

Streif, Frank

Conference Paper

Tax Competition in Europe - Europe in competition with other world regions?

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2015: Ökonomische Entwicklung - Theorie und Politik - Session: Taxation, No. G15-V1

Provided in Cooperation with:

Verein für Socialpolitik / German Economic Association

Suggested Citation: Streif, Frank (2015) : Tax Competition in Europe - Europe in competition with other world regions?, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2015: Ökonomische Entwicklung - Theorie und Politik - Session: Taxation, No. G15-V1, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft

This Version is available at:

<https://hdl.handle.net/10419/112832>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Tax Competition in Europe - Europe in competition with other world regions?

Version: March 1, 2015

Abstract

Corporate tax levels have fallen substantially in Europe during the last decades. There is a broad literature on tax competition which has been identified as one reason for the decline in corporate tax levels. However, none of these studies explicitly ask the question whether tax competition within regions is different from tax competition across regions, e.g. due to "global regionalism" of foreign direct investments. This is a crucial question to answer in order to discuss the desirability of (local) tax harmonization, for example, within the European Union. Therefore, the study aims to give hints on the following questions: Is the decline in corporate tax levels in Europe mainly driven by inner-European tax competition? Or is it (also) due to pressure from other world regions? The results of this study which makes use of tax reaction functions (spatial econometrics) indicate that there is evidence for tax competition within Europe (with respect to effective average tax rates) whereas there is no evidence that European countries compete with countries from other regions.

JEL Classification Code: H2, H77, H87

Keywords: Corporate taxes, Tax competition, Europe

1 Introduction

Cooperate tax levels have fallen substantially in Europe during the last decades. In Germany, the effective average tax rate (EATR) has fallen from 45.82% in 1990 to 28.40% in 2013. Figure 1 shows the development of the average EATRs for four world regions which are covered in this study (Latin America, Europe, Asia-Pacific, North America). The development of the cooperate effective tax levels in Europe appears most remarkable. The top line, which represents the European countries, shows that the EATR has fallen substantially from above 30% in 1996 to just above 20% in 2012.¹ The downward trend in taxation levels in Europe is steadily over time, however, the decline until 2005 is more distinct than afterwards. Unlike in the other regions, the average EATR in the covered countries in Latin America has risen slightly over the period from 1996 to 2012. In North America (USA and Canada) and in the Asia-Pacific region the average EATR has fallen, however, less dramatically than in Europe. There is a broad literature which stipulates that the global decline in cooperate tax levels is due to tax competition. However, none of these studies explicitly ask the question whether tax competition within regions is different from tax competition across regions. This is a crucial question to answer in order to discuss the desirability of (local) tax harmonization, for example within the European Union. Therefore our study aims to give hints on the following question: Is the decline in cooperate tax levels in Europe mainly driven by inner-European tax competition or is it (also) due to pressure from other world regions?

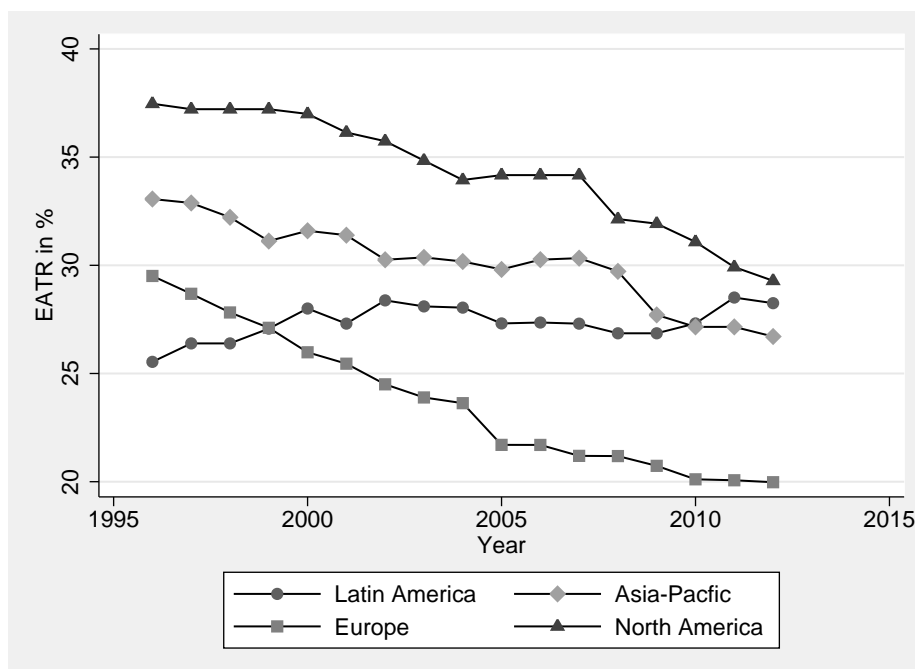
The investigation of this question deserves special attention for at least the following reason: The desirability of tax harmonization within the EU is linked to the relationship of the EU with third countries or other world regions. In a globalized world, tax competition might not stop at the European border. Tax harmonization would possibly reduce tax pressure within Europe, however, the pressure from outside - *if it exists* - would not vanish. By harmonizing their tax systems, member states might loose their flexible possibilities to react to tax changes in countries from other world regions. Schön (2003, p. 28) describes this as the member states putting themselves into a "straitjacket". On the other hand, Schön (2003) remarks that the existence of other economic areas could make harmonization within Europe even more necessary in order to reduce transaction and compliance cost within Europe and make Europe as a whole more competitive compared to other world regions. Due to pressure from outside Europe, the positive effects of tax competition (e.g. disciplining public budgets) would still apply in an harmonized system. Complementary to this reasoning, Sørensen

¹The data set for the European countries includes all "old" member states (EU15) as well as all countries of the Eastern enlargements in 2004 and 2007. In addition Switzerland, Croatia, Iceland, Norway and Turkey are in the data set.

