Rate Cutting Tax Reforms and Corporate Tax Competition in Europe*

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Abstract

While there is a large and growing number of studies on the determinants of corporate tax rates, the literature has so far ignored the fact that the behavior of governments in setting tax rates is often best described as a discrete choice decision problem. We set up an empirical model that relates a government's decision whether to cut its corporate tax rate to the country's own inherited tax and taxes in neighboring countries. Using comprehensive data on corporate tax reforms in Europe since 1980, we find evidence suggesting that the position in terms of the tax burden imposed on corporate income relative to geographical neighbors strongly affects the probability of rate cutting tax reforms. Countries are particularly likely to cut their statutory tax rate if the inherited tax is high and if they are exposed to low-tax neighbors.

Keywords: Tax reform, tax competition, corporate taxes

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1 Introduction

During the last decades, corporate income tax policies in European countries have been characterized by frequent rate cutting tax reforms, resulting in a significant downward trend in statutory tax rates. While the average statutory corporate tax rate for 12 Western European countries amounted to 46% in 1980 it declined to 40% in 1990 and, even further, 28% in 2007 for the identical set of countries. Single country examples demonstrate the downward trend even more impressively: In the early eighties, Sweden's companies faced a statutory tax rate of 66%. Subsequently, this rate was slashed down to 30% in 1991 and further to 28% later on. Large European countries like Germany show a similar profile albeit with a more prolonged adjustment: Starting with a tax rate of 62% on retained profits in 1980, the German rate only fell gradually to 57% in 1995 before it was cut back to 39% in 2001 and 30% in 2008. In that downward movement, the new member states of the EU have been among the pioneers of a particularly aggressive low tax policy. For instance, Poland gradually cut back the corporate tax from 40% in 1996 to 19% in 2004. But while these facts are hardly disputable, the driving forces behind what is often perceived as a 'race to the bottom' in corporate tax rates are less clear. Two fundamentally different explanations exist.

First, the downward trend of corporate taxes observable in the EU over the last 25 years may reflect increased competitive pressure on national tax policies. The literature has discussed several forms of competition leading to cross border links in tax policies, ranging from capital mobility and the mobility of

profits to yardstick competition.[1] These explanations have in common that they imply a strategic interaction between national governments so that tax policy decisions of one country trigger reactions of other countries with a more or less pronounced spatial pattern.

Second - and fundamentally different - the convergence of tax rates at lower levels could equally well mirror phenomena unrelated to any cross-border links of tax policies among European countries. Slemrod (2004) points to the fact that internationally similar changes in the domestic economic or political environment may have caused the decline in the corporate tax rate. The political preference for a high corporate tax as a necessary element of a progressive tax system may have become weaker in industrial countries as a consequence of common intellectual trends or shifts in ideology. Alternatively, a general tendency to improve labor incentives through a lower top marginal income tax rate may have paved the way for a lower corporate tax rate. The link between corporate and labor income tax rates follows from the back stop function of the the corporate tax for the reclassification of labor income as business income.

Understanding the forces behind the downward trend in corporate taxes is crucial for many important policy issues in the EU like the introduction of minimum taxes and tax harmonization in general. Therefore, our study aims at testing for the existence of cross-border links in corporate tax policy decision making. While a sizable part of the empirical tax competition literature has dealt with the correlation between a given country's tax rate and taxes of

[1] See, e.g., Devereux et al. (2008) and Fuest et al. (2005) for a general discussion and Besley and Case (1995), Revelli (2001), Revelli (2002), Bordignon et al. (2003) and Vermeir and Heyndels (2006) for work addressing yardstick competition among states and local jurisdictions.

other countries, we focus on actual decisions of national governments to cut their country's corporate tax rate. Our empirical model relates an indicator for rate cutting reforms to a country's own tax rate and neighbors' taxes. We therefore test to what degree a country's position in terms of the tax burden on corporate income relative to its geographical neighbors affects the probability of rate cutting tax reforms.

Focusing on rate cutting tax reforms is advantageous for a simple reason: Since they are the outcome of complex political decision making processes, tax rates are characterized by substantial inertia, i.e. in many countries they do not change very frequently. Sweden which, as mentioned, cut its tax rate substantially in the early nineties, kept its rate stable between 1994 and 2008. Similar patterns with periods of at least five years of rate stability could be observed since 1990 in numerous Western European countries such as Austria, Belgium, Denmark, Finland, Ireland, Netherlands, Norway, Portugal, Spain and the United Kingdom. From a practical point of view, the tax setting behavior of governments should therefore be described as a discrete choice decision problem rather than a process of continuous adjustment of taxes to optimal levels. Moreover, if governments tend to choose their tax rate at one point in time to then keep it constant for a couple of years, one might well overstate the actual degree of interaction in the choice of the tax rate by collecting data over many years and treating observations for a given country as independent observations.

To the best of our knowledge, we provide the first analysis of the determinants of rate cutting tax reforms. However, our study is closely related to other con-

tributions to the well established literature on the determinants of corporate tax policy. A first strand of relevant literature deals with the impact of increased economic integration on corporate tax rates. Rodrik (1997), Swank and Steinmo (2002), Slemrod (2004), Winner (2005), Schwarz (2007) and Ghinamo et al. (2007) all find that increased openness is associated with lower levels of company tax rates[2], thus providing suggestive evidence on the role of international tax competition in shaping national tax policies. A second strand of literature explicitly tests for interaction in national tax policies and directly estimates tax reaction functions. Recently, Devereux et al. (2008) have dealt with competition in statutory tax rates as well as tax levels attributable to marginal investments among OECD countries. As Redoano (2007) and Davies and Voget (2008), they find that tax levels are positively related to other countries' taxes. Similarly, Egger et al. (2007) find positively sloped reaction functions for both corporate and personal income taxes. Haufler et al. (2009) discuss the effect of capital mobility on the ratio between corporate income tax to labor income tax and report evidence suggesting that the relative level of a country's corporate tax develops in accordance to the worldwide average of corporate tax rates over time.

