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▶ To cite this version:

Nicolas Chatelais, Mathilde Peyrat. Are Small countries leaders of the European tax competition ?. Documents de travail du Centre d'Economie de la Sorbonne 2008.58 - ISSN : 1955-611X. 2008. <halshs-00332479>
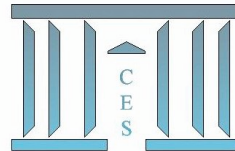
HAL Id: halshs-00332479
https://halshs.archives-ouvertes.fr/halshs-00332479

Submitted on 21 Oct 2008

CES Working Papers

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2008.58

CNRS

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DE LA RECHERCHE
SCIENTIFIQUE

Are Small countries leaders of the European tax competition?

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Abstract:

The aim of this paper is to develop a better understanding of the literature dealing with strategic fiscal behaviours of small EU countries using estimations of tax reaction functions of competing national governments. Deriving a simple model of tax competition in a Nash and a Stackelberg game, we use panel data and tools from spatial econometrics to examine the role of small countries in tax competition within the enlarged European Union. We find that interactions are stronger among smaller EU countries than between larges ones and rates set in small countries influence those in big countries. Finally, small countries located in the centre of the EU have more influence on tax policies choices of big countries than small countries located in the periphery of EU.

Keywords: Strategic Interactions, Tax Behaviours, Spatial Econometrics, European Union, Tax Competition, Small Countries

1   Introduction

Since the Treaty of Maastricht (1992) and the establishment of real and nominal convergence rules, several economic regulation tools such as monetary or exchange policy can no longer be used in cyclical adjustments or in response to policies in other neighbouring countries. Countries are now competing through tax and fiscal policy. Indeed, the statutory corporate tax rate has dropped since 1995 in all European countries. This competition arises from both the recognition of different tax regimes within EU by most mobile tax bases in their location choice and the un-cooperative commitment of some countries to attract these tax bases.

Fiscal interactions between countries are derived from the existence of externalities (positive or negative) of tax and fiscal policies among countries. Consequently, choices of tax policies are not independent. In addition, countries are competing to attract mobile tax bases (capital, profits, high incomes…) localized in their neighbours. Knowing almost perfect spatial mobility of the tax base constituted by capital and profits, each national government adopts non-cooperative behaviours when setting their corporate tax rate. This strategy aims to attract productive capital and / or profits in order to increase the production and / or income tax.

In this article, we test whether governments influence each other in their choice of tax policies and specifically in tax rate setting. We will try to determine whether small countries, defined by their geographic size, are tax competition leaders in Europe. This is based on the hypothesis of a size effect in small countries which can encourage the pursuit of a tax rate lowering strategy to attract mobile taxable bases. Indeed, the capital transfer from the big country that results is relatively high in proportion to its production or its GDP. This capital transfer offsets the initial loss of tax revenue.

The issue of strategic interactions between local governments has been often treated in the literature. However between states, it is increasingly an important topic of research. Thus, we can make reference to works from Altshuler and Goodspeed (2002), Devereux, Lockwood and Redoano (2002), Redoano (2003) who obtain a positive Nash reaction function for European countries and those of Ruiz (2006), who concludes a lack of fiscal interaction in Europe. Most of tax competition models and estimates that follow result from a Nash framework. However, we can examine if some countries do not observe fiscal and tax policies evolutions among its neighbours in order to react in a second time. Thus, Gordon (1992) and Altshuler and Goodspeed (2002) deal with strategic interactions in a theoretical Stackelberg world. In contrast to these two articles suggesting that the United States has played a leading role towards Europe in tax competition especially with the TRA (Tax Reform Act 1986), we test empirically the role of small countries towards larger in the EU-25. In addition, we investigate which countries or which types of small countries are leaders of the tax competition. We distinguish two groups of small countries which can influence big countries. Empirically, it seems that small countries close to the centre of the European Union, notably Belgium, have the most influence on large countries at the core and therefore are the real instigators of tax competition. Thus, large countries always adopt a position in line with respect to these small countries also at the centre.

The article is organized as follows. We will first state tax competition in Europe, recalling the theoretical role played by small countries in tax competition based on a quantitative analysis (section 2). We will then present a

theoretical model (section 3) that we econometrically estimate (Section 4). Finally, we will present our findings (section 5) to conclude on the important role of small countries in the European tax competition.

2   Tax competition within the European Union

Faced with the existence of a wide variety of taxation systems within the European Union, firms and particularly multinationals (MNF), may find beneficial to integrate this variable in their decision-making strategic processes (localization, investments...). Knowing that, some national governments can opt for an aggressive tax strategy in order to attract these productive entities, or at least their profits, and thus compel other governments to participate in the competition game due to high capital mobility. In the European Union case, it seems that small countries are at the origin of tax competition and that large countries react to this aggressive strategy.

2.1   Why small countries practise tax competition? Existence of a size effect

In the traditional literature, the notion of size is often defined by the market size. For some small countries, the tax policy has to compensate for the small size of the domestic market. If a company is located in a large country, it can take advantage of the relatively large domestic market at its disposal to exploit increasing returns to scale. In contrast, the market size being relatively restricted in a small country, companies can not thus benefit of these scale economies and prefer to locate near the large market. Therefore, governments of small countries would benefit from having a less heavy tax system in order to offset their initial market size handicap. However, on a European scale, the domestic market size is not a very relevant argument. Indeed, since tariff barriers are free or very low and transport costs are reduced, companies have free access to the European market.

The relatively small market size is not thus a convincing argument to justify a decrease in tax rate. However, another effect linked to its small size may encourage a country to practice a tax rate reduction strategy. A relatively low tax rate results in a capital transfer towards the country setting this rate. For a small country, the capital transfer that result is relatively large in proportion to its production or its GDP, which largely offsets the initial loss of tax revenues. On the contrary, larges countries have interest in less reacting to the tax competition because cutting tax-rates do not attract sufficient capital relative to their production and initial losses of tax incomes are not compensated by productive transfers.

When a change of the tax rate occurs, different consequences will sustained according to the size from the country concerned. This change has an impact of width different on the capital per capita ratio depending on the size of the country. This is due to greater capital elasticity to tax rate in small countries. Thus, at the Nash equilibrium in a two country model, the small country will be encouraged to set a tax rate lower than in the big foreign country.

For example, Bucovetsky (1991) and Wilson (1991) have proposed a theoretical framework incorporating two jurisdictions having a different number of inhabitants. Originally, no capital transfer would be excepted if the two localities adopt the same tax rate. The exchange will thus take place only because the two jurisdictions have set different tax rates. As in previous models (Tiebout 1956), capital taxation is used to finance a public good and leads to a capital market equilibrium involving equal after-tax returns. Consequently, tax rates set in a locality determine capital stock in the other one, and thus its revenue from taxes. Contrary to a theoretical framework with two

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identical jurisdictions, the capital marginal productivity elasticity to tax rate is not any more equal in both localities. Indeed, the amount of work available is lower in the small jurisdiction, the elasticity is therefore greater. Thus, capital flight will be higher in a small country than in a large if they adopt an equal tax rate increase. This externality is even more important as the jurisdiction size is small. In conclusion, being more influenced by tax competition, the small locality may find a benefice in establishing its tax rates below those set in larges ones.

International tax competition challenges imply to refer any more to various tax bases elasticities in tax policy elaboration.

The theory (Bucovetsky, 1991 and Wilson, 1991) predicts that at equilibrium, large countries of the European Union, having capital elasticity lower than smaller countries, choose higher mobile bases tax rates than smaller members. This proposal has been empirically verified by Huizinga-Nicodème (2006), whose regressions show a significant and robust relationship between the corporate tax burden and the size of their home country measured by the logarithm of GDP.

2.2   Tax rates Reductions in small countries

In this section we will point out an overall reduction in statutory corporate tax rates since 1995 in Europe. We will show a more pronounced decline in small countries of the European Union. Before, we justify the choice of statutory rate compared with other indicators of tax pressure in order to deal with tax competition.

2.2.1   Imperfect indicators of tax pressure

The theoretical or statutory tax rate is the most frequently used indicator in economics to measure the tax burden because it is relatively simple to evaluate. However, this indicator may lack of efficiency because it does not take into account the tax base or potential tax shelter. In addition, the calculation of the tax base is rather difficult to assess accurately.