(2004) sets up a general equilibrium model in which he distinguishes between global tax coordination and regional tax coordination. In this context he concludes that "[with] high capital mobility between the tax union and the rest of the world, the welfare gain from regional capital income tax coordination is only a small fraction of the gain from global coordination, even if the tax union is large relative to the world economy" (Sørensen, 2004, p. 1).

The assessment of these arguments requires substantiated knowledge if and to which extent tax competition occurs within Europe and between Europe and other world regions. This paper aims to contribute to these questions.

Figure 1: Development of EATRs



2 Literature and Theoretical Background

FDI in the context of regional blocs

There are reasons why tax competition between countries of the same regional bloc might be more intense than between different regional blocs. Low trade cost within a regional bloc have effects on the volume and the location of FDI coming from within the regional bloc and the rest of the world. A multinational firm which wants to market its products in a region but which is from outside the region needs to decide to either produce in

each country of the region, produce in one country within the region and use that location as export-platform, or export its products from its home market (third country). Also companies from within the region need to decide where to locate most efficiently. Decisive factors for this can be trade costs and barriers to FDI within and across a regional bloc. Theoretical papers have analyzed the effects of global regionalism and economic integration on the choice between exporting and FDI. Motta and Norman (1996) emphasize the meaning of regional blocs for firms which have a production base inside or outside a regional bloc. Crucially, Motta and Norman (1996) show in their model that economic integration within a bloc causes outside firms to invest in the regional bloc. Furthermore, in regional blocs there is a case for "intra-regional export platform FDI, with the investing firm supplying the majority of the countries in the regional bloc by intra-regional exports" (Motta and Norman (1996, p. 775)). Additionally, Motta and Norman (1996) point out that FDI activity of inside firms might actually decrease since they will choose intra-regional exports instead of dispersed FDI when intra-regional trade cost are sufficiently low. This work has been preceded by Rowthorn (1992) who analyzes intra-industry trade and investment under oligopoly and emphasizes the role of the market size and the extent of trade barriers between the countries concerned. Increasing size of a foreign market makes it more attractive for a multinational to set up local production facilities there. Also Motta (1992) and Smith (1987) model the choice of firms between direct investment and exporting, however, only by modelling two countries and not by considering regional blocs. In contrast, Ekholm, Forslid, and Markusen (2003) explicitly analyze the possibility of export-platform foreign direct investment by setting up a model with three countries. They show that FDI in a host country can occur when third countries can be accessed from there via a free-trade area and the parent firm is located outside. This pattern is confirmed by data on US affiliates which shows that US affiliates in free-trade areas mainly export to other countries in that free-trade area. Similarly, Blonigen, Davies, Waddell, and Naughton (2007) find strong evidence for an export-platform motivation of US FDI in Europe and, thus, that FDI decisions are not only determined by the bilateral characteristics but also by the ones of "third countries". Blomstrom and Kokko (1997) indicate that the free trade agreement between the United States and Canada (CUSFTA)² appears to have resulted in less intra-regional FDI between the two countries due to bilateral trade being a more efficient way to serve the other country's market. At the same time there is evidence that both Canada and the United States have become more attractive for extra-regional FDI from the rest of the world which can be attributed to export-platform function which the two countries play for

²The Canada-United States Free Trade Agreement (CUSFTA) was agreed on in 1987 and contains mainly the elimination of tariffs and the reduction of non-tariff barriers.

each other. The interdependencies of FDI flows between countries is likely to be mirrored in the tax setting behaviour of governments. In our paper, we particularly want to test if global regionalism (e.g. in the form of free-trade agreements or lower physical, legal and regulatory trade costs within regional blocs), specifically in the European context, is reflected in strategic tax interaction among governments.