Compared to the estimation of tax reaction functions our approach more directly addresses the discrete political decisions that eventually have led to what is one of the most intensely debated issues in corporate taxation in Europe: national governments being engaged in a step-by-step process of cutting

[2]Swank and Steinmo (2002) and Bretschger and Hettich (2002, 2005) estimate insignificant effects of capital market liberalization on company tax rates computed in accordance with the Mendoza et al. (2004) methodology. These results are, however, compatible with the tax competition hypothesis since high tax base elasticities can lead to higher tax revenues despite a decline of tax rates.

the statutory corporate income tax rate from an average of well above 45% in 1980 to merely 24% in 2007. Our results indicate that the probability for tax rate reductions among European countries strongly depends on a country's relative position in terms of the tax burden on corporate income. In particular, high tax countries are significantly more likely to reduce their tax rates. Across various specifications and estimators, we find a country to be 2.1 to 2.6 percentage points more likely to cut its tax rate if the actual rate is one percentage point higher compared to a country that is identical in all other respects. Moreover, we find striking evidence for a direct effect of tax rates set by competing countries on a given country's willingness to reduce its own tax. If other countries cut their taxes by one percentage point on average, a given country's probability to react by cutting its own tax is increased by 1.5 to 3.2 percentage points. In sum, our findings strongly support the view that part of the recent downward trend in corporate tax rates in Europe is induced by direct interaction among governments in setting corporate income tax rates.

The paper proceeds as follows. Section 2 gives a short overview of the trends in corporate taxation in Europe since 1980. In Section 3, we discuss our empirical approach and the data. The empirical results are presented in Section 4, and Section 5 concludes.

2 Corporate taxation and tax reforms in Europe, 1980-2007

The statutory corporate income tax rate (STR) is the most prominent measure for a country's tax burden on corporate income. It affects effective average

and effective marginal tax rates, which are relevant for location and, respectively, investment decisions of firms (see Devereux and Griffith, 2003; Devereux and Lockwood, 2006).[3] Furthermore, the *STR* directly impacts multinational companies' incentives to shift paper profits among affiliates.

Figure 1 depicts average statutory corporate income tax rates in Europe since 1980.[4] The graph covers up to 32 countries including the 27 EU member states and, in addition, Croatia, Iceland, Norway, Turkey, and Switzerland. In 1980, the mean statutory tax rate based on 11 Western European countries was 45.6%. By 2007, the mean statutory tax rate among 32 European countries has decreased to 24.1%.

[Figure 1 about here]

The Eastern European countries have been particular aggressive in reducing statutory rates.[5] The Czech Republic has reduced its statutory rate nine times since 1992, followed by Bulgaria and Poland with eight and seven reforms, respectively. On average, the 11 Eastern European countries considered in this study have reduced their tax rates from 31.5% in 1996 to 18.9% in 2007. During the same period, the 21 considered Western European countries have

[3]The statutory tax rate neglects any difference in the determination of the tax base and the existence of non-income taxes. Although these provisions of a tax system are also important determinants of effective tax rates, a cut of the statutory tax rate leads to lower effective tax rates holding other things equal provided that the provisions determining the tax base are not outstandingly favorable.

[4]We use the headline tax rates of the corporate income tax adjusted for surcharges and typical local income taxes, which are imposed on the same or a similar tax base. The computation of the *STR* accounts for local income taxes as the *IRAP* in Italy or the *Gewerbesteuer* in Germany.

[5]See Devereux (2007) for further evidence and related discussion and Bellak and Leibrecht (2009) for evidence on FDI flows induced by low-tax policies by Eastern European countries.

lowered their mean statutory tax rate from 36.3% to 26.8%.

In the empirical part, we focus on tax rate cuts. Note that our definition of a tax rate cut accounts for institutional features of the corporate tax system in countries where the observed overall tax burden on corporate income may vary even if there is no change in national tax policies. In particular, in countries with local business income taxes, we only consider countrywide reforms of the local tax, but we do not consider changes which are merely modifications at the local level. With this definition, in the 32 countries considered 148 tax rate cuts occurred between 1981 and 2007. On average, national governments have cut their corporate tax rate every four years.

[Figure 2 about here]

Figure 2 depicts, for all years considered, the fraction of countries that actually lowered their tax rate. Particular intensive rate cutting activities have occurred between 1989 and 1994 and since 1998. In contrast, during the mid 1990s only very few tax rate cuts were observed. Only the transition economies in Eastern Europe intensively reduced their statutory tax rates. Since 1998, our data show a general tendency towards intensified rate cutting activities with no particular geographical pattern.

3 Empirical approach and data

3.1 Empirical model

Our empirical analysis aims at identifying the key determinants of rate cutting tax reforms among European countries. As discussed above, a sizable recent literature has analyzed the determinants of countries' business tax rates, focussing on the forces of globalization in general and other countries' tax policies in particular. Most contributions come to the conclusion that international competition for firms and capital investment has significantly contributed to the remarkable decline of statutory tax rates in Europe since the 1980s. If this claim is correct, we should be able to go one step further and model a government's discrete decision to implement a rate cutting tax reform (or not to implement such a reform) as a function of the country's relative position in terms of the tax burden on corporate income.

Based on the available empirical evidence on international tax competition, we expect to find support for two key hypotheses. First, governments of high tax countries should be more likely to reduce taxes. Second, governments should react to taxes set by neighbors. In particular, a country that is exposed to neighbors with low taxes is expected to cut its own tax rate with higher probability than an otherwise identical country exposed to high-tax neighbors.

We take a straightforward approach to test these hypotheses and model the policies of national governments regarding corporate taxation as being subject to adjustment pressure originating from various sources. Among them,

there are external forces such as other countries' tax policies and the changing degree of mobility of relevant tax bases. Internal forces result from the political-economic situation (such as the ideology of the parties in power or pressure related to the timing of elections) or socio-economic factors such as, for instance, the demographic situation. The model is based on the idea that an adjustment of the tax rate occurs if the adjustment pressure exceeds a critical level. Since we analyze a period of a systematical downward trend in corporate tax rates, the focus is on tax cuts and the neglect of the few tax increases seems legitimate.

