *Journal of Public Economics*, 52, pp 285.

Davis & Weinstein (2003). Market access, economic geography, and comparative advantage: An empirical assessment. *Journal of International Economics*, 59(1), pp 1.

Desai, M. (1999). Are we racing to the bottom? evidence on the dynamics of international tax competition. *Proceedings of the 91st Annual Conference on Taxation (Washington D.C.: National Tax Association)*, p. 176.

Devereux, M. & Griffith, R. (1998). Taxes and the location of production: evidence from a panel of us multinationals. *Journal of Public Economics*, 68, pp 335.

Devereux, M., Griffith, R. & Klemm, A. (2002). Corporate income tax reforms and international tax competition. *Economic Policy*, 35, pp 451.

Devereux, M., Lockwood, B. & Redoano, M. (2003). Do countries compete over corporate tax rates. *CEPR discussion paper*, (3400).

Disdier, A. & Mayer, T. (2004). How different is eastern europe? structure and determinants of location choices by french firms in eastern and western europe. *Journal of Comparative Economics*, 32, pp 280.

Figlio, D., Kolpin, V. & Reid, W. (1999). Do states play welfare games?. *Journal of Urban economics*, 46(3), pp 437.

Geys, B. (2006). Looking across borders: a test of spatial policy interdependence using local government efficiency ratings. *Journal of urban economics*, 60, pp 443.

Haufler, A. & Wooton, I. (2003). Regional tax coordination and foreign direct investment. *Journal of Accounting and Public Policy*, .

Hayashi, M. & Boadway, R. (2001). An empirical analysis of intergovernmental tax interaction: the case of business income taxes in canada. *Canadian Journal of Economics*, 34(2), pp 481.

Head, K. & Mayer, T. (2002). Non-europe: the magnitude and causes of market fragmentation in the eu. *Weltwirtschaftliches Archiv*, 136(2), pp 285.

Heyndels, B. & Vuchelen, J. (1998). Tax mimicking among belgian municipalities. *National Tax Journal*, 60, pp 89.

KPMG (2006). Kpmg's corporate tax rate survey. *KPMG international*, .

Krogstrup, S. (2004). Are corporate tax burdens racing to the bottom in the european union?. *EPRU Working paper series*, p. 43.

Ladd, H. (1992). Mimicking of local tax burdens among neighboring counties. *Public finance review*, 20, pp 450.

Mendoza, E. & Tesar, L. (2004). Why hasn't tax competition triggered a race to the bottom? some quantitative lessons from the eu. *Journal of Monetary economics*, 52, pp 163.

Mooij, R. D. & Ederveen, S. (2003). Taxation and foreign direct investment: a synthesis of empirical research. *International Tax and Public Finance*, 10, pp 673.

Mukand, S. & Rodrik, D. (2005). In search of the holy grail: policy convergence, experimentation, and economic performance. *American Economic Review*, (1), pp 374.

Nicodème, G. (2001). Computing effective corporate tax rates: Comparisons and results. *DG ECFIN economic paper*, (153), pp 50.

Nielsen, S., Raimondos-Møller, P. & Schjelderup, G. (2007). Taxes and decision rights in multinationals. *Journal of public economic theory*, forthcoming.

Ollé, A. S. (2003). Electoral accountability and tax mimicking: the effects of electoral margins, coalition government and ideology. *European journal of political economy*, 19, pp 685.

Redoano, M. (2003). Fiscal interactions among european countries. *Warwick Economic Research papers*, (680), pp 30.

Revelli, F. (2002). Local taxes, national policies and spatial interactions in english district election results. *European Journal of Political Economy*, 18, pp 281.

Revelli, F. (2003). Reaction or interaction? spatial process identification in multi-tiered government structures. *Journal of urban economics*, 53, pp 29.

Ruiz, F. & Gerard, M. (2007). Is there evidence of strategic coporate tax interaction among eu countries?. *Working paper University of Mons*, p. 43.

Salvatore, D. (2002). Relative taxation and competitiveness in the european union: what the european union can learn from the united states. *Journal of Policy modeling*, 24, pp 401.

Stewart, K. & Webb, M. (2006). International competition in corporate taxation: evidence from the oecd time series. *Economic policy*, 45, pp 153.

Vandenbussche, H. & Crabbé, K. (2006). De vennootschapsbelasting: de positie van België in het verruimde europa, "corporate taxes: the position of Belgium in the enlarged Europe". *Tijdschrift voor Economie en Management*, L1, pp 129.

Werck, K., Heyndels, B. & Geys, B. (2007). It depends on who you're looking at: neighbourhood effects in local government cultural expenditures. *working paper*, p. 34.

Wilson, J. (1999). Theories of tax competition. *National Tax Journal*, p. 269.

Woolridge, J. (2003). *Econometric analysis of cross section and panel data*. Cambridge, MIT press.