Some of the literature which looks at regional integration and FDI flows focuses on the European context. Pain (1997) finds out that U.K. direct investments within the EU have been stipulated by the internal market programme since 1990. Crucially, he also found that some U.K. firms have diverted their investments from the United States into the EU. This gives micro-level evidence that regional economic blocs do not function independently to other regional blocs or the rest of the world but that there are interdependencies which for instance occur due to export-platform strategies.³ Baltagi, Egger, and Pfaffermayr (2007) argue that economic policy (e.g. tax policy or regional trade agreements) aimed at attracting FDI in a subset of host countries (e.g. a region) will not only effect FDI there but also in other potential locations. They show that the geographical and qualitative extension of regional trade agreements within Europe have had significant effects on FDI creation and diversion. They conclude that "a sizable stimulus of investment in one country or region eventually causes a reduction of investment in other countries or regions" (Baltagi, Egger, and Pfaffermayr (2007, p. 24)). Thus, countries and regions compete for FDI and we want to find out how governments take this into account when setting taxes. In fact, Raff (2004) exactly draws this connection between tax and FDI competition in a specified regional arrangement in his theoretical contribution on "Preferential Trade Agreements and Tax Competition for Foreign Direct Investment". He shows in a model with three countries where two of them represent members of a preferential trade regime and the other represents the rest of the world that FDI might increase in the integrated region. Countries within the integrated economy might have an incentive to attract FDI from the rest of the world by a favourable tax environment. This setting is relevant for our paper and reflects patterns in the real world where trade within regional blocs is likely to be less costly than across regions but at the same time tax policies within regions are hardly harmonized.

Redoano (2014) also picks up this point and is closely related to our paper as it also focuses on the European context. The main hypothesis stipulates that "the lower cost of cross-border FDI between EU member countries, on the one hand, and the lack of tax harmonization programs be-

³Baldwin, Forslid, and Haaland (1995) also confirms the possibility of investment diversion in the European context.

tween members, on the other hand, should cause EU countries to compete more intensively for FDI amongst themselves than with countries outside the EU. This might in turn cause them to react more to each others' taxes than to taxes of countries outside the EU" (Redoano (2014, p. 354)). The paper develops a theoretical model which reflects this intuition and differentiates bilateral FDI investments between member states, between member and non-member states, and between non-member states solely. The FDI decision and its volume depends on the taxes levied in the host country and the cost of the cross-border investments which might be of physical, legal or regulatory nature. The model predicts that EU member states react more to each others taxes than they do to non-member states. This is empirically confirmed on the basis of an exclusively European dataset. In our paper we go one step further and analyze in how far tax competition within Europe and between Europe and the rest of the world differs. When doing so, we do not explicitly model membership in a free-trade areas but more generally membership in a region. Regional blocs can be distinct from each other for several reasons: Firstly, distance between countries of the same regional bloc is often smaller than across blocs. Secondly, cultural barriers within a regional bloc are likely to be smaller and consumer preferences to be more similar which makes export-platform strategies within regions more attractive than across regions. This potentially feeds back to the tax setting behaviour of governments as argued by Raff (2004) and Redoano (2014). However, the intensity and existence of strategic tax interactions depend on a range of determinants like the "accessability" of a regional bloc from outside as well as the extent of FDI and trade liberalization within the bloc. Ex-ante it is not possible to answer the question if the decline in corporate tax levels in Europe is mainly driven by inner-European tax competition or whether European countries also react to the tax levels of other countries from other world regions.

Tax Competition Literature

The previous tax competition literature has rather neglected these questions. The *theoretical strand* of the existing literature tries to identify assumptions and conditions, under which different possible consequences of tax competition occur (for example a race to the bottom).⁴ Other papers theoretically determine in which dimension (e.g. statutory tax rates) countries compete with each other.⁵

Descriptive approaches have shown how various tax parameters have developed over the last centuries. Elschner, Heckemeyer, and Spengel (2011)

⁴E.g. Zodrow and Mieszkowski (1983), Gordon (1986), Razin and Sadka (1991) and Zodrow (2006).

⁵E.g. Hauffer and Schjelderup (2000), Devereux, Lockwood, and Redoano (2008), Fuest and Hemmelgarn (2005) and Becker and Fuest (2011).

point out that the effective corporate taxation has declined substantially from 1998 to 2009 in the EU. Devereux, Griffith, and Klemm (2002) determine that the average statutory tax rates in Europe and the US have declined significantly from 48% to 35%. However, the tax base has been broadened at the same time which explains that tax revenues and effective tax rates have declined less than tax rates.⁶

Another strand of literature tries to investigate strategic interactions among countries by using *tax reaction functions*. Devereux, Lockwood, and Redoano (2008) analyse for 21 OECD countries if they compete with respect to their corporate taxes. They find strong evidence for international tax competition in statutory tax rates. States also seem to interact with respect to the effective tax rates; evidence for this is weaker though. The study does not show whether the results are driven by certain country constellations or country clusters and therefore is not able to address the research questions which this paper poses. Egger and Raff (2014) develop a theoretical model on the strategic interaction between countries with respect to corporate taxation. The model allows for two dimensions of interactions, i.e. interaction in tax rates and tax bases. The contribution is novel as it allows the countries to pursue two (competitive) aims with setting its tax parameters, namely attracting foreign FDI and increasing the size of the investments. In their empirical contribution they precisely estimate the slopes of the tax policy reaction functions and show in a counterfactual simulation that the changes in the countries' tax rates and bases are a consequence of the increased regional trade integration.