Formally, a government's decision to reduce the country's business tax rate is modeled as a discrete choice decision problem and captured in an econometric model using a standard latent variable framework. Suppose that the observable decision to either cut the corporate tax rate, y_{it}, or not to do so is related to the latent predisposition towards lowering taxes, y_{it}^*, according to

$$y_{it} = 1[y_{it}^* > 0], \qquad i = 1, \ldots, N; \quad t = 1, \ldots, T \tag{1}$$

where $1[\cdot]$ is the indicator function. Suppose furthermore that a government's predisposition towards reducing the statutory tax rate in country i and period t is a function of the corporate tax rate inherited from the previous period, $\tau_{i,t-1}$, and of a linear combination of other countries' corporate tax rates in $t-1$, $\tau_{-i,t-1} = \sum_j w_{ij}\tau_{j,t-1}$, where the w_{ij}'s are predetermined weights complying to $w_{ii} = 0$ and $\sum_j w_{ij} = 1$. Adding a vector of exogenous country or government characteristics $x_{i,t-1}$, a common period-specific effect η_t, an unobservable country-specific effect c_i and a residual u_{it} and choosing a linear

specification for the latent variable provides us with

$$y_{it}^{*} = \alpha\tau_{i,t-1} + \beta\tau_{-i,t-1} + x_{i,t-1}\gamma + \eta_t + c_i + u_{it}, \tag{2}$$

where α, β and γ are the (vectors of) coefficients to be estimated. Note that the explanatory variables all enter the estimation equation with a one-period lag relative to the dependent variable. This is to account for the fact that implementing a tax reform is likely to involve some time lag. Note furthermore that including a common period-specific effect as well as an unobservable country-specific effect is arguably the most promising way to ensure that our estimates are robust to the likely presence of common trends in tax reform policies as well as unobserved heterogeneity among countries.

In the following section we report results for probit, fixed effects logit and linear probability models. The probit model and the fixed effects logit (Chamberlain, 1980) assume that the error u_{it} is distributed symmetrically about zero, with a cumulative distribution function G. The binary response model thus takes the form

$$\begin{aligned} P(y_{it} = 1|\tau_{t-1}, x_{it}, c_i) &= P(y_{it}^{*} > 0|\tau_{t-1}, x_{it}, c_i) \\ &= G(\alpha\tau_{i,t-1} + \beta\tau_{-i,t-1} + x_{i,t-1}\gamma + \eta_t + c_i). \end{aligned} \tag{3}$$

In contrast, the linear probability model allows for response probabilities outside the unit interval, and applying it to discrete choice decision problems may thus not seem appropriate from a technical perspective. However, from a practical point of view it is worth mentioning that in most applications the linear probability model tends to give marginal effects that are very close to

those derived from more sophisticated models for discrete responses.[6] We will discuss the choice of the estimator in more detail in Section 4.

Note that there are 23 cases in our sample where countries actually increased their corporate tax rate. Since we are interested in the determinants of tax cutting reforms, we treat them as 'no-reform' cases. The only reasonable alternative would have been to estimate an ordered probit (or logit), which seems an unnecessary complication given the limited number of tax increases.

Equation (2) employs spatial weights that for each country determine the tax rate of a composite neighbor, i.e. a weighted average of other countries' statutory tax rates. Due to a lack of degrees of freedom, the $N \times N$ matrix of weights cannot be estimated and, thus, has to be imposed a priori. We follow the common practice in the spatial econometrics literature and define the weights according to some inverse measure of distance.[7] Note that using weights which are differentiated according to geographical distance is in line with empirical evidence showing that distance negatively affects FDI (Carr et al., 2001; Markusen, 2002). Moreover, geographical distance should also negatively affect the intensity of transactions that are used to disguise pure paper-profit shifting.

One important feature of weighting schemes relying on geographical distance is that geographical conditions can safely be regarded as being exogenous to our

[6] See Wooldridge (2002, chap. 15) for a discussion. For a thorough review of the various approaches to estimate discrete response models, see Maddala (1983).

[7] See Cliff and Ord (1981) and Anselin (1988) for a more detailed discussion. A small but growing recent literature discusses genetic and cultural distance as an alternative to geographical distance. See, e.g., Spolaore and Wacziarg (2009), who also provide a review of other contributions.

model of tax reforms. This contrasts with a number of alternative weighting schemes which have been employed in related contexts. For instance, in their study of state spending spillovers, Case et al. (1993) discuss weight schemes that define the degree of 'neighborliness' between states based on economic and social characteristics such as the states' per capita income or the percentage of the population that is black. As recently pointed out by Baicker (2005), using such country characteristics is likely to burden the estimation of the coefficients of interest with a severe endogeneity problem because the characteristics used to define the weights tend to be correlated with the residual of the estimation equation. To give an example, it is tempting to experiment with schemes that define weights using the similarity of income levels between countries. If countries with similar incomes are more likely to be affected by economic shocks in similar ways, it is likely that the effect of such common unobserved factors on tax policies will (falsely) be attributed to neighbors' tax policies.

Another issue that has to be addressed when selecting a weight scheme is distance decay. Although it is widely accepted in the tax competition literature (see Brueckner, 2003, and Revelli, 2005 for surveys) that physical distance matters for competition for mobile tax bases, there is not much guidance on how to specify distance decay in a weight matrix. Practical considerations, however, suggest that the set of reference jurisdictions should be rather small (or, in the case of a continuous criterion, distance decay should be pronounced), because otherwise it will be difficult to identify the spatial effects of interest. This can bee seen from the fact that with no distance decay (all other countries contribute equally to the average policy of 'neighbors'

captured in the estimation equation), β is not identified in the presence of common period-specific shocks. Technically, imposing a sufficient degree of distance decay allows for cross-sectional variation in neighbors' average tax rate, τ_{-i}. A potential impact of neighbors' taxes on a given country's tax policy can thus be identified even in the presence of common period effects.[8]

Reflecting the abovementioned considerations, the most commonly used strategy to define spatial weights is to apply a common border or contiguity criterion. Unfortunately, some European countries do not have any contiguous neighbor, making it impossible to apply the common border criterion to European countries without further assumptions. We therefore replace it with a simple distance decay scheme that uses the (squared) inverse distance between the countries' capital. Furthermore, given the intuition saying that larger countries should exert a stronger influence on other countries' tax policies than smaller countries, we adjust the weights for differences in country size, measured by population.[9]