To remedy this shortcoming, it was created and introduced new tools to assess the tax burden: implicit tax rates and effective tax rates or simulated tax rates. In general, implicit tax rates ("backward looking") are used to analyze the ex-post corporate tax burden and tax distribution effects. But they do not take into account the process of investment location choices or firm's marginal investments. The calculation of effective tax rates ("forward looking") may alleviate this problem.

The indicator used in this article, is the statutory corporate tax rate which is generally used in the context of international comparisons. The standard rate is the sum of the highest federal tax rate plus any more local taxes (e.g. regional). Because of its simplicity and availability, this tax rate plays an important signal effect. It is a determining factor with regard to the firm location and profit transfers among various entities of a multinational company based in several countries. The MNF will indeed try to reduce declared benefits in countries where the nominal tax rate is high and transfer them in countries where the nominal tax rate is lower.

However, the statutory tax rate observed in various countries give only a partial view of the actual tax pressure exerted on firms.

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To conclude, the statutory tax rate is a good tax assessment element of a country. It is a very important element in international comparisons and which influences considerably tax competitiveness "felt" by firms. Even if the felt tax competitiveness differs from the real competitiveness, it is often the first which influences direct investment decisions and, more generally, the localization of mobile factors of production.

The nominal tax rate criterion can act as a signal effect because the taxation systems scrubland leads to difficult decision making process for firms.

We can also establish comparisons between various tax rates in Europe (table 1). Thus, when we classify countries according to various indicators of fiscal pressure (statutory, EATR, EMTR), the ranking obtained is relatively identical to statutory tax rates. A similar classification is obtained if we take into account effective tax rates calculated by Devereux, Griffith and Klemm (2002).

Thus, in this article we assume that nominal tax rates are principal vectors of tax competition: their reductions are analysed as signal effects and the study of these rates gives excellent information of a government tax policy and the tax burden which it exerts on firms.

Table 1: Country classification with respect to tax pressure level (2005)

| Country	Ranking		
	Statutory tax rate	EATR	EMTR
Germany	1	2	2
Italy	2	5	6
France	3	3	1
Greece	4	9	13
Malta	5	4	4
Spain	6	1	3
Netherlands	7	8	7
Austria	8	16	14
Belgium	9	6	10
Luxemburg	10	10	17
Denmark	11	11	11
United Kingdom	12	7	5
Finland	15	15	9
Czech Rep.	14	16	18
Sweden	15	12	12
Estonia	16	17	17
Portugal	17	14	16
Slovenia	18	18	20
Poland	19	20	22
Slovakia	20	21	23
Hungary	21	19	15
Cyprus	22	25	24
Latvia	23	23	21
Lithuania	24	24	25
Ireland	25	22	19

sources: OECD, European Commission, EATR et EMTR are from ZEW

EATR: Effective average tax rate, EMTR: Effective marginal tax rate

Since 1990, the average corporate tax rate in the enlarged European Union countries did not cease falling, from 38.9% in 1990 to 25.8% in 2006 (Figure 1).

Figure 1: *Evolution of Statutory corporate tax rate in EU25*
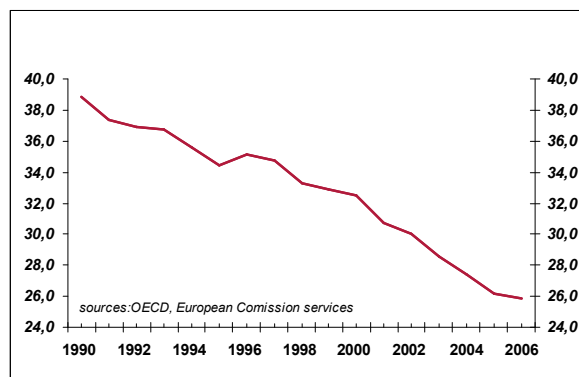
To explain the statutory tax rates fall in Europe, we can split the EU in two sub-groups according to their size. The partition was done according to two criteria that are geographical area and population. Thus we get a straightforward frontier between countries:

- Large countries: Germany, France, Great Britain, Italy, Spain and Poland
- Small countries: Belgium, the Netherlands, Luxembourg, Ireland, Portugal, Greece, Austria, Finland, Denmark, Sweden, Slovenia, Slovakia, Hungary, Czech Republic, Estonia, Lithuania, Latvia, Malta and Cyprus.

This partition is nuanced when we take GDP as the choice criteria, especially for Poland, but this anomaly can be explained by the past weighing on economic structures of this country.

Thus it is quite remarkable (figure 2) that small countries set corporate tax rate lower than those established in large ones. In addition, it should be noted a stronger and earlier tax rates decrease in small countries than in larges ones.

This tax strategy is characterized by an upper point's gap in 2006 and has undergone a significant change over the last decade.

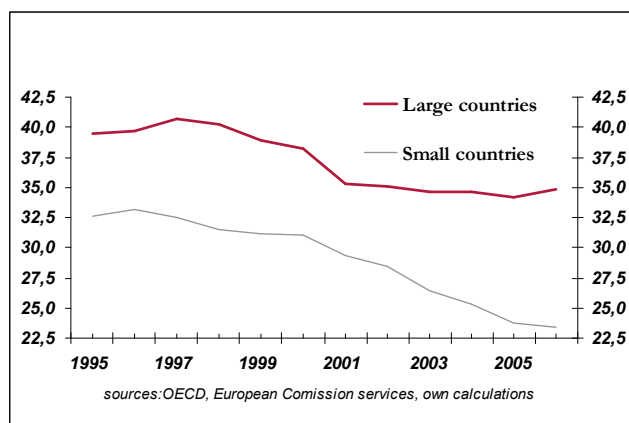*Figure 2*: *Evolution of Statutory tax rates in small and large countries*


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Table 2: Corporate statutory tax rates

	1995	2000	2006
Large countries	39.5%	38.3%	34.9%
Small countries	32.6%	31.1%	23.4%

Indeed, according to the table (2), the tax rates gap between these two groups of countries was already on average of 7 points in 1995, and reached more than 11 points in 2006. According to table (3), small countries are at the origin of the European tax competition. Indeed these ones have initiated a very significant tax-cutting process and sharply intensifying during the twenty-first century. For example, small countries have reduced their tax rates by more than 28% between 1995 and 2006, while the decline in larges countries hardly established at 12%. This decline has been particularly strong since the beginning of 2000 with a loss of 7.7 points in corporate tax rates in small countries. It appears that larger countries have been forced to respond by reducing their rates also by 3.6 points.

Table 3: Corporate tax gap

	1995-2000	2000-2006	1995-2006
Large countries	- 1.2 pts	- 3.6 pts	- 4.6 pts
Small countries	- 1.5 pts	- 7.7 pts	- 9.1 pts

Map 1: Corporate statutory tax rate evolution between 1995 and 2005
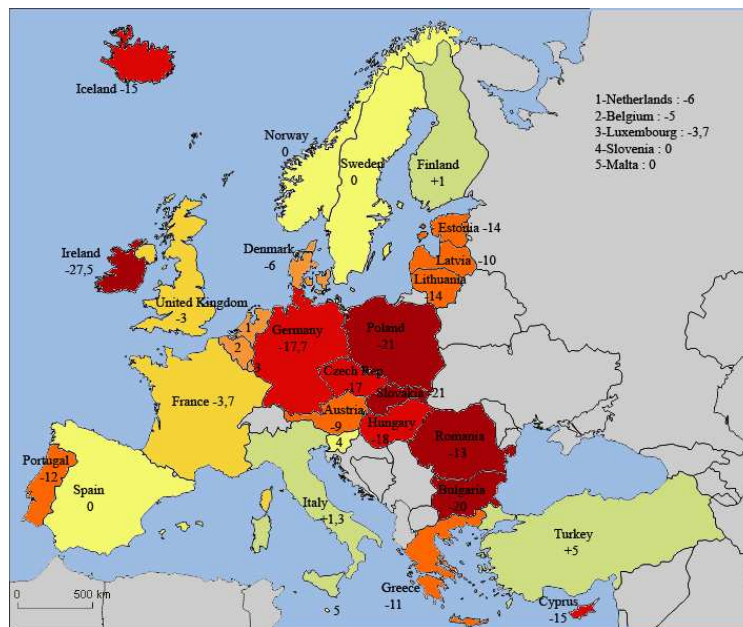
However, the map (1) shows the existence of strong disparities within the group of small countries but also in that of larges ones.