In the European context Crabbé and Vandebussche (2008) analyse by means of tax reaction functions whether EU-15 member states which are geographically close to the at the time ten new member states, react more strongly to their tax levels than to the other EU-15 countries. The analysis shows that direct neighbours of the new member states react more strongly to the tax level of the candidate countries than non neighbouring countries of the EU-15 group do. Another study by Davies and Voget (2008) concludes that the extension of the EU has intensified tax competition. The authors differentiate between EU countries and non-EU countries. Further distinctions between EU candidate countries and countries from other world regions are not made. Therefore, it is not possible to answer the question whether EU states compete with other world regions. An earlier study by Altshuler and Goodspeed (2002) is closely related to our research question as it poses the question whether the US acts as a Stackelberg leader for the European countries. They find that European countries do react to the US tax level. However, the measure of taxation, corporate tax revenues divided by

⁶Also see Gorter and de Mooij (2001) who find a broadening of the tax bases in Europe and Becker and Fuest (2011) who also confirm this and show that firm mobility might be a reason to deviate from investment neutrality. Devereux (2007) shows the development of statutory tax rates of the OECD countries from 1965 to 2004.

GDP, is only an indirect measure of the effective average tax rate. Furthermore, the dataset mainly consists of the cold war era and does not contain the new member states.⁷ A further study by Overesch and Rincke (2011) also focuses on the European context but not on the relationship between European countries and the rest of the world. In their empirical analysis they consider European countries and find strong (weak) evidence for competition in statutory tax rates (effective average tax rates). Given that the dataset only consists of European countries the paper cannot address the questions raised in this paper. As mentioned before, Redoano (2014) sets up a model which models EU membership "as a reduction in 'distance' between countries" (Redoano, 2014, p. 1). One of the model predictions is that EU member states react more to other EU member states taxes than to Non EU members' taxes. This is empirically tested on a panel dataset of Western European countries and mainly confirmed. In our paper we go one step further and analyze in how far tax competition within Europe and between Europe and the rest of the world differs.

⁷Therefore, the (external) validity of the results with respect to today's time seems limited.

3 Empirical Methodology

The tax competition literature cited in section 2 makes use of tax reaction functions to detect strategic interaction among countries. Tax reaction functions assume that a country's i level of corporate taxes is a function of the level of corporate taxes in the other countries. Theoretically, it is possible that country i reacts differently to all the other individual countries. However, most of the literature which uses tax reaction functions makes the assumption that country i reacts to the average level of corporate taxation of all other countries. This assumption is mainly due to data limitations since in the case of country specific response possibilities the number of coefficients to be estimated would equal the number of countries to be considered. Due to the high number of coefficients, this is no feasible estimation strategy. The literature has solved this problem by building an average of the tax levels of all other countries and making an ex-ante choice about the weighting of the elements in this average. Thus, the variable of interest is the weighted average tax level of all the other countries (i.e. other than i). In this case, there is just one coefficient to be estimated which then captures how country i reacts to the average tax rate of all the other countries. For example Devereux, Lockwood, and Redoano (2008) use one average when testing whether or not there is international tax competition. In our paper, we use specifications which allow for more than one average in order to detect which country constellations and which regions drive the results. Furthermore, for some regressions we will use subsamples in order to be able to address our research questions. With respect to the weighting matrix, there have been different approaches in the literature, e.g. model-based choices with weights according to GDP or trade flows. However, these weighting variables might be related to the corporate tax levels themselves and therefore be endogenous. This threatens the validity of the results. Recently, Klemm and Parys (2012) have used uniform weights and Redoano (2014) distance weights. We choose to use both uniform and distance weights in our specifications since they circumvent the endogeneity problem. We present results for both weighting specifications which allows assessing the robustness of the results.⁸

However, beside the average taxes of the other countries, the tax level of a country might also be determined by its own tax level in the previous period if countries face adjustment costs when changing their effective average tax rate (EATR). Consequently, they adjust their EATR only gradually when exogenous factors change and do not jump into a new equilibrium instantly. Therefore, we assume a dynamic model with the lagged depen-

⁸Overesch and Rincke (2011) and Crabbé and Vandenbussche (2008) also use distance weights in their main specifications.

As distance measure we use simple geodesic distances provided by the research institute CEPII.

dent variable as explanatory variable. Dynamic models in this or similar circumstances have been applied before, for example by Klemm and Parys (2012) in a taxation context or by Foucault, Madies, and Paty (2008) in the context of public spending interactions in French municipalities. Contrarily, the above cited papers of Devereux, Lockwood, and Redoano (2008), Crabbé and Vandenbussche (2008) and Davies and Voget (2008) do not consider dynamic models. However, our results show that a governments' choice on their countries' EATRs is highly path-dependent.

In our specification, the EATR of country $i=1, \dots, N$ at time $t=1, \dots, T$ is denoted by τ_{it} where N denotes the number of countries and T represents the number of time periods. The tax reaction function of state i can be written as (**baseline specification**):

$$\tau_{it} = \gamma\tau_{it-1} + \delta \sum_{j=1}^N w_{ij}\tau_{jt} + X_{it}\beta + \rho t + \alpha_i + \varepsilon_{it} \quad (1)$$

where α_i is a country-specific fixed effect, ρt represents a linear time trend and ε_{it} is an idiosyncratic error.