Formally, the weights are determined as follows. With d_{ij} denoting the distance between the capitals of countries i and j in kilometers, and *pop* being total population, we set $w_{ij} = 0$ if $j = i$ and

$$w_{ij} = \frac{\ln(pop_j)/d_{ij}^2}{\sum_{k \neq i} \ln(pop_k)/d_{ik}^2} \quad \forall\ j \neq i. \tag{4}$$

The denominator scales the w_{ij}'s such that $\sum_j w_{ij} = 1$. This row-standardization of weights implies that relative distance (and relative country size) matter for

[8]However, there are some authors who argue in favor of uniform weights. See, e.g., Devereux et al. (2008), and Redoano (2007).

[9]In contrast to GDP, it seems reasonable to assume that population is exogenous to tax policies.

the determination of weights. Although the assumption that relative (and not absolute) characteristics matter is certainly disputable, row-standardized weights have recently been used in the vast majority of studies dealing with spatial effects in public finance. The main advantage of using standardized weights is that, for all countries, τ_{-i} gives the weighted average of neighbors' taxes. As a consequence, the parameter β has a straightforward interpretation (this is not the case if the weights are not standardized).

Geographical distance is squared to make the weights being more 'selective' in terms of distance, i.e. to differentiate more strongly between geographically close and more distant countries of equal population size as neighbors of a given country. The inclusion of population size ensures that, in terms of their weights in the computation of composite neighbors' taxes, the contribution of very small countries like Luxembourg or Malta is discounted relative to big countries like France or Germany (holding distance fixed).

In Section 4, we come back to the issue of imposing an appropriate spatial weight matrix and present some sensitivity checks suggesting that our results are robust to a number of straightforward alterations of our weight scheme.

3.2 Data

Our data cover up to 32 European countries for the period from 1980 to 2007. The sample includes all 27 member states of the European Union and is extended by Croatia, Iceland, Norway, Turkey, and Switzerland. During the 1980s the sample consists of western and northern European countries. The

first year with a complete record for all 32 countries is 1996.

As our dependent variable, we employ a binary variable which takes value one in case of a cut in the statutory tax rate and zero in all other cases. Table 1 provides some descriptive statistics.

[Table 1 about here]

Our choice of additional control variables is guided by the need to take account of factors which could play a role in increasing or decreasing the pressure to cut the corporate tax rate. First, we consider several general country characteristics. As measures of country size, we include both GDP and population. We expect that the larger a country the less it is subject to forces from external competition.[10] The size of government is measured as the ratio of public consumption to GDP. If the size of government increases, the leeway for tax cuts shrinks. Hence, we expect a negative coefficient. Furthermore, the age structure of the population could influence tax policy due to budgetary effects of demographic change. Theory does not, however, suggest a particular sign for the coefficient.

In addition, we consider several politico-economic factors which may influence the probability of a tax reform. In particular, we consider an indicator for election periods.[11] It is well known from the literature on political business

[10]While it would be desirable, it is not generally feasible to include the stock of private capital among the controls. Apart from the fact that data on countries' capital stocks is not available for all countries in our sample, including a proxy for the capital stock would burden the estimation with an additional endogeneity problem because the capital stock in a given country is, by the logic of the tax competition model, a function of tax rates in all countries.

[11]Technically, the indicator covers both the election and the pre-election year. Tax policy

and budget cycles that governments tend to be particular generous in election or pre-election years. In general, this should also hold with respect to the likely timing of tax cuts. However, the election year effect is less clear for corporate tax policy because tax cuts for companies might be criticized by voters from a distributive point of view and thus be less popular in the course of an ongoing election campaign. Hence, the sign prediction is ambiguous. Moreover, government ideology may affect the probability of corporate tax reductions. From the perspective of income redistribution, left parties can be expected to be less inclined to cut taxes for companies.

Finally, we employ three different indicators for openness since previous literature has found more open countries to have lower corporate taxes. Irrespective of how openness is actually measured, the degree of economic integration should matter for tax policies, with the expected sign being positive.

4 Results

As mentioned in the previous section, there are various approaches to estimate the coefficients and corresponding marginal effects of our discrete choice model of corporate income tax cuts in Europe. The key difficulty is the likely presence of unobserved country-specific effects, such as, for instance, a general predisposition towards lowering tax rates that cannot be accounted for by observable country characteristics. Unfortunately, the options to account for additive unobserved heterogeneity across countries are somewhat limited in

decisions in these two years can be expected to be influenced by similar forces related to a government's reputation and popularity.

the standard models for discrete responses such as probit and logit. Therefore, we will report results using a variety of estimators, ranging from pooled probit to fixed effects logit and linear probability models. Compared to estimators that are designed to properly account for discrete responses, the linear probability model (LPM) has two attractive features: the parameter estimates are easy to interpret, and the fact that the model is linear allows for the inclusion of country fixed effects. In all regressions reported below, we employ a full series of year dummies to account for common effects in corporate tax rates.

To get a first impression of the performance of the different models, Table 2 depicts the results of four baseline estimations. Note that we have not included any control variables apart from countries' own and neighbors' taxes. Column (1) reports a simple probit. Since there is no option to account for unobserved heterogeneity in the probit framework, we report a standard probit on the pooled data. Note, however, that we include a full series of year effects. For ease of interpretation, we show average partial effects evaluated at sample means and corresponding standard errors. We note that the simple probit points to a positive impact of a country's inherited tax on the probability to cut the corporate income tax rate. However, the null of no impact of neighbors' tax rates cannot be rejected. Column (2) repeats the baseline estimation without accounting for country-specific time-invariant effects using a linear probability model. As expected, the results are very similar to those in Column (1).