This tax rates decline was particularly strong in Ireland, Czech Republic, Slovakia, Portugal, Estonia, Lithuania and Cyprus. Thus, the most striking decline is attributable to Ireland (Figure 3a), whose rate has experienced a vertiginous fall from 40% to 12% in just over 10 years, showing a very clear tax strategy on behalf Irish governments. However, this decline is relative because it has been accompanied by a tax base broadening and the removal of MNF

specific arrangements. Thus, even if statutory tax rates have fallen, the implicit tax rates decline is less important. Slovakia has also pursued a very aggressive corporate tax policy (Figure 3a), decreasing its tax rate from 40% to 19% in just over 10 years. Portugal and the Czech Republic have also changed their tax rates in the same direction, but with a less pronounced decline (Figure 3a).

We can also refer to the sharp decline in tax rates in Estonia (Figure 3b) if we take into account the taxation of profits put to reserves (0%) instead of distributed profits (23%). We can ask whether in the long term corporate tax rates could be at zero. According to some economists as Artus (2006a), Mintz (1992) and Weichenrieder (2005), this hypothesis can not be excluded.

We can already make a very important remark: tax competition is more a small countries tax strategy rather than those of new entrants (10 CEEC). Indeed, we noticed that it is not only new entrants who have lowered their tax rates, but the majority of small EU countries. Proof of this is the sharp decline in Ireland and Portugal tax rates (Figure 3a). The proposal's corollary implies that the corporate tax rate will not go up in new small entrants countries at the end of the convergence process unless this strategy is ineffective and leads to budgetary problems.

*Figures 3 (a and b): Corporate tax rates evolution in small countries*
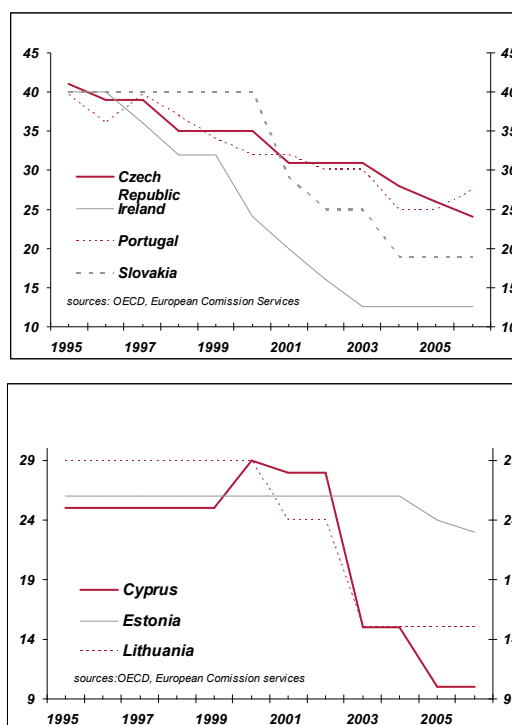
We can also observe different strategic behaviours within the group of larges countries. In general, facing the non-cooperative tax behaviour of smaller countries, the reaction of large countries was moderate. During the last decade, the trend has been downward, more or less, in all large countries. For example, France and, to a lesser extent, Italy and Great Britain (Figure 4) have experienced a slight decrease in tax rates, with an increase of rates in 1997 in France due to the change of government and in Italy in 2005 due to encountered budgetary difficulties. Faced with competition from smaller countries, Spain has been able to maintain its tax rate to 35% (Figure 4) thanks to the good health of its economy. Nevertheless, there should be from 2007, a decline of both the household income tax and the

corporate tax rate (expected to decline by 5 percentage points between 2007 and 2011). It was in Germany that the tax rate has most strongly fallen (Figure 4), declining from 56.6% in 1995 to 38.9% in 2001. This spectacular decline can be explained by the fact that Germany had the highest corporate tax rate in Europe. Since 2001, Germany did not lower its rate, but it should not continue since a fall of this rate is planned for 2007 to 30%.

The other only large country having significantly reduced its tax rate is Poland (Figure 4). Like Germany, Poland had a rather high tax rate (40%) in 1995 (larger than France). Moreover, a very important criterion not to omit is the distance to the European centre. Indeed, Poland being on the periphery, it will tend to lower its tax rate to offset agglomeration forces and attracts firms.

Thus, we observe that small countries impose a downward pressure on large countries which are constrained to respond by reducing in turn, their tax rates on mobile bases.

Figure 4: Corporate tax rates evolution in large countries
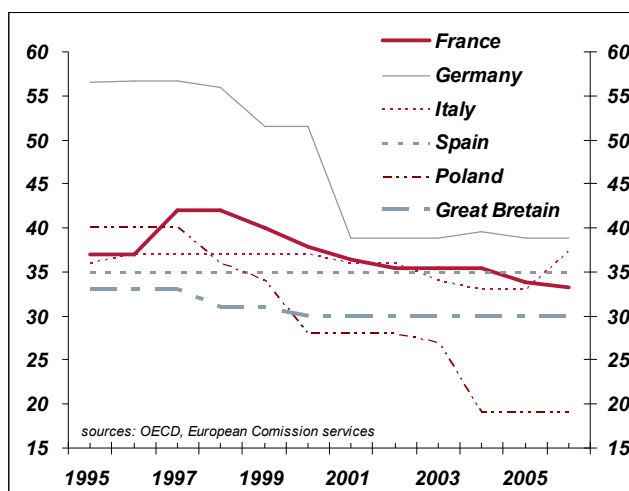
The theoretical tax rate evolution in all EU countries during the last decade lead to a corporate tax rate gap in favour of small countries (map 2).

Map 2: Corporate tax rates levels in 2006
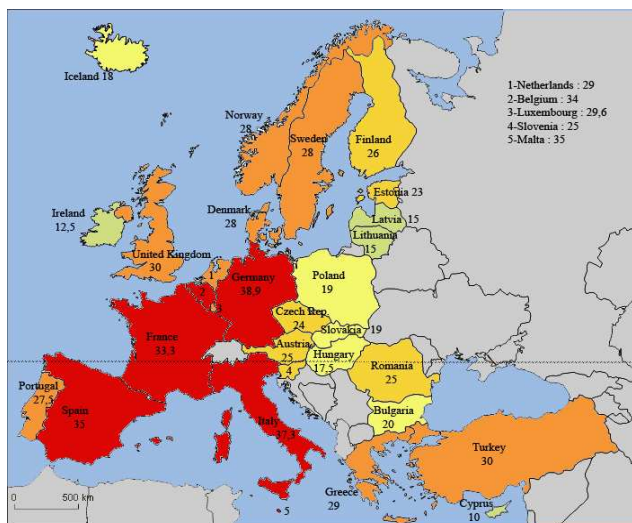
3 Tax competition Model

3.1 *Simple tax competition model*

We use a simple tax competition model to obtain national governments reaction functions. Reaction functions developed thereafter, based on Bruckner's theoretical model (1999, 2003), will treat only the competition on corporate tax rate, and not income, consumption or property tax rates, because it seems that tax competition primarily affects firms.

Thus, we will establish two types of reaction functions according to the game taken into account:

   - A Nash equilibrium where all countries set their tax rates simultaneously;

   - A Stackelberg equilibrium where a country or a group of countries set their tax rates first and other EU countries adopt a Follower behavior.

For simplicity, we are building a model of an economic area with two countries, generalizable with n countries, where capital (K_i) invested in the country i, i = 1.2, is perfectly mobile and labour (L_i) is considered as a fixed production factor. A private consumption good X_i is produced combining production factors according to a constant returns to scale technology. This production function is given by $F(K_i, L_i)$, written $f(k_i)$, where k_i is the number of capital per worker units. For simplicity, we assume the number of workers in each country i is equal to its population.

The economy is composed of two consumer goods, a private good X_i and a public good G_i.