The EATR of country i is a function of the average EATR of its competitors, which is represented by the "spatial lag" term $\sum_{j=1}^N w_{ij}\tau_{jt}$ where w_{ij} is the weight with which country j 's EATR (τ_{jt}) goes into the average EATR ($w_{ij} = 0$ if $i = j$). X_{it} represents a vector of time varying control variables which are expected to influence the EATR and which represent sensible controls in order to make the variable of interest (spatial lag) uncorrelated with the error term.⁹

The dynamic nature of the specification imposes (internal) validity problems. In an ordinary OLS regression, the country-fixed effect in the error term causes the lagged dependent variable to be upward biased. The problem of endogeneity does not vanish when using fixed-effects OLS estimation as Nickell (1981) has shown. Also, drawing on a fixed-effects model which uses demeaning to purge out the country-fixed effect in the error does not solve the problem since it will make the demeaned error and the lagged dependent variable being correlated.¹⁰ In a random effects model the same issue arises. Dynamic panel data estimators tackle this problem by constructing first differenced regression equations. In such a specification, the

⁹We do not include time dummies since they would almost be identical to the spatial lag in case of uniform weighting. The time dummy would represent the average tax level in a given year. The spatial lag, in turn, also represents the average tax level in a given year except that it does not include the tax level of the county which is explained in the regression. Due to the high multicollinearity between the spatial lag and the time dummy, the spatial lag could not be interpreted sensible in this case. Klemm and Parys (2012) also use a linear time trend due to this problem. Please also see Elhorst (2010) for this point.

¹⁰The consideration of appropriate control variables does not solve this problem.

error term and the first differenced lagged dependent variable are still correlated, however, this can be circumvented by instrumenting the difference of the lagged dependent variable by lags of its levels (or differences).

In tax reaction functions, whether they are assumed to be dynamic or not, a second major endogeneity concern occurs. The spatial lag (average weighted tax level of the other countries) is endogenous by assumption since tax reaction functions actually claim that countries interact with each other. Thus, the idiosyncratic error term of country i is correlated with the spatial lag as country i itself has an influence on the tax setting behaviour of the other countries. This problem is inherent in the methodology of reaction functions. The literature deals with this problem by instrumenting the spatial lag by the averaged covariates of all other countries. This approach is chosen for example by Devereux, Lockwood, and Redoano (2008), Davies and Voget (2008), Klemm and Parys (2012) and Redoano (2014). These covariates qualify as instruments as they are uncorrelated with a country's idiosyncratic error term but are correlated with the other countries' tax levels. The covariates of the other countries are averaged by the same weighting scheme which is used to construct the spatial lag (in equation (1)).¹¹

Both endogeneity problems described above can be tackled efficiently by system GMM estimation as proposed by Blundell and Bond (1998). System GMM uses lagged levels for instrumenting current differences and lagged differences for instrumenting current levels. Furthermore, it allows for the inclusion of exogenous variables as instruments which are not part of the regression specification which is appropriate for our setting.¹² System GMM has also been applied recently by Klemm and Parys (2012) in this context. Furthermore, Madariaga and Poncet (2007) apply this method in the context of FDI spillovers and Foucault, Madies, and Paty (2008) in the context of public spending interactions.

The Hansen J test of overidentifying restrictions allows us to check whether the instruments are correlated with the residuals. The null hypothesis that there is no correlation between instruments and residuals cannot be rejected for any of the regressions conducted in the analysis. To check

¹¹Please see Section 7.2 in the Appendix for an illustration in matrix notation.

¹²I.e. it is relevant for using the covariates of the other countries to instrument the spatial lag.

For instrumenting the endogenous variables, we use the second and third lag in the transformed equation (difference equation) and the first, second and third lag for the level equation. Leaving out the first lag in the transformed equation is due to the fact that observations would be lost otherwise. This is the standard approach for endogenous variables as described by Roodman (2009, p. 124). Furthermore, we restrict the number of instruments by only using up to three lags in order to keep the number of instruments manageable as suggested by Roodman (2009, p. 124). This lag specification applies to all regressions which we run, thus our results are not driven by varying the lag specification among the regressions. The robust option is used in order to produce errors which are robust to heteroskedasticity and "arbitrary patterns of autocorrelation" within countries (Roodman, 2009, p. 123).

for autocorrelation in residuals, the Arellano and Bond (1991) statistics on first and second order autocorrelation of the first-differenced residuals is employed. The second order correlation is relevant in our case since our model is specified in first-differences and we want to check for autocorrelation in levels.¹³

4 Data

Country coverage

Our (balanced) panel data set covers 46 countries over the period 1996 to 2012. The data set consists of four world regions, namely Europe, North America, the Asia-Pacific region and Latin America. Naturally, the European region makes up for the majority of the 46 countries.¹⁴ Since we primarily want to look at competition in FDI, the effective average tax rate (EATR) is the relevant measure as argued by Devereux and Griffith (1998, p. 337) and Devereux and Griffith (2003).¹⁵