[Table 2 about here]

As unobserved country characteristics can be expected to play an important role in shaping the countries' tax policies, we now add country-specific effects. Column (3) shows coefficients derived from a fixed effects (FE) logit as the standard approach to control unobserved heterogeneity in limited dependent variable models. Note that we can make use of our data only beginning with 1983 as the countries in the sample did not reduce their statutory tax rates in 1981 and 1982. Moreover, there is one country, Malta, that kept its tax rate constant over the whole period for which information on the statutory rate is available. These observations cannot be used by the conditional maximum likelihood procedure of the FE logit, reducing the effective sample size to 584 observations. The FE logit has the drawback that one cannot compute average partial effects without specifying a distribution for the unobserved effects. Column (3) therefore provides only qualitative evidence. Interestingly enough, the FE logit baseline estimation uncovers a significant negative effect of neighbors' tax rates on the probability for a tax rate reduction. Thus, the FE logit baseline estimation provides the first piece of suggestive evidence that both expected effects (higher probability of tax cuts for high tax countries and countries exposed to low tax neighbors) might be present in our data. Finally, we also estimated a linear probability model incorporating a full series of country effects, shown in Column (4). Note that both coefficients are significantly larger compared to those reported for the LPM without country effects in Column (2). Moreover, the negative effect of neighbors' tax rates is now close to being significant at the 10% level. From the series of baseline estimations we draw the conclusion that it seems to be of crucial importance to account for unobserved heterogeneity across countries. Given that and the applied

nature of our endeavor, we rely on the fixed effects linear probability model to provide further evidence on the determinants of statutory tax reforms.

Table 3 summarizes the results of four additional estimations of the FE LPM. The estimations differ in terms of the measure for the openness of countries. As discussed above, a sizable literature has analyzed the effect of openness on corporate tax rates in Europe. When estimating the direct impact of neighbors' tax rates on the decision to cut the statutory tax rate, we certainly need to take account of the potential impact of openness itself. Since many different measures for openness have been proposed, we checked the robustness of our results using various of these measures.

[Table 3 about here]

Column (1) reports an estimation with our full set of controls including a common trade-based openness measure, i.e. the sum of exports and imports divided by GDP. In addition, we account for a full series of country and year effects. First of all, the results point to a significant positive impact of the inherited statutory rate on the probability of a tax cut. We estimate a country with an inherited statutory rate being one percentage point higher than that of an otherwise identical country to be 2 percentage points more likely to reduce its tax rate. Hence, high tax countries, all other things equal, are significantly more likely to cut their taxes than low tax countries. Secondly, we note a negative effect of the tax rate of the composite neighbor on a given country's reform probability. A one-percentage point decrease in neighbors' average tax rate makes a statutory tax rate cut 1.5 percentage points more likely. Note,

however, that the trade-based openness measure is far from being significant as an independent explanatory variable. Using different openness measures may therefore affect the evidence regarding the impact of tax competition. Column (2) depicts a second set of results, with openness now measured as the difference between total savings and total investment in absolute value divided by GDP, as suggested by Feldstein and Horioka (1980). Note that the Feldstein-Horioka measure turns out to be statistically significant. However, contrary to our expectations, more open economies show a lower probability to cut corporate taxes than less open economies. More importantly, our results regarding the role of own and neighbors' taxes in shaping the willingness to cut the statutory tax rate proves to be highly robust to the alternative measurement of openness. In fact, the partial impact of neighbors' taxes on the probability of reform is now estimated to be even larger.

Further estimations substantiating the previous results are shown in the remaining columns. In Column (3), we use a three-year moving average of the Feldstein-Horioka measure to account for the cyclical movement of savings, investment, and GDP. The results are almost identical to those obtained in Column (2). Column (4) uses a fourth measure of openness, namely the sum of inward and outward FDI (annual flows) divided by GDP. Again, the results are similar to those discussed before. Even the magnitude of the tax competition effect does not change much across specifications.

Apart from the effects mentioned so far our results also point to an interesting political economy effect on national tax policies: Consistent across all reported specifications, the probability for a cut in corporate taxes is 10 to

13 percentage points more likely in election periods. Thus, the pattern of a generous budgetary policy in election periods as reported in, e.g., Alesina et al. (1992) is supported with respect to corporate tax cuts. The interpretation of this effect is somewhat difficult, as corporate tax cuts are unlikely to be particularly popular among the electorate. Possibly, however, they are an ingredient of expansionary fiscal packages often observed prior to a general election. The remaining control variables are all insignificant. We interpret this as being the result of including both fixed country and year effects (along with the right-hand-side tax variables) in our model. It seems that country and year effects in particular capture most of the variation in our tax reform indicators. Since we are not primarily interested in the effect of country characteristics other than own and neighbors' tax, we feel that the insignificance of other country characteristics is unproblematic.

As discussed in the previous section, we use spatial weights based on squared inverse distance and country size, measured by population. A straightforward robustness check is to employ alternative weight specifications. In the following we report robustness checks along two dimensions, namely the degree of distance decay and the presence of population to adjust the weights for country size. As our weight scheme has inverse distance squared, it seems reasonable to check all results by using $\ln(pop_j)/d_{ij}$ and $\ln(pop_j)/d_{ij}^3$ instead. Across all estimations, we find results which are qualitatively unaffected and quantitatively similar to those reported before. Using the trade-based measure to account for openness, running the regression including all control variables yields parameters for a country's own tax between 2.11 (0.422) for the former

and 2.27 (0.439) for the latter scheme. As regards the impact of neighbors' tax rates, we obtain estimates of -2.76 (1.50) and -1.38 (0.478), respectively. We note that the point estimates for the three different schemes are not statistically different from each other, but that a certain degree of distance decay is essential to obtain sufficiently precise estimates for the impact of neighbors' taxes. This finding seems to correspond to the issue of a potential collinearity problem if weights with a low or moderate degree of distance decay are employed in models including period effects (see the discussion in Section 3).