A tax is levied on investment in each country, with t_i the tax rate per unit of capital in the country i. The firm profit function in the country i is defined as follows:

$$\Pi_i = f(k_i) - r.k_i - t_i.k_i \qquad (3.1)$$

With r, the common interest rate in the area

The profit maximization is equivalent to equalize the marginal productivity to the interest rate plus the tax rate:

$$f'(k_i) = r + t_i \qquad (3.2)$$

The capital net tax rate of return is equal to the marginal productivity less taxes. As capital is perfectly mobile, net returns should be equal in both countries:

$$f'(k_1) - t_1 = f'(k_2) - t_2 = r \qquad (3.3)$$

Where r is the uniform net return. Then, we note $\overline{K}$ the capital amount available in the area, thus obtaining the following condition:

$$\overline{K} = L_1.K_1 + L_2.K_2 \qquad (3.4)$$

Countries' capital endowments are equal and are equally distributed among workers, leading to individual endowments given by $k* = \overline{K} / (L_1 + L_2)$.

For simplicity, we specify an identical firm production function among countries:

$$f(k_i) = \beta . k_i - \frac{\alpha . k_i{}^2}{2} \qquad \text{where } \beta, \alpha > 0 \qquad (3.5)$$

Thus, equations (3.3) and (3.4) determine k_1, k_2, and r according to tax rates t_1 and t_2.

$$k_1 = \frac{t_2 - t_1}{\alpha} . \frac{L_2}{(L_1 + L_2)} + \frac{L_2}{L_1} k* \qquad (3.6)$$

$$k_2 = \frac{t_1 - t_2}{\alpha} . \frac{L_1}{(L_1 + L_2)} + \frac{L_1}{L_2} k* \qquad (3.6')$$

It is clear that the capital elasticity to tax rate is negative, $\partial k_i / \partial t_i = -\dfrac{L_2}{\alpha.(L_1 + L_2)} < 0$. Ceteris paribus, a tax rate increase in country i causes capital flight towards another country to equalize the net return. The rate of return derivative to the tax rate, $\partial r / \partial t_i$, is also negative, indicating the net return is reduced by higher tax rates.

We define a utility function for residents, U_i, having homogeneous preferences in each country. This utility function $U_i (X_i; G_i)$ is a trade-off between consumption of a private good X_i and a public good G_i.

Consumers' incomes (R_i) are composed of labour incomes (wages), $w_i = f(k_i) - k_i . f'(k_i)$ and capital endowments returns, rk*. The country i residents' budget constraint is:

$$x_i = w_i + r.k* \qquad (3.7)$$

We assume the public good is fully financed by tax on capital. We thus obtain the government fiscal constraint:

$$g_i = t_i . k_i \qquad (3.8)$$

Substituting w_i in (3.7), and using (3.8), we can rewrite the utility function in the following form:

$$U_i \left[f(k_i) - k_i . f'(k_i) + r.k*; t_i . k_i \right] \qquad (3.9)$$

Residents of country i choose t_i to maximize (3.9), taking into account tax rate effects on k_i and r. In addition, the tax rate is regarded as a constant.

Without loss of generality, we consider the utility function U_i as additive (linear preferences):

$$U_i(x_i; g_i) = x_i + \gamma_i g_i \tag{3.10}$$

Now the analytical framework is presented, we must consider different types of games that countries will participate.

3.2   Nash Equilibrium

Each government seeks to maximize the representative agent utility function under both public and private budget constraint. Thus, we maximize (3.10) subject to constraints (3.7) and (3.8).

$$\underset{\tau_i}{Max} U_i = f(k_i) - k_i.f'(k_i) + r.k * + \gamma_i.t_i.k_i \tag{3.11}$$

Nash equilibrium tax rates t_1 and t_2 are located at the intersection of countries 1 and 2 reaction functions. Substituting (3.6) into (3.11), the equation can be solved in order to obtain the reaction function of country 1:

$$t_1 = \left[\frac{L_2{}^2 - \gamma_1.L_2.(L_1 + L_2)}{L_2{}^2 - 2\gamma_1.L_2.(L_1 + L_2)} \right].t_2 + \lambda_1.k * \tag{3.12}$$

Where:

$$\lambda_1 = \left(\frac{\alpha.(L_1 + L_2)^2}{L_2{}^2 - 2\gamma_1.L_2.(L_1 + L_2)} \right)\left(\frac{L_2{}^2}{L_1.(L_1 + L_2)} + \frac{1}{2} - \gamma_1.\frac{L_2}{L_1} \right)$$

In the same way, we obtain the country 2 reaction function:

$$t_2 = \left[\frac{L_1{}^2 - \gamma_2.L_1.(L_1 + L_2)}{L_1{}^2 - 2\gamma_2.L_1.(L_1 + L_2)} \right].t_1 + \lambda_2.k * \tag{3.12'}$$

Where:

$$\lambda_2 = \left(\frac{\alpha.(L_1 + L_2)^2}{L_1{}^2 - 2\gamma_2.L_1.(L_1 + L_2)} \right)\left(\frac{L_1{}^2}{L_2.(L_1 + L_2)} + \frac{1}{2} - \gamma_2.\frac{L_1}{L_2} \right)$$

Rearranging (3.12) and (3.12), we obtain

$$t_1 = \left[\frac{1 - \gamma_1 / s_1}{1 - 2\gamma_1 / s_1} \right].t_2 + \lambda_1.k * \tag{3.13}$$

$$t_2 = \left[\frac{1 - \gamma_2 / s_2}{1 - 2\gamma_2 / s_2} \right].t_1 + \lambda_2.k * \tag{3.13'}$$

Where $s_1 = \dfrac{L_2}{(L_1 + L_2)}$ and $s_2 = \dfrac{L_1}{(L_1 + L_2)}$ are each population shares in the total area population.

Second order conditions to get a maximum in the optimization program requires $(1 - 2\gamma_1/s_1) < 0$ or $\gamma_1 > \dfrac{s_1}{2}$.

Thus, equation's (13) denominator is negative. Therefore, the reaction function slope, equal to $(1 - \gamma_1/s_1)/(1 - 2\gamma_1/s_1)$, is negative when $\dfrac{s_1}{2} < \gamma_1 < s_1$ and positive when $\gamma_1 > s_1$. In the same way for the second country, in order to maximize its optimization program, we need to have $\gamma_2 > \dfrac{s_2}{2}$ and conditions on the sign of the reaction function slope are symmetric, that is, negative when $\dfrac{s_2}{2} < \gamma_2 < s_2$ and positive if $\gamma_2 > s_2$.

This theoretical result indicates that country 1 will decrease (increase) its tax rate in response to an increase in country 2 when the marginal public good utility is small (large).

The intersection of the two reaction functions (3.13) and (3.13) gives the Nash equilibrium.

Equations (3.13) and (3.13') show that reaction functions both depend on country preferences and its size. Occulting the case where $\gamma_i = s_i$, the slope is different from zero. Thus, with econometric estimates, the empirical test to verify the strategic interactions existence will consist in checking the get parameter significance. Otherwise, this would tend to prove the absence of strategic interaction between European countries.

Suppose now both countries are of equal size, ie that $L_1 = L_2$, we obtain following reaction functions:

$$t_1 = \left[\frac{1 - 2\gamma_1}{1 - 4\gamma_1}\right].t_2 + \left[\frac{4\alpha(1 - \gamma_1)}{1 - 4\gamma_1}\right].k* \qquad (3.14)$$

$$t_2 = \left[\frac{1 - 2\gamma_2}{1 - 4\gamma_2}\right].t_1 + \left[\frac{4\alpha(1 - \gamma_2)}{1 - 4\gamma_2}\right].k* \qquad (3.14')$$

Thus, if both countries have same preferences, $\gamma_1 = \gamma_2 = \gamma$, both countries will react in the same proportion to changes in tax rates in the neighbouring country.

This two countries model is also valid for an N countries economic area. We empirically test this model in the case of the European Union where we strongly suspect tax strategic behaviours. The confirmation of this theory will consist in testing the significance of the reaction function slope in each country. If this test is significant, it will clearly indicate the presence of strategic behaviours within the European Union.

3.3   Stackelberg leader extension

In contrast to the theoretical Nash framework where all countries are considered on an equal footing, the Stackelberg model will afford to highlight the presence of leader(s) element(s) in the tax competition. Thus, we derive the model in a leader / follower framework, where the leader country set its tax rate first without taking into

account those in other countries. Then other follower countries will set their own taking into account the tax rate set in the first country.