Development of Effective Average Tax Rates

EATRs are strongly correlated with statutory tax rates. However, EATRs also take into account depreciations methods for assets and valuation methods for inventories.¹⁶ This can be important when governments do not only interact with respect to statutory tax rates but also use favourable depreciation to become more attractive for FDI. Section 7.1.1 in the appendix explains our data sources and computation assumptions.¹⁷ The data on the EATRs shows that the average EATR in Europe has decreased significantly from 1996 to 2012 (Figure 1 in section (introduction)). It is insightful to have a closer look at this development descriptively. Table 7.1.2 in the Appendix shows that there have been considerable changes from 1996 to 2012. The mean EATR of the EU28 has fallen from 29.5% in 1996 to 20.4% in 2012. There are substantial differences in the EATR of the old (EU15) and the new member states (EU13). Throughout time the mean EATR of the EU15 is higher than the one of the EU13. Additionally, the dynamics of the EATRs are different between the two groups. The new member states lowered their mean EATR by 7.5 percentage points until 2004 (year of entry into the EU). Afterwards, they kept decreasing their tax rates, however, the pace with which they lowered their rates became considerably slower. Overall, the reduction of the mean EATR of the EU+13 has been 3.9 percentage

¹³We cannot reject the null hypothesis of no autocorrelation at the 10% significance level for all regressions of this study.

¹⁴Table 6 and 7 in the Appendix provide information on the countries covered.

¹⁵Davies and Voget (2008) also use EATRs for firms' location decision.

¹⁶In general, the EATR assumes an investment into a profitable project.

¹⁷Partly missing yet.

points from 2004 to 2012. In contrast, the old member states lower their mean EATR less during the pre-enlargement period but actually slightly increase their downward dynamic after the enlargement. Overall, the mean EATR of EU15 and EU13 diverges from 4.1 percentage points in 1998 to 8.1 percentage points in 2004. Afterwards, the difference stays relatively constant (8.4 percentage points in 2012). Our paper considers these inner-European developments when conducting the empirical analysis.

Control Variables

For the empirical analysis, we merge the EATR data with a set of time varying control variables X_{it} which has been typically used in the literature. Government consumption expenditure ($Gov't.Consumption_{it}$) is supposed to reflect the need of a government (or society) to generate tax revenues in order to fulfill its preferences for the provision of public goods and redistributive policies.¹⁸ We also include demographic variables which might have an effect on the tax setting of a state, i.e. the share of people living in urban areas ($Urban_{it}$)¹⁹ and the share of the dependents as percent of the working-age population ($Dependency_{it}$)²⁰.

Table 1: Descriptive Statistics

Variable	Unit	Mean	Std. Dev.	Min	Max	Obs.	Source
EATR	Percent	25.8	7.7	8.3	47.9	748	ZEW/Oxford
<i>Controls:</i>							
GDP (ln)	USD in Bill.	26.2	1.7	22.3	30.3	748	Worldbank
Gov't Con- sumption	% of GDP	18.0	4.5	5.7	29.8	748	Worldbank
Urban	Percent	71.8	14.5	26.8	97.5	748	Worldbank
Dependency	Percent	49.2	5.1	36.0	66.9	748	Worldbank
Openness	(exports + im- ports)/GDP	0.9	0.5	0.2	3.9	748	Worldbank

Clearly, the openness of an economy potentially affects how strong a government competes for FDI. Therefore, we include an openness measure which has been used in the literature before (i.e. Overesch and Rincke (2011)). This is computed by dividing the sum of imports and exports by GDP ($Openness_{it}$). However, the effect of this openness measure is not

¹⁸In a similar setting this has also been used by Davies and Voget (2008) and Redoano (2014).

¹⁹Among others this variable has also been used by Devereux, Lockwood, and Redoano (2008) and Davies and Voget (2008)

²⁰Indirectly, this measure has also been employed by Overesch and Rincke (2011) and Crabbé and Vandenbussche (2008). However, they use two separate variables (the share of young and old people to the population). Davies and Voget (2008) and Redoano (2014) use the dependency measure directly.

unambiguous in our view since high trade volumes can also indicate that multinational find it more attractive to serve the market by imports rather than through direct investments as argued in section (2). To control for the size of an economy and thus for its possible market power we include the GDP (in constant USD) of the respective country (GDP_{it})²¹. Table 1 provides descriptive statistics on these covariates and the EATR.

5 Results

Global Tax Competition

The first specification reflects the presented baseline regression in section 3. Thus, the EATR of country i is explained by the the weighted average EATR of all other countries. The results in column 1 (uniform weighting) and 2 (distance weighting) of Table ?? indicate that there is international tax competition. The single spatial lag is positive and significant at the 5% level with uniform weights and at the 1% level with the distance weights. Although the international tax competition literature has collected numerous evidence for the presence of international tax competition, none of these studies has actually done this for the measure of EATR in a worldwide dataset. Davies and Voget (2008) use a very similar dataset and also measure tax competition with respect to EATR. However, they find no significant effect when just using one spatial lag (Davies and Voget, 2008, p. 26 columns 2 and 3). In contrast to this study they choose a static setting. This might be a first indication that specifying a dynamic model matters. The assumption that states adjust their tax parameters only gradually towards a new equilibrium is confirmed by a very high and significant estimated coefficient of the lagged dependent variable in Table ??.