As regards the role of country size in the weight formula, we found that omitting the population figures from the weight formula has little effect on our estimates. When using the trade based openness measure, the coefficient of a country's own tax is estimated to be in the range of 2.11 (0.420) (scheme based on $1/d_{ij}$) and 2.26 (0.437) (scheme based on $1/d_{ij}^3$). For the effect of neighbors' taxes, we obtain corresponding estimates between -2.75 (1.57) and -1.38 (0.498). All these coefficients are very close to those resulting from the population-inflated schemes. Furthermore, we also replaced the distance between capitals by the distance between country centroids. Again, the coefficient estimates for own and neighbors' taxes were only marginally affected. We conclude that our findings regarding the pressure of a country's relative position (in terms of the statutory tax rate) on implementing tax reforms and cutting the corporate income tax are robust to a number of straightforward changes of the weight matrix imposed. Whereas the physical distance between countries is critical in the sense that we loose precision in the estimate of the impact of neighbors' taxes for moderate levels of distance decay, it is of little

practical importance whether we employ simple distance-based or population-inflated weights.

We complete the discussion of our results by some robustness checks regarding the model specification and the potential endogeneity of the right-hand-side tax variables. First of all, we need to make sure that our findings are not specific to the linear probability model. As mentioned above, the FE LPM was chosen for the reason that it allows to account for unobserved country-specific effects and, at the same time, gives coefficient estimates which are easy to interpret. Column (1) in Table 4 provides the estimated coefficients of a FE logit that accounts for the full set of controls.[12] Again, we can only provide qualitative evidence on the effects of interest. We note that the FE logit gives highly significant parameter estimates confirming qualitatively our previous findings on the impact of tax competition on the willingness to cut the statutory business tax rate.

[Table 4 about here]

A second issue is the potential endogeneity of the tax rate variables on the right hand side of our estimation equation. Although we control for a number of country characteristics as well as year and country effects, there might still be unobserved variables driving a given country's willingness to cut taxes and, at the same time, affecting the country's own as well as neighbors' statutory tax rates. Since such correlation would cast doubt on the consistency of our parameter estimates, we construct instruments for the potentially endogenous

[12]Note that we have used the three-year moving average of the Feldstein-Horioka measure here. Using a different openness measure gives very similar results.

variables to be used in first stage regressions of two-stage least squares (2SLS) procedures.

A first set of instruments consists of the two-period lag of the statutory tax rate and neighbors' average population (in logs). Recall that all explanatory variables enter the model with a one-period lag relative to the indicator for a tax rate reduction in the current period. Hence, we instrument $\tau_{i,t-1}$ and $\tau_{-i,t-1}$ by $\tau_{i,t-2}$ and $\ln(pop)_{-i,t-1}$. As the literature on the determinants of the corporate tax rate has shown, tax rates tend to be positively related to measures of country size. We use population figures to construct the instrument for neighbors' taxes as neighbors' population is arguably exogenous in our tax reform equation. Results from a 2SLS estimation using these instruments are reported in Column (2).

While there seems little reason to doubt the validity of neighbors' population as an instrument for neighbors' taxes, using a country's own lagged tax rate as an instrument for the current tax may be questioned. For instance, if the unobserved factor inducing correlation between the tax rate and the residual is serially correlated, the instrument will no longer be exogenous. We therefore check our estimation results using an alternative set of instruments. In particular, we use a country's lagged top personal income tax rate ($PITR$) and the corresponding weighted average among neighbors. The choice of this set of instruments is motivated by the strong empirical association between the top individual rate and the statutory corporate income tax rate reported, e.g., by Slemrod (2004). Estimation outcomes using $PITR$-related instruments are shown in Column (3) of Table 4.

We find that both instrumental variables estimations confirm our previous results. While the estimated coefficients of a country's own tax are very similar to those obtained from the FE LPM, the effect of neighbors' taxes on the predisposition to cut the statutory tax rate is now estimated to be somewhat larger. Furthermore, for both sets of instruments the relevant coefficients from the first stage regressions show the expected sign and prove to be highly significant, making us confident that we have chosen suitable instruments. Moreover, the F-statistics of the first stage regressions suggest that we do not have to worry about potential problems resulting from weak instruments.

The instrumental variables estimations are also supportive of the result that tax cuts are more likely during election campaigns. Moreover, we find weak evidence that bigger economies (in terms of GDP) tend to reduce tax rates more frequently.

5 Conclusion

Due to substantial implementation costs, governments do not continuously adjust tax rates to optimal levels. Rather, descriptive evidence suggests that governments set taxes to the preferred level in one period and then stick to the rate chosen for some periods. Consequently, the choice of the tax rate involves a discrete choice decision problem that has to date been ignored in the literature dealing with the determinants of corporate tax rates. It is the purpose of this study to fill part of this gap.

Focusing on statutory corporate taxes in Europe, we have offered a simple empirical framework for the analysis of rate cutting tax reforms in a comprehensive data set covering 32 countries. Our results suggest that the remarkable activity of national governments in Europe since 1980 to implement rate cutting reforms was to a significant part driven by tax competition rather than by alternative explanations such as a common intellectual trend. In particular, we find that high tax countries experience substantial pressure to reduce corporate taxes. Furthermore, our findings point to a significant impact of neighboring countries' tax policies on the probability for tax rate reductions. Thus, countries which are geographically close to low tax countries are substantially more likely to lower their tax rate.

A further insight relates to the political economic dimensions of tax rate adjustments. Our results indicate that corporate tax cuts are significantly more likely during election campaigns, suggesting that they are part of popular economic programmes subject to some sort of a political business cycle.

Our study provides evidence on international tax competition that is complementary to a number of recent studies. Most importantly, the results show that national policies regarding rate cutting tax reforms in Europe are strongly affected by pressures resulting from tax policies of other countries. The main advancement relative to previous empirical work is that, by using a discrete choice decision framework and focusing on rate cutting tax reforms rather than statutory tax rates, we provide direct evidence on the step-by-step process of cutting statutory rates that has often been claimed to be at the heart of the 'race to the bottom' in international tax competition.