For simplicity, we are always thinking in the context of a two countries model where we will adopt a two stages sequential approach (backward induction):

- Step 1: We determine the follower country's reaction function
- Step 2: We determine the leader country's reaction function

<u>Step 1</u>: Country 1, the follower, chose its tax rate t_1 depending on the leading country tax rate t_2.

Country 1 chooses its rate t_1 to maximize its utility function U_1 (X_1; G_1). This makes it possible to characterize the calculated previously best reaction function given by (3.13).

$$t^{follower} = \left[\frac{1 - \gamma_1 / s_1}{1 - 2\gamma_1 / s_1}\right] . t^{leader} + \lambda_1 . k* \qquad (3.15)$$

<u>Step 2</u>: Country 2, the leader, chooses t_2 to maximize its utility function, taking into account the country 1 best reaction function (BR1) in its utility function maximizing program, we get:

$$t^{leader} = \frac{[(AS_2 - S_2 + \gamma_2)(\lambda_1 S_2 + \alpha L_1 / L_2) - \alpha L_1 / L_2) - \alpha/2]}{[2S_2\gamma_2(1 - A) - S_2{}^2(1 - A)^2]} . k* \qquad (3.15')$$

With $A = \frac{(1 - \gamma_1 / S_1)}{(1 - 2\gamma_1 / S_1)} > 1$

The leader country sets its tax rate to maximize its inhabitant's welfare and follower countries act as in the case described previously in the Nash equilibrium.

From these two theoretical results (tax rates fixed in a Nash and Stackelberg framework), we will seek to empirically verify the earlier advanced argument where small EU countries practise tax competition.

4   Empirical methodology

4.1   Econometric specification

The empirical estimation underlying theory is a strategic tax competition model (Brueckner 1999, 2003) in a game where countries set their corporate tax rates simultaneously (Nash reaction function, Wildasin, 1988) or following the leader country's tax rate (Stackelberg reaction function). Empirically, we will estimate reaction functions in both cases for EU countries. We are in line with the few abundant literature dealing with estimation of national reaction functions (Devereux, Lockwood and Redoano, 2002, Redoano, 2003, Altshuler and Goodspeed, 2002, Ruiz, 2006).

We econometrically estimate the two following equations:

$$\tau_{i,t} = \delta + \beta \sum_{i \neq j} \omega_{ij} \tau_{j,t} + \theta X_{i,t} + \varphi d_i + \eta T_t + \varepsilon_i \qquad (4.1)$$

$$\tau_{i,t} = \delta + \beta \sum_{i \neq j} \omega_{ij} \tau_{j,t} + \theta X_{i,t} + \alpha \tau_{L,t-1} + \varphi d_i + \eta T_t + \varepsilon_i \qquad (4.2)$$

Where i represent country, t, the time, τ_i is the home country tax rate, $\tau_{j,t}$, are "neighbouring" countries tax rates, $\tau_{L,t-1}$ is the lagged leader tax rate, X_i is an exogenous vector of domestic socio-economic control variables, ω is a weighting matrix discussed later and $\alpha, \beta, \theta, \eta, \varphi$ are parameters to estimate, d_i being potential individual effects and T, an eventually trend necessary for the estimate, and ε_i, the error term. We detail the exogenous control variables in a later part.

Thus, slopes of Nash (4.1) and Stackelberg (4.2) reaction function are respectively β and α. According to the theoretical model, these slopes can be negatives because of the desire to maintain public expenditure, but we expect that these slopes are rather positives because of the high capital elasticity to tax rates.

4.2   Econometric estimation

We chose to use panel data to carry out this empirical study. Most of studies on tax competition were realized with cross section data. The panel method has several advantages; it enables to take into account the tax competition dynamics between countries without eliminating effects related to cross section information. In addition, the panel reduces the risk of colinearity among explanatory variables, since these variables are expressed in two dimensions. Finally, this approach makes it possible to cure the presence of time invariant omitted variables (unobservable individual correlated with some of explanatory variables).

According to the homogeneity tests procedure presented by Hsiao (1986) for the following regression:

$$Y_{i,t} = \alpha_i + \beta_i X_{i,t} + \varepsilon_{i,t}$$

The considered panel is then a panel with individual effects: the 26 vectors β_i can be considered as identical between countries while constants α_i differ among the 26 countries. Parameters α_i are considered as deterministic constants specific to each 26 countries. These parameters can correspond to omitted structural variables that may explain tax rates choice in different countries. The fixed effects model provides converging estimates, even when there is a correlation between explanatory variables and unobservable characteristics.

But when estimating (4.1) and (4.2), we were confronted with several problems often present in spatial econometrics (Anselin, 1988):

- Endogeneity of $\tau_{i,t}$
- The possible spatial dependence of error terms.

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4.2.1 Variables endogeneity

The presence of strategic interactions implies that tax rates, $\tau_{i,t}$ of different countries are jointly determined. Indeed, the theoretical model imposes a joint determination of tax rates in Nash equilibrium, and this simultaneity induces that the explanatory variable is endogenous what makes the use of OLS inconsistent.

There are three methods to solve this endogeneity issue:
- Estimate (4.1) with the method of Maximum Likelihood (ML)
- Using the method of Instrumental Variables or the Generalized Method of Moments (Anselin 1988).
- This endogeneity problem can be avoided by assuming that interactions take place with one or more delay. In this case, $\tau_{j,t}$ would be replaced by $\tau_{j,t-n}$ in (4.1) where the number of lags will be determined.

We chose to estimate the equation (4.1) with the Generalized Method of Moments. This method is also consistent with the second potential econometric problem that may be the errors spatial dependence.

4.2.2 Spatial dependence of errors

The spatial autocorrelation is the "correlation of a variable with itself (autocorrelation) attributable to the data geographic organization (spatial)" (Griffith, 1992)
To check the absence of errors autocorrelation, it is important to carry out this test in order to eliminate fallacious estimation risks:
- Risk of having estimated standard deviations bias, estimators remaining however unbiased.
- Risk of common shock presence producing a correlation between tax rates of a country and those of neighbours and that this correlation wrongly leads to conclude that neighbouring rates affect the rate of a given country, whereas actually it is not the case. This is a well-known risk in spatial econometrics (Anselin 1988).

The Moran statistical test is the most used in the detection of spatial autocorrelation (see Anselin & al, 1996; Anselin and Kelejian, 1997). Thus, the Moran statistics calculation allows to determine for each country if the tax rate is fixed randomly compared to the geographical proximity (in this case, the statistic is not significant), and therefore if there is a spatial autocorrelation (positive or negative) with the setting of tax rates between countries.
This confirms the existence of positive spatial autocorrelation between series.

To overcome these econometric issues, two estimation methods are possible. The first consists in regressing the equation (4.1) with the method of Maximum Likelihood taking into account the error structure described in (4.3). This method has been explored by Case et al (1993). Another approach is to use the Instrumental Variables method.
The estimation method chosen was that of Generalized Moments (GMM). Kelejian and Prucha (1998) have shown that with the presence of spatial dependence of errors, instrumental variables method, and therefore the Method of Moments provide a robust estimate of β. With several exogenous structural variables it seemed more conducive to use this method.

We must now take into account the neighbouring countries influence of on the domestic country by building weighting matrices.

4.2.3 Weighting Matrices

In reality, a country has generally more than one neighbour, it is important to order the influence of its neighbours on the domestic country by building weighting matrices. These weightings will be used to measure the impact of a neighbour on a country by assigning it a value. Thus, we will evaluate the influence for each pair of states.

Weights of the weighting matrix ω are constructed to take into account the influence of tax rates of each country considered as a "neighbour" on the home country's tax rate. In order to identify all possible influences, we opted for the construction of 3 weighting matrices:

- **Geographic weight :**
  - Distance matrices:
    - Distance between countries : $\omega_{ij}^d = \dfrac{1}{d_{ij}} \bigg/ \sum_j \dfrac{1}{d_{ij}}$

Where ω_{ij}^d are the *ij* elements of the weighting matrix W^d and d_{ij} is the geographical distance between country *i* and country *j*. Unlike most studies, we do not take the distance between capitals of each country, but the weighted distance calculated by Mayer and Zignago (CEPII), considering several cities in the country in order to take into account the geographic distribution of population within the country.