The result of an estimated spatial lag coefficient which is positively significant raises two questions: Firstly, does this result also hold when just looking at European countries? And secondly (and the other way around), does this result also hold when excluding European countries from the data set? Our first results and the results of for example Devereux, Lockwood, and Redoano (2008) might be driven by European tax competition and are therefore not actually evidence for worldwide tax competition.²² Column 3 (uniform weighting) and 4 (distance weighting) of Table ?? address this (second) question by conducting regressions which exclude all European countries. In this case the spatial lag turns insignificant for both specifications (uniform and distance weighting). Thus, from this perspective the result

²¹Redoano (2014), Egger and Raff (2014) and others also use this control variable in comparable settings.

²²Aside from that, Devereux, Lockwood, and Redoano (2008) look at statutory tax rates and EMTRs instead of EATRs as relevant measures for tax competition.

Table 2: Global tax competition vs. global tax competition without Europe

Dependent variable τ_{it}	(1)	(2)	(3)	(4)
	All countries uniform	distance	Without Europe uniform	distance
Lagged EATR	0.807*** [0.035]	0.824*** [0.031]	0.862*** [0.056]	0.865*** [0.041]
Average EATR (Spatial Lag)	0.418** [0.204]	0.251*** [0.088]	0.327 [0.306]	0.017 [0.054]
Gov't consumption (lag)	0.002 [0.031]	0.010 [0.051]	0.079 [0.054]	0.061 [0.039]
Urban (lag)	0.026* [0.016]	0.004 [0.023]	0.003 [0.007]	-0.006 [0.007]
Openness (lag)	0.293 [0.349]	-0.148 [0.537]	-1.026 [1.046]	-1.452 [1.073]
GDP (lag and ln)	0.601*** [0.109]	0.341** [0.162]	0.297* [0.160]	0.151 [0.148]
Dependency (lag)	0.056** [0.026]	0.066 [0.044]	0.063** [0.027]	0.080** [0.032]
Time Trend	0.110 [0.106]	0.083 [0.054]	0.069 [0.080]	0.016 [0.049]
Constant	-248.176 [218.773]	-180.306* [108.155]	-155.825 [170.321]	-36.366 [96.755]
Observations	704	704	208	208
Number of countries	44	44	13	13
Hansen test P-value	0.999	1	1	1
AR(1) P-value	0.0195	0.0225	0.0160	0.0108
AR(2) P-value	0.113	0.119	0.891	0.830

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

of international tax competition might be driven by the group of European countries. Theoretically, however, it is conceivable that the last result is not so much a sign for tax competition being a specific European phenomenon but rather a sign for tax competition taking place within regional blocs than across regions. This might be due to lower costs for market access (and the possibility of export-platform FDI strategies), higher information flows or lower cultural burdens within regional blocs. The uniform specification in column 1 of Table ?? assumes that tax competition between countries of the same region and countries from different world regions is the same. The distance specification indirectly allows for differences by giving more distant countries a lower weight. However, this does still not allow for structural differences in tax competition within and between regional blocs.

Regional Tax Competition

Table 3 presents results when regressing the EATR of country i on the weighted average EATR of the countries in its own region. There is somewhat mixed evidence for the general existence of tax competition within regions. The spatial lag of the uniform specification is significant whereas the one of the distance specification does not turn out significant at the 10% significance level (column 1 and 2 of Table 3). The economic effects appear to be quite small in both specifications (below 0.1). When excluding the European countries from this exercise in column 3 and 4 of Table 3, the spatial lag in both specifications turns insignificant. This indicates that there is no evidence for general tax competition between countries within a region.²³ In fact, it rather seems that tax competition primarily plays a role in Europe. This calls for running an analysis which only considers European countries. This is done in column 5 and 6 of Table 3. Now, the spatial lag turns positively significant in both regression specifications. Consistently, the economic effect of the spatial lag appears considerably larger than before and they are statistically more robust. With respect to the other variables in the regressions produced in Table 3 the picture is relatively consistent: The coefficient estimate for the lagged dependent variable is always highly significantly different from zero and above 0.8. Like in Table ?? there is evidence that the level of GDP (in logarithms) and the dependency ratio explain the level of the EATR.

The result of tax competition within Europe is in line with the literature. However, it is different with respect to the details. Overesch and Rincke (2011) find evidence for inner-European tax competition, however, only with respect to statutory tax rates. They also test for competition in EMTRs and EATRs but find no robust evidence in these cases. This is not necessarily

²³However, this empirical finding might be solely due to the lower number of observations and therefore the lower statistical power. If this was the case, one would nevertheless have no general evidence for regional tax competition.