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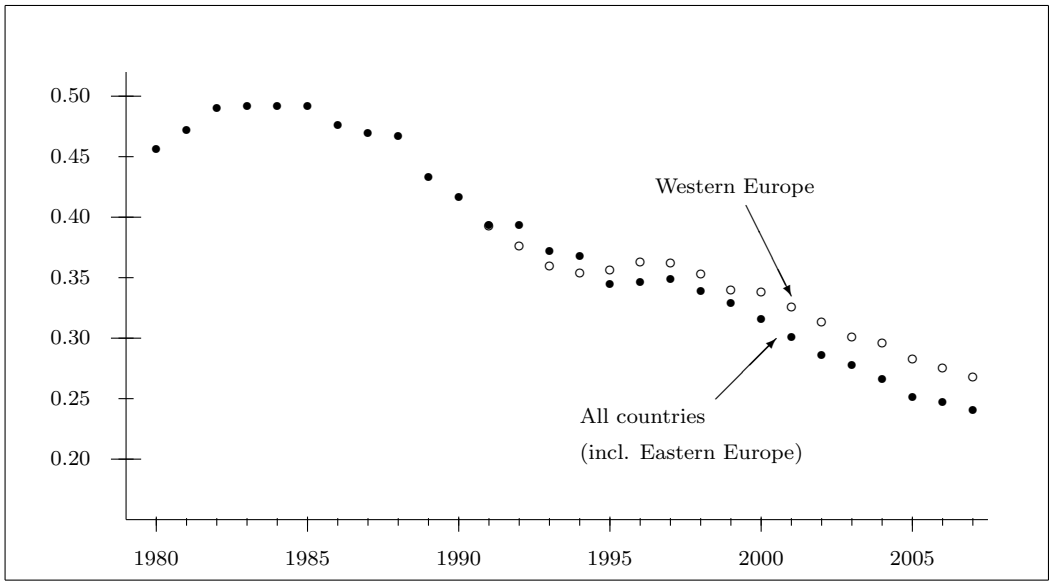
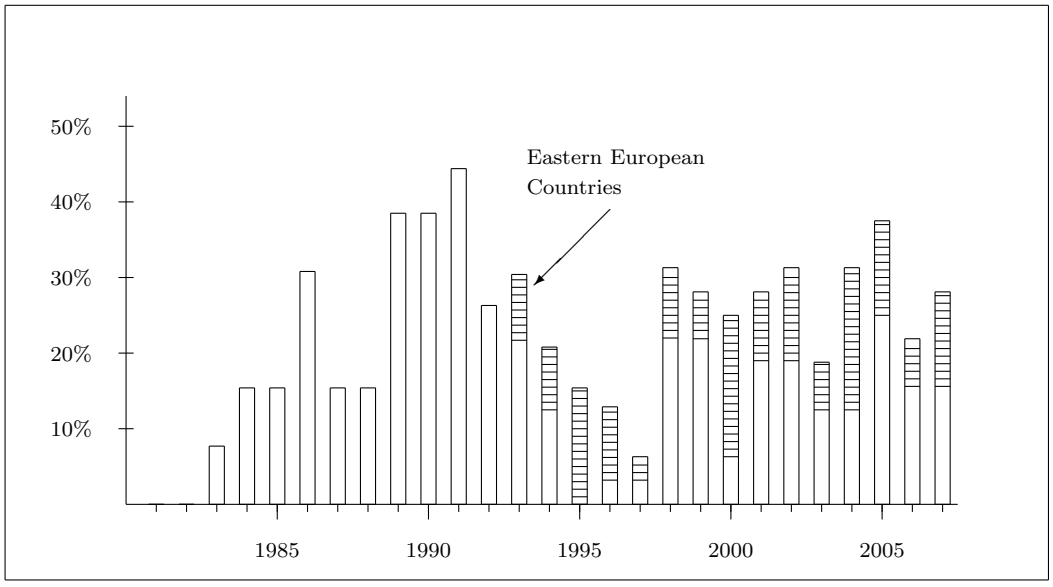
Figure 1: Average statutory corporate income tax rate in European countries, 1980-2007



Graph shows unweighted average of statutory corporate income tax rates. Western European countries considered (period): AT (81-07), BE (80-07), CH (80-07), CY (91-07), DK (80-07), ES (91-07), FI (80-07), FR (80-07), DE (80-07), GR (90-07), IE (80-07), IS (90-07), IT (80-07), LU (80-07), MT (94-07), NL (80-07), NO (90-07), PT (90-07), TR (96-07), SE (82-07), UK (80-07). Eastern European countries: BG (93-07), CZ (92-07), EE (95-07), HR (95-07), HU (92-07), LV (95-07), LT (95-07), PL (92-07), RO (94-07), SI (95-07), SK (92-07).

Figure 2: Fraction of tax rate cutting countries, 1981-2007



The bars depict the fraction of tax rate cutting countries in all countries for which tax data are available. For details on sample composition see notes below Figure 1.

Table 1: Descriptive Statistics

Variable	Definition/Type	Obs.	Mean	Std.Dev.	Min.	Max.
Tax rate cut	Indicator	620	0.239	0.427	0	1
Own tax rate	Statutory corporate income tax rate adj. for surcharges	652	0.348	0.110	0.100	0.659
Composite neighbor's tax rate	Weighted average of other European countries' statutory tax rates	652	0.360	0.080	0.197	0.585
PITR	Personal top income tax rate	648	0.483	0.123	0.160	0.870
GDP	GDP in billions of purchasing power parities (PPP)	648	305.5	435.7	3.1	2,317
Population	Total number of inhabitants in thousand persons	652	19,240	23,698	255	82,520
Population between 15 and 65 years	Fraction of population between 15 and 65 years	652	0.669	0.019	0.588	0.720
Public consumption	Total public consumption as fraction of GDP	635	0.199	0.039	0.095	0.3
Election period	Indicator	595	0.518	0.500	0	1
Government: Left	Indicator	586	0.358	0.480	0	1
Government: Right	Indicator	586	0.423	0.494	0	1
Government: Center	Indicator	586	0.138	0.345	0	1
Government: Other	Indicator	586	0.080	0.272	0	1
Capital mobility	Sum of inward and outward foreign direct investment as proportion of GDP	522	0.114	0.659	-0.079	10.93
Trade openness	Sum of exports and imports as fraction of GDP	652	0.931	0.463	0.357	3.13
Feldstein-Horioka	Diff. between savings and investments as fraction of GDP	566	0.043	0.038	0	0.257

Sample includes 32 European countries with observations ranging from 1980 to 2007. Tax variables based on own calculations. Information on countries' tax systems has been collected from several databases provided by the International Bureau of Fiscal Documentation (IBFD), Amsterdam, and from surveys annually provided by Ernst&Young, PwC and KPMG. The information on FDI flows is taken from World Development Indicators of the World Bank. The other control variables are taken from Eurostat and augmented by the World Bank's World Development Indicators. Indicators for government ideology and election years are obtained from the Database of Political Institutions (Beck, 2001).