    - Distance to the centre (Belgium-Brussels) : $\omega_{ic}^d = \dfrac{1}{d_{ic}} \bigg/ \sum_j \dfrac{1}{d_{ic}}$

As with the previous matrix, the distance from the centre is weighted by the geographical distribution within each country.

- **Economic weight :**
  - GDP : $\omega_{ijt}^{gdp} = \dfrac{1}{(GDP_{it} - GDP_{jt})} \bigg/ \sum_{jt} \dfrac{1}{(GDP_{it} - GDP_{jt})}$

The distance weighting ω_{ij}^d, where geographically closest countries have a larger impact, seems to be the most obvious. However, with the New Geographic Economy contribution, it seemed important to build a matrix of weights from the centre, supposed to be Brussels in our study, to take into account agglomeration forces in the tax rate setting process. Indeed, more a country is close to the centre, less it will be influenced by tax choices of peripheral countries. This does not call into question our initial hypothesis that small countries are tax competition instigators, because those are mostly at the European Union periphery.

We also add a notion of "economic neighbour" to take into account the size of countries and their possible similar behaviours. Indeed, large countries having much heavier economic structures than smaller countries, it seems clear that they do not have the same capacities of reaction, either in time and magnitude of changes. Thus, we consider a GDP weighting matrix. It should be noted that this matrix may vary over time. We note that each matrix is normalized to 1, thereby encouraging comparisons and index construction such as that of Moran used to test the autocorrelation.

4.3   Data and variables

We estimate models (4.1) and (4.2) using time series data of 25 European Union countries, before the integration of Bulgaria and Romania in January 2007, plus Iceland over the period 1995 - 2006. We have deliberately chosen to begin the period of study in 1995 as the majority of countries of the former Warsaw Pact and the Soviet Union have started their conversion towards a market economy only a few years after their emancipation. The explained variable, $\tau_{j,t}$, is represented by top statutory tax rates. These data are derived from the OECD and the European Commission database. This choice reflects the importance of this rate in the tax pressure evaluation by firms prevailing in a country. Moreover, it represents more than 40% of income from taxation (Redoano, 2003). We concentrate only on the corporate tax rate because it seems it is the principal tool of tax competition between states; tax competition on high incomes being more marginal, and unproven (Devereux, Lockwood, Redoano, 2004). We use statutory tax rates rather than effective (simulated) tax rates because first ones appear to be more relevant as signal effect to the firms' attention. Indeed, Devereux, Lockwood, Redoano (2004) have shown that the effective marginal corporate tax rate (EMTR) is not relevant in order to reflect strategic interactions. This is in line with our expectations, because this rate is more used to note the after tax return of a marginal investment.

Geographic weightings are carried out from dyadic data calculated by Mayer and Zignago (CEPII). We use weighted distances to take account of the population geographical distribution within the country. Economic weights are computed from GDP data available on the DRI database.

Finally, instrumental variables and control variables take into account for each country:

- The share of public expenditure in GDP,
- The deficit,
- The domestic demand
- The direct investment as a % of GDP
- The unemployment rate,
- GDP,
- The GDP per capita,
- The share of over 60 years in the population

The presence of these variables is warranted to reflect the structural constraints weight present in national economies. Indeed, a relatively large country with important public expenditure will be inclined to respond less quickly and less intensely to lower tax rates in other countries. Moreover, the presence of variables such as GDP, GDP per capita and the deficit as a % of GDP makes it possible to take into account positive and negative shocks

on national economy which would affect consequently the tax rate level in the country. These data are derived from the Datastream database.

For our estimates, we have verified that all these series were stationary, whether they are dependent or explanatory variables. When that did not happen, we make them stationary to make sure of our estimates accuracy.

5   Results

In this part, we test countries reaction delays to other European countries tax policies. We demonstrate that there is a group of leaders in the tax competition but also succeed in characterizing this group of leading countries. The first step is to demonstrate that small countries, taken as a whole, are tax competition leaders. Then we establish a distinction according to the geographical location of these countries within Europe. So we separate the group of small countries into two groups: "integrated" (located in the centre of Europe) and "distant" (located at the periphery). It appears that only the "integrated" group plays a significant role in corporate tax rate setting of larges countries. Lastly, the third stage is to determine whether a small country, taken individually, plays a leading role in the tax competition.

5.1   Existence of strategic behaviours in the EU

While regressing each country tax rate on tax rates of other countries in the European Union, we found the presence of strategic interactions within the European Union (Chatelais and Peyrat 2008). Table (4) also shows that countries observe their neighbours fiscal policies and respond the following year. Indeed, taking account of a tax reform in a neighbouring country, the home country will develop a new tax schedule by changing its rates the following year in order to stop capital flight. We note that the domestic country's reaction is more than proportional compared to the tax rates decline in countries with a common border (estimated coefficients are respectively 1.35 and 1.84 for distance to the centre and bilateral distances matrices). This can be explained by the fact that the country reacts to tax rates falls in other countries but it also anticipates its neighbour's reaction to its own lower tax rates and / or tries to attract taxable incomes. Countries react more strongly to their closest geographical neighbours' tax rate since a tax rates fall can jeopardize access to the market known as "home market bias". Indeed, a firm may locate in the neighbouring country, taking advantage of a more attractive tax system, while having access to the domestic market at a lower cost. The distance to the centre criterion also appears to be important in the decision-making process and in reaction. Countries, including small distant ones, will be attentive with core countries' fiscal policies and will tend to react by lowering their tax rates more sharply in order to compensate for agglomeration forces present in the centre.

However, for estimates made with the GDP weighting matrix, we found similar coefficients with one lag (1.00) or none (1.08). Finally, we can note that estimates with two lags of delays are not significant. This suggests that countries react quickly, usually in the following year. This delay is an average, some countries will react faster, theoretically small ones, while others will take longer to respond, probably larger ones.

Table 4: **Reaction function estimates with and without lags for all countries of UE for 1995-2006**

Dependent variable : $d\tau_i$ (corporate tax rate)

GMM with individuals fixed effects

Explanatory Variables:	Coefficients Estimates		
	Wcentre	Wdistance	Wgdp
$d\tau_j$	0,97**	0,95*	1,08***
	(2,15)	(1,85)	(3,92)
$d\tau_j(1)$	1,35**	1,84*	1,00**
	(2,05)	(1,85)	(2,12)
R^2	0,16 [0,11]	0,13 [0,08]	0,15 [0,14]
Sum squared resid	889 [940]	1129 [1097]	899 [909]
DW	1,92 [2,01]	2,02 [2,16]	2,03 [2,00]
J-stat	7,37 [12,46]	3,55 [4,84]	7,27 [8,97]

t-stat in bracket

* statistic significance level at 10%, ** à 5% et *** à 1%

Regressions statistics between [ ] concern estimations with one lag.

This first empirical part of the study allows establishing the presence of strategic behaviours within countries of the European Union. In addition, it appears that countries will react more to their neighbours' tax policies after one year. According to the theory developed in the preceding parts and initial estimates, we can assume that there are leading countries in the tax competition and that they are small countries. We thus now try to detect the influence of small European countries on tax rates set in large countries. We carry out estimates for the group of large and small countries which enable to highlight the greatest reactivity of small countries compared to large ones. In other words, we sought to determine whether small countries implement aggressive tax strategy vis-à-vis big countries.

5.2   Small countries: leaders of the tax competition in Europe.

According to the theory developed previously, we expect that small countries of the European Union apply aggressive lowering tax rate strategy vis-à-vis larges countries in order to attract taxable incomes. The fact that countries wait to note others tax policy before making their own reforms suggest the existence of leaders in the falling tax rates process.

According to table (5), Chatelais and Peyrat (2008) find that tax interactions are stronger between small countries than in all European countries or among large countries. These interactions are weak or even non-existent within the group of larges countries (see Table 5).

The presence of strategic interactions being established, we show that small European countries are at the origin of this tax competition.

We continue with panel estimates. A group of 8 small countries will play the Stackelberg leader role. This group is defined as follows: Belgium, Denmark, Czech Republic, Ireland, Portugal, Slovakia, Lithuania and Latvia. The average tax rate of this group was calculated using three weights: the distance from the centre, the weight of GDP and population.