9 Appendix A

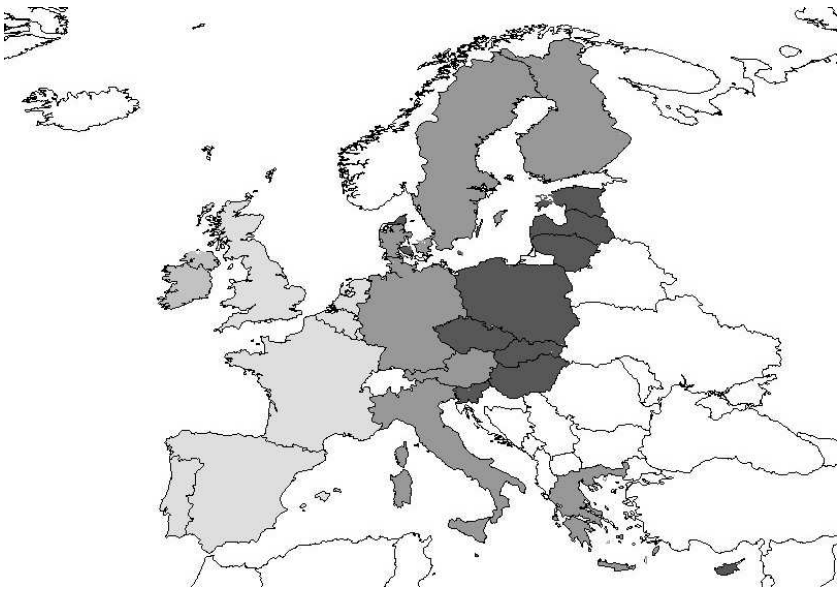

Figure 6: Map of EU25

New member states (EU10= black)= Estonia, Latvia, Lithuania, Poland, Hungary, Czech Republic, Slovakia and Slovenia

Neighbors of NMS (dark grey)= Sweden, Denmark, Germany, Austria, Italy and Greece

non-neighbors (light grey)= Netherlands, Belgium, France, UK, Spain and Portugal

Ireland (grey)

The computations of the model in section 4 in more detail:

The inverse demand functions are derived from:

$Q = M - bP$ where for simplicity is assumed that b=1. $\Rightarrow P_A = M - Q_A$ and $P_B = M - Q_B$.

Using these inverse demand functions, the after-tax profits in country A and B are respectively

$$\begin{aligned} \pi_A &= (M - Q_A)Q_A(1 - t_A) \\ \pi_B &= [(m - Q_B)Q_B + (M - Q_{AB})Q_{AB} - cx^2 Q_{AB}](1 - t_B) \end{aligned} \tag{18}$$

Maximizing the after-tax profits leads to the equilibrium output. The maximization is as follows

For A:

$$\begin{aligned} \frac{\partial \pi_A}{\partial Q_A} &= (1 - t_A)(M - Q_A - Q_A) = 0 \\ \Rightarrow Q_A^* &= \frac{M}{2} \\ &and \\ \frac{\delta \pi_A}{\delta Q_{AB}} &= (1 - t_A)((m - Q_{AB}) - Q_{AB} - cx) = 0 \\ \Rightarrow Q_{AB}^* &= \frac{m - cx}{2} \end{aligned} \tag{19}$$

For B:

$$\begin{aligned} \frac{\partial \pi_B}{\partial Q_B} &= (1 - t_B)(m - Q_B - Q_B) = 0 \\ \Rightarrow Q_B^* &= \frac{m}{2} \\ &and \\ \frac{\partial \pi_B}{\partial Q_{BA}} &= (1 - t_B)(m - Q_{BA} - Q_{BA} - cx) = 0 \\ \Rightarrow Q_{BA} &= \frac{M - cx}{2} \end{aligned} \tag{20}$$

Proof: $CS_1 > CS_2$

$$CS_1 = \int_0^{Q_A^*} (P_A dQ_A) - P_A Q_A^* = \frac{Q_A^2}{2} \tag{21}$$

$$CS_2 = \int_0^{Q_A^*} (P_A dQ_A) - P_A Q_A^* - cxQ_A = \frac{Q_A^2 - 2cxQ_A}{2}$$

$$\Rightarrow \frac{Q_A^2}{2} > \frac{Q_A^2 - 2cxQ_A}{2}$$

Proof: $\frac{\delta t_A^*}{\delta M} > 0$

$$\begin{aligned} \frac{\delta t_A^*}{\delta M} &= \frac{[2cx + t_B 2(M - cx)][M^2 + (m - cx)^2] - 2M(2cx(M - m))}{[M^2 + (m - cx)^2]^2} \\ &\quad \frac{-2M(t_B(m^2 + (M - cx)^2)}{[M^2 + (m - cx)^2]^2} \\ &= \frac{2(1 - t_B)cx[(m - cx)^2 + M(2m - M)]}{[M^2 + (m - cx)^2]^2} > 0 \end{aligned} \tag{22}$$

Table 4: First stage regression results of benchmark regression in Table 1, column (4).

	$\Delta Tax_{i_{EU14},t-1}$	$\Delta W_{ij}Tax_{NMS,t}$
$\Delta popdensity_{i,t}$	.2	-0.17
	(0.2)	(0.13)
$\Delta gdp\ per\ capita_{i,t}$	0.0004	-0.001***
	(0.001)	(0.003)
$\Delta income\ tax_{i,t-1}$	0.4***	0.27***
	(0.16)	(0.1)
$\text{Tax}_{i,t-2}$	-0.09***	-0.04***
	(0.03)	(0.02)
$\Delta W_{ij}population > 14y_{j,t}$	-0.37	-0.83*
	(0.81)	(0.51)
$\Delta W_{ij}population\ density_{j,t}$	0.35	-0.07
	(0.33)	(0.21)
$\Delta W_{ij}active\ population_{j,t}$	-6.81E-09	-5.33E-08
	(7.5E-08)	(4.69E-08)
constant	2.34***	0.38
	(0.91)	(0.57)
Obs	156	156

Standard errors are in parentheses. note:***,** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.