Table 2: Corporate income tax cuts and neighbors' taxes: Baseline estimations

	(1) Probit (dP/dx)	(2) LPM	(3) FE Logit	(4) FE LPM
Own tax rate	1.234***	1.144***	20.05***	2.244***
	(0.303)	(0.237)	(3.003)	(0.393)
Composite neighbor's tax rate	-0.535	-0.438	-13.33***	-1.266
	(0.613)	(0.591)	(4.991)	(0.769)
Number of observations	597	597	584	597
(Pseudo) R^2	0.09	0.09	-	0.13

The table shows marginal effects (slopes evaluated at sample means) in Column (1) and coefficients in Columns (2)-(4). Standard errors in parentheses (Column (1): robust to serial correlation; Column (2) and (4): robust to heteroscedasticity and serial correlation). All estimations include a full series of period effects (year dummies). Column (4) in addition includes a full series of country effects. All regressions use observations from 1983 to 2007. Significance level: *** 1%.

Table 3: Corporate income tax cuts and neighbors' taxes: Linear probability model

	(1)	(2)	(3)	(4)
Own tax rate	2.214***	2.132***	2.101***	2.210***
	(0.448)	(0.452)	(0.473)	(0.440)
Composite neighbor's tax rate	-1.533**	-1.855**	-1.810**	-1.704**
	(0.690)	(0.793)	(0.799)	(0.734)
Public consumption	-0.104	0.247	0.839	-0.427
	(1.264)	(1.330)	(1.386)	(1.361)
log(GDP)	0.145	0.418	0.583	0.384
	(0.242)	(0.381)	(0.386)	(0.403)
log(POP)	0.530	0.517	0.226	1.332
	(0.905)	(1.029)	(1.024)	(0.917)
Population between 15 and 65 years	4.050	0.859	0.440	1.597
	(2.629)	(3.613)	(3.945)	(4.067)
Openness[a]	0.161	-2.682***	-3.621***	-0.028
	(0.244)	(0.831)	(1.078)	(0.053)
Election period	0.119***	0.122***	0.128***	0.104***
	(0.027)	(0.028)	(0.027)	(0.032)
Government: Right	0.053	0.053	0.056	0.050
	(0.055)	(0.057)	(0.058)	(0.061)
Government: Center	0.065	0.041	0.041	0.022
	(0.095)	(0.091)	(0.093)	(0.102)
Government: Other	0.104	0.117	0.073	0.121
	(0.125)	(0.145)	(0.147)	(0.135)
Number of observations	538	482	474	478
R^2 (within)	0.17	0.19	0.19	0.17

Table shows coefficients and standard errors (robust to heteroscedasticity and serial correlation) for the linear probability model. All estimations include a full series of country and period effects (year dummies). Regression shown by Column (1) use observations from 1983 to 2007, the regressions shown by Columns (2)-(4) use observations from 1983 to 2006 (varying effective sample size is due to missing values in explanatory variables).

[a] Openness measured as: Column (1): sum of exports and imports divided by GDP. Column (2): difference between total savings and total investment in absolute value divided by GDP. Column (3): three-year moving average of difference between total savings and total investment in absolute value divided by GDP. Column (4): sum of inward and outward FDI (annual flows) divided by GDP. Significance levels: * 10%; ** 5%; *** 1%.

Table 4: Corporate income tax cuts and neighbors' taxes: Fixed effects logit and 2SLS

		(1)	(2)	(3)
Estimator		FE logit	2SLS	2SLS
Own tax rate		27.79***	2.581***	2.078*
		(4.525)	(0.500)	(1.178)
Composite neighbor's tax rate		-22.93***	-3.184**	-2.331*
		(6.647)	(1.454)	(1.393)
Public consumption		9.152	0.571	0.736
		(10.18)	(1.315)	(1.414)
log(GDP)		4.899*	0.692*	0.690*
		(2.846)	(0.410)	(0.383)
log(POP)		-2.714	0.198	0.079
		(7.899)	(1.151)	(1.194)
Population between 15 and 65 years		37.85	1.477	-0.156
		(23.84)	(3.177)	(3.406)
Openness		-31.54***	-4.234***	-3.830***
		(9.501)	(1.003)	(0.970)
Election period		1.016***	0.125***	0.136***
		(0.299)	(0.043)	(0.042)
Government: Right		1.082***	0.055	0.049
		(0.397)	(0.047)	(0.048)
Government: Center		0.355	0.077	0.060
		(0.682)	(0.097)	(0.092)
Government: Other		1.438*	0.072	0.075
		(0.737)	(0.112)	(0.114)
Years		1983-2007	1982-2007	1981-2007
Number of observations		439	453	471
R^2 (within)		-	0.20	0.20
IV for τ_i		-	lagged STR	PITR
IV for τ_{-i}		-	neighbors' pop.	neighbors' PITR
First stage results:				
F-Statistic for IVs:	1^{st} stage for τ_i	-	250.1	44.2
	1^{st} stage for τ_{-i}	-	38.5	170.8
Coefficients of IVs:	IV for τ_i	-	0.81 (0.04)	0.39 (0.07)
	IV for τ_{-i}	-	0.14 (0.02)	0.005 (0.0003)

Table shows estimated coefficients and standard errors (in parentheses, robust for 2SLS). While Column (1) depicts results of a FE logit, Columns (2) and (3) show results of linear 2SLS estimations. All estimations include a full series of period effects (year dummies). Columns (2) and (3) also include a full series of country effects. Openness defined as in Table 3, Column (3). Significance levels: * 10%; ** 5%; *** 1%.