Dependent variable : dτ_i (corporate tax rate)

GMM with individuals fixed effects

Explanatory Variables:	Coefficients Estimates		
	Wcentre	Wdistance	Wgdp
dτ_j small countries	1,05**	1,07**	1,13***
	(2,04)	(2,07)	(4,20)
dτ_j large countries	0,70*	0,78*	0,52
	(1,78)	(1,87)	(0,79)
R²	0,12 [0,05]	0,12 [0,03]	0,13 [0,15]
Sum squared resid	708 [290]	875 [267]	703 [224]
DW	1,89 [2,08]	2,00 [2,04]	2,05 [1,90]
J-stat	5,79 [0,95]	2,71 [2,97]	4,38 [4,59]

t-stat in bracket

* statistic significance level at 10%, ** à 5% et *** à 1%

Regressions statistics between [ ] concern estimations with for the large countries group (Germany, France, United Kingdom, Italy, Spain and Poland)

Results of the table (6) show estimates of the following equation conducted with the three weighting matrices (distance from the centre, distance and weight of bilateral GDP):

$$\tau_{i,t} = \delta + \beta \sum_{i \neq j} \omega_{ij} \tau_{j,t} + \theta X_{i,t} + \alpha \tau_{L,t-1} + \varepsilon_i \qquad (4.1)$$

Table 6: **Reaction function estimates for large EU countries over 1995-2006**
with all small countries as leaders

Dependent variable : dτ_i (corporate tax rate)

GMM with individuals fixed effects

Explanatory Variables:	Coefficients Estimates		
	Wcentre	Wdistance	Wgdp
dWτ	0,48	0,06	0,87
	(1,11)	(0,14)	(1,32)
Dleader(2)	2,18**	2,76**	2,48**
	(1,95)	(2,26)	(1,96)
Constant	2,13*	2,39*	2,57
	(1,72)	(1,80)	(1,65)
R²	0,07	0,09	0,03
Sum squared resid	248	253	310
DW	2,08	2,11	2,06
J-stat	2,61	2,91	2,08

t-stat in bracket
* statistic significance level at 10%, ** à 5% et *** à 1%

Estimates with distance from the centre weight and bilateral distances weight produce conclusive results (unlike those obtained with the GDP weight, estimated coefficients are significantly different from zero). The detailed results below were achieved with weighting by the distance from the centre. Most of large countries being in the European Union core , it appears that they are more influenced by the change in tax rates of small countries close to the centre.

However, it should be noted that there is no strategic behaviour among major countries when we add the group of small countries leaders of Stackelberg in the regression. This may indicate that the pressure that small countries impose on large ones is strong enough to that competition between major appears negligible (and is not revealed in econometric regressions).

In conclusion, we show that small countries impose a (downward) pressure on large countries' corporate tax rates. It would be interesting to make a distinction between small countries to see those having the most influence on larges ones. Indeed, we should remember that we weighted the tax rate of the eight small countries group by their distance from the centre (small countries close to the core and thus close to large ones have the most weight). We assume that small countries close to the centre and those at the periphery do not have the same impact on tax rates setting in big countries.

5.3 Small countries close to the centre are the "real" tax competition leaders

The importance of the small countries group in tax rate setting has been demonstrated. We refine this analysis by distinguishing small countries close to the centre and those at the periphery. Indeed, small countries are very numerous (20 "small" against 6 "big") in the European Union, we make a distinction within this category. Our assumption is that small countries close to the centre have the most influence on core major countries and consequently they are the real instigators of this tax competition. Big countries always adopt a position of follower with respect to these small countries integrated to the centre rather than vis-à-vis small peripheral countries.

We split our sample of small countries into two groups: "integrated ones" close to the Economic heart and "distant ones"

- "integrated": Ireland, Belgium, the Netherlands, Luxembourg, Denmark, Austria, Slovenia and Czech Republic
- "distant": Sweden, Finland, Estonia, Latvia, Lithuania, Hungary, Slovakia, Greece, Portugal, Cyprus, Malta, and Iceland.

This separation was done only on geographical criteria, and the absence of Scandinavian countries in the "integrated" category is justified. The 6 big remaining countries (Germany, France, Great Britain, Spain, Italy and Poland) are the third group of countries.

The so-called "integrated" countries

Table (7) summarizes estimates made with the group of small integrated countries. Small countries have indeed a central influence on tax rate established in large countries (for both geographical weighting matrices). Big countries always react with two years late and always strongly with a coefficient greater than 2. Small countries integrated to the centre plays a leadership role vis-à-vis big countries in tax rate setting. It should be noted in this case, there is the presence of strategic interactions among major countries. However, rates in large neighbouring countries are less important than rates set in small integrated countries. But remember that large countries such as France and Spain have not yet done so their tax reform in 2006, which are planned for coming months.

Dependent variable : $d\tau_i$ (corporate tax rate)

GMM with individuals fixed effects

Explanatory Variables:	Coefficients Estimates		
	Wcentre	Wdistance	Wgdp
dWt	0,90***	1,00**	1,20**
	(2,54)	(2,65)	(2,24)
Integrated Leader (2)	2,57*	2,17*	2,14
	(1,81)	(1,82)	(1,50)
Constant	2,34	2,01	1,81
	(1,54)	(1,55)	(1,23)
R²	0,15	0,11	0,09
Sum squared resid	328	322	322
DW	1,97	1,98	2,01
J-stat	2,32	1,78	1,81

t-stat in bracket

* statistic significance level at 10%, ** à 5% et *** à 1%

Thus small "integrated" countries are leaders in the big countries corporate tax rate setting. Now let us consider if we can demonstrate whether the same was true for small countries located at the periphery.

Small "peripheral" countries

How large countries do react in dealing with changes in tax policies of small peripheral countries? Table (8) shows there is a weak influence of small distant countries or even a lack of influence if we refer to the distances matrix. Estimated coefficients are 0.53 for weighting by the distance from the centre and 0.64 for that by the GDP.

Table8: **Reaction function estimates for large EU countries over 1995-2006 with small peripheral countries as leaders**

Dependent variable : $d\tau_i$ (corporate tax rate)

GMM with individuals fixed effects

Explanatory Variables:	Coefficients Estimates		
	Wcentre	Wdistance	Wgdp
dWt	-0,08	0,48	0,68
	(-0,22)	(1,14)	(1,38)
Periphery leader(2)	0,53*	0,18	0,64*
	(1,75)	(0,61)	(1,71)
Constant	0,13	-0,05	0,87
	(0,25)	(-0,10)	(1,10)
R²	0,26	0,18	0,14
Sum squared resid	184	205	250
DW	2,19	2,12	2,15
J-stat	10,79	12,64	5,80

t-stat in bracket

* statistic significance level at 10%, ** à 5% et *** à 1%

These coefficients are significantly lower than those found for the group of small countries taken as a whole or for the group of small integrated countries. We deduce from it that small peripheral European countries have very little influence on the tax rate setting in large countries.

Small countries integrated to the centre have much more influence than small distant countries on big countries tax policies and therefore play a leading role vis-à-vis larges countries. Finally, in this last part of the analysis, we demonstrate that a small individual country is playing a leading role in the tax competition. We concentrate on small core countries without neglecting some peripheral nations that have experienced tremendous reductions in their tax rate.

5.4   *Existence of individual leader in the tax competition*

Tests conducted earlier indicate that the group of small "integrated" countries is the tax competition ringleaders in Europe. We assume that one of these countries can be a leader: Ireland, Czech Republic, the Netherlands, Belgium or Denmark. These countries have experienced significant reductions in their tax rate, but they do not have the same location within the European Union and have different levels of development. That is why we think relevant to test whether one or several of them, taking into account their characteristics, could be leaders.

Table (9) reveals that only Ireland and Belgium can be considered as individual leaders for major countries, but have different influences. While Ireland has a relatively weak impact (0.40), but quite real, Belgium tax rate reductions play an important role in tax reforms of its large neighbours. Similarly the table (10) shows that there are strategic interactions between some peripheral countries with respect to large countries. These are Slovakia, whose influence is quite weak (0.24) and Lithuania whose influence is similar to that of Ireland (0.48).

Table 9: Reaction function estimates for large EU countries over 1995-2006 with small integrated countries as leaders

Dependent variable : $d\tau_i$ (corporate tax rate)

GMM with individuals fixed effects

Weighting by bilateral distances

Explanatory Variables:	Coefficients Estimates				
	Ireland	*Denmark*	*Netherlands*	*Czech Republic*	*Belgium*
WT	0,87**	0,85	0,99**	1,30**	-1,64*
	(2,07)	(1,64)	(2,60)	(2,36)	(-2,34)
leaders(2)	0,40*	0,38	0,81	-0,65	1,01**
	(1,76)	(0,56)	(1,45)	(-1,42)	(2,37)
Constant	0,81	0,22	0,41	-0,52	-1,89**
	(1,40)	(0,23)	(0,66)	(-0,64)	(-2,37)
R²	0,14	0,04	0,10	0,07	0,07
Sum squared resid	287	240	277	340	231
DW	2,02	2,09	2,02	2,25	2,09
J-stat	6,28	2,57	4,29	7,12	8,36

t-stat in bracket

* statistic significance level at 10%, ** à 5% et *** à 1%

Table 10: **Reaction function estimates for large EU countries over 1995-2006 with small peripheral countries as leaders**

Dependent variable : $d\tau_i$ (corporate tax rate)

GMM with individuals fixed effects

Weighting by bilateral distances

	Coefficients Estimates			
Explanatory Variables:	Slovakia	Portugal	Lithuania	Latvia
WT	0,57*	0,65**	-0,33	-0,56*
	(1,71)	(2,03)	(-0,68)	(1,75)
leaders	0,24*	-0,06	0,49*	0,18
	(1,70)	(-0,22)	(1,88)	(0,70)
Constant	0,57	-0,30	-0,24	-0,05
	(0,68)	(-0,50)	(-0,65)	(-0,12)
R²	0,05	0,12	0,34	0,14
Sum squared resid	238	219	163	214
DW	2,18	2,11	2,07	2,12
J-stat	8,95	1,94	11,13	4,43

t-stat in bracket

* statistic significance level at 10%, ** à 5% et *** à 1%

In conclusion, we have highlighted the existence of a tax competition leading countries group in Europe. We first demonstrated that this is the group of small countries. Then, refining our analysis, that only small countries at the centre of Europe (and therefore close to large countries) have a real influence on the corporate tax rate setting strategy.

Moreover, it seems that, apart from Belgium, small individual countries have very little influence on the setting of tax rates in large countries. Big countries react more to tax policies noted in small countries at the centre taken as a whole. We can ask whether in addition to a size effect, a group effect can exist. The fact that only one country lowers its tax rates has certainly less impact on large countries policies if several small countries lower tax their rates in a short period of time.

6   Conclusion

The tax competition in Europe has a significant impact on national economies and obliges countries to take into account their neighbours fiscal behaviours. Our theoretical argument is that small countries of the European Union are at the origin of the tax competition and impose a downward pressure on corporate tax rates. Small countries practise this non-cooperative strategy because of the existence of a size effect. Indeed, the capital transfer is relatively more important for a small country than for a large one.

We demonstrate in this study, the presence of strategic interactions between European Union countries and especially the leading role of small countries in the tax competition. Specifically, consideration by large core countries of fiscal policies of small countries integrated to the centre has been demonstrated. This is confirmed by future tax reforms in big major countries. Indeed, we note a decline in the German corporate tax rate to 38.4% in 2007 which is expected to continue in 2008 to 29.9%. The same conclusion is drawn in Spain which is expected to pass its initial tax rate (35%) to 32.5% in 2007 and then to 30% in 2008. No drop in rates has been recorded in France, but the Sarkozy government seems inclined to drop very sharply in the next two years. United Kingdom will also reduce its tax rate by two percentage points in 2008 to be decreased to 28%. Thus, we see clearly that tax rates of major

countries are under downward pressure and nothing seems to indicate a stop of the tax competition in years ahead. Indeed some small countries continue to cut their tax rate. We can quote Slovenia which is carrying out successive falls of a point per year between 2006 and 2010, making pass its rate from 25% to 20%. The Netherlands, a country integrated to the centre, also dropped its tax rate from 29% to 25.5% in 2007. This trend is confirmed in Denmark with a drop of 3 percentage points in 2007. Small peripheral countries would not be outdone as the Czech Republic (-5 points by 2010), Estonia (-2.2 points by 2010), Finland (-1 point in 2007), Greece (-4 points in 2007), Hungary (-1.5 points in 2007) and Portugal (-2.5 points in 2007) have also expected declines in their corporate tax rate.

Thus, we have clearly demonstrated the important role of small countries in the European tax competition as well as the downward pressure on large countries tax rates. This downward trend seems far from being finished and brings back on the scene front the problem of political good-will in order to create pretence of cooperation within the EU.

Bibliography:

Artus, P. (2006). *Absence de coordination budgétaire, fiscale et sociale dans l'Union Européenne : une grille d'analyse,* Flash 227, Ixis-cib

Altshuler, R. & Goodspeed, T. (2002). *Follow the leader? Evidence on European and US tax competition.* Department of economics working papers, Rutger University.

Anselin, L. (1988). *Spatial Econometrics: Methods and Models* Dordrecht: Kluwer Academic Publishers.

Anselin, L, Le Gallo, J & Jayet, H. Spatial Panel Econometrics, chapter 18.

Baldwin, R. & Krugman, P. (2004). *Agglomeration, Integration and Tax Harmonization.* NBER working paper, (9290), pp 23.

Brueckner, J K. (1999). *Testing for Strategic Interaction among Local Governments: The Case of Growth Controls.* Journal of Urban Economics 44(3), 438-467.

Brueckner, J K. (2003). *Strategic interaction among governments: An overview of empirical studies.* International Regional Science Review, 26(2), April pp 175-188.

Bucovetsky, S. (1991)*Asymmetric Tax Competition.* Journal of Urban Economics, vol.30(2):pp 167-181, September.

Chatelais, N., & Peyrat, M. (2008). *Comportements stratégiques fiscaux des pays en Europe.* Working Paper, Documents de travail du Centre d'Economie de la Sorbonne. Forthcoming.

European Commission. (2003). *Structures of the taxation systems in the European Union.* Technical report, European Commission.

Devereux, M., Lockwood, B., & Redoano, M. (2004). *Do Countries Compete over Corporate Tax Rates?* CEPR Discussion Paper No. 3400.

Devereux, M., Griffith, R. & Klemm, A. (2002). *Corporate income tax reforms and international tax competition.* Economic Policy, 35, pp 451-495.

Hsiao, C. (1986). *Analysis of Panel Data*, Econometric society Monographs N011. Cambridge Universirty Press.

Huizinga, H. & Nicodeme, G. (2006). *Foreign ownership and corporate income taxation: An empirical evaluation.* European Economic Review, Elsevier, vol. 50(5), pages 1223-1244, July

Kelejian, H. & Prucha, I. (1998). *A Generalized Spatial Two-Stage Least Squares Procedure for Estimating a Spatial Autoregressive Model with Autoregressive Disturbances.* Journal of Real Estate Finance and Economics 17(1): pp 99-121.

Mintz, J., (1992)? *Is there a Future fo Capital Income Taxation?*. OCDE Economics Department Working Papers, n 108

Redoano, M. (2003). *Fiscal Interactions among European Countries*. Warwick Economic Research Papers, 680.

Ruiz, F. (2006). *Is there evidence of strategic corporate tax interaction among EU Countries?*, FUCaM

Tiebout, C. (1956). *A pure theory of public expenditure*. Journal of Public Economy 64 , pp 416-424

Weichenrieder, A. (2005). *(Why) Do we need Corporate Taxation?* CESifo Working Paper Series

Wildasin, D. (1988). *Nash Equilibria in Models of Fiscal Competition*, Journal of Public Economics 35, pp 229-240.

Wildasin, D. (2003). *Fiscal competition in space and time*. Journal of Public Economics, 87: pp 2571-2588.

Wilson, J.(1991). *Tax Competition with Interregional Differences in Factor Endowments*. Regional Science and Urban Economics 21, pp 423-51.

Wilson, J. (1999).*Theories of Tax Competition*. National Tax Journal 52, pp 269-304.

Zodrow, G.. & Mieszkowski, P. (1986). *Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods*. Journal of Urban Economics 19, pp 356-370.