Table 3: Regional tax competition

Dependent variable τ_{it}	(1)	(2)	(3)	(4)	(5)	(6)
	All countries		Without Europe		European countries	
	uniform	distance	uniform	distance	uniform	distance
Lagged EATR	0.889*** [0.024]	0.864*** [0.033]	0.911*** [0.031]	0.905*** [0.032]	0.825*** [0.052]	0.829*** [0.047]
Average EATR same region	0.084** [0.035]	0.052 [0.033]	-0.028 [0.034]	-0.040 [0.033]	0.385*** [0.142]	0.212** [0.100]
Gov't Consumption (lag)	0.027 [0.023]	0.021 [0.029]	0.021 [0.030]	0.024 [0.030]	0.032 [0.033]	0.040 [0.033]
Urban (lag)	0.015 [0.010]	0.018 [0.013]	0.006 [0.005]	0.006 [0.004]	0.053 [0.040]	0.046 [0.037]
Openness (lag)	0.192 [0.180]	0.041 [0.223]	-0.943 [0.648]	-1.007 [0.684]	-0.007 [0.479]	-0.351 [0.557]
GDP (lag and ln)	0.237** [0.097]	0.285*** [0.099]	0.112 [0.089]	0.115 [0.087]	0.399*** [0.147]	0.249* [0.144]
Dependency (lag)	0.054*** [0.015]	0.054*** [0.017]	0.032** [0.015]	0.028* [0.016]	-0.036 [0.058]	-0.034 [0.055]
Time trend	0.001 [0.026]	-0.024 [0.029]	-0.014 [0.033]	-0.020 [0.032]	0.132 [0.091]	0.053 [0.057]
Constant	-13.041 [53.151]	38.539 [57.792]	26.922 [65.365]	39.165 [63.029]	-282.21 [186.645]	-116.62 [114.874]
Observations	704	704	208	208	496	496
Number of ID	44	44	13	13	31	31
Hansen test P-value	1	1	1	1	1	1
AR(1) P-value	0.0210	0.0181	0.0103	0.0113	0.0202	0.0210
AR(2) P-value	0.120	0.115	0.774	0.777	0.0992	0.100

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

contradicting to our results but is likely due to the fact that they address the endogeneity of their dynamic specification by using fixed effects. However, as explained in Section 3 and also by Overesch and Rincke (2011) themselves, this does not fully solve the endogeneity problem. The result of inner-European tax competition confirms the results of Davies and Voget (2008) which are also looking at competition with respect to EATR. They use a static model whereas our study confirms the result by means of a dynamic model.

Tax Competition in Europe - Europe in competition with other world regions?

Before zooming closer into European tax competition we want to address the question whether or not there is evidence that European countries react to the effective tax levels of non-European countries. This question plays a significant role in the discussion on the advantages and disadvantages of tax harmonization as argued in the Introduction. Assuming that European countries react to the level of taxation in non-European countries, full harmonization of cooperate taxation in Europe could actually put the member states into a "straitjacket" which prevents them to flexibly react to tax pressure from other world regions as argued by Schön (2003, p. 28).²⁴ The analyses in column 1 and 2 of Table 4 address this question. The EATR of European countries is regressed on the weighted average EATR of the other European countries and the weighted average EATR of the countries of the rest of the world. Consistently with the result from before, the European spatial lag is positive and statistically significant at the 1% level (for both types of weighting matrices). Evidence for the relevance of the effective average tax levels in the non-European countries is not found. The spatial lag for the non-European countries is not significant at the 10% significance level. Thus, one can cautionary conclude that there does not seem to be evidence for tax pressure on European countries from other world regions. The fall in effective tax rates in Europe can rather for the most part be attributed to inner-European tax interactions.

With respect to the inner-European tax competition, it makes sense²⁵ to differentiate further between countries belonging to the EU15 and to the EU+13 in the multivariate analyses. For this we now only explain the EATR of the EU15 countries on the weighted average EATR of the other EU15 countries. Column 3 and 4 in Table 4 show that evidence for tax competition in this setting becomes weak. This is not totally surprising given that from the descriptives presented in Table 1 in Section 4 most of the dynamics in the EATRs seem to originate from the new member states and the interaction between new (EU13) and older member states (EU15). Thus the data only shows robust evidence for (European) tax competition when analyzing all countries and their interactions together and not when only examining parts of it. Column 5 and 6 of Table 4 show results when regressing the EU15 states additionally on the EATR of the EU13²⁶ states and the EATR of all other states which are not in Europe.²⁷ There is some evidence that the EU15 countries react to the new member states. However,

²⁴For a thorough discussion on this and related arguments please see Schön (2003).

²⁵Given the development at time of entry of the new member states as described in Section 4.

²⁶The EU13 group includes Croatia although it only finally joined the European Union in 2013.

²⁷Thus, Switzerland, Norway and Turkey are not included in this analysis

this point should not be overemphasized since the spatial lag of the EU12 countries is only statistically significant when weighting by distance. This is actually related to the results of Table Crabbé and Vandebussche (2008) which find that old member states located close to the new member states react stronger to the new member states' effective corporate tax levels than other member states do. Overall, the results can cautiously be interpreted in the way that the interactions between old and new member states have driven corporate average tax levels down.

Table 4: European considerations

Dependent variable τ_{it}	(1)	(2)	(3)	(4)	(5)	(6)
	European Countries		EU15 countries		EU15 countries	
	uniform	distance	uniform	distance	uniform	distance
Lagged EATR	0.833*** [0.052]	0.871*** [0.030]	0.797*** [0.115]	0.833*** [0.068]	0.801*** [0.114]	0.838*** [0.061]
Non European Average EATR (Spatial Lag)	0.415 [0.262]	0.067 [0.207]				
European Average EATR (Spatial Lag)	0.571*** [0.183]	0.248** [0.107]				
Gov't Consumption (lag)	0.034 [0.032]	0.042 [0.026]	-0.042 [0.071]	-0.031 [0.068]	-0.040 [0.072]	-0.024 [0.053]
Urban (lag)	0.052 [0.040]	0.034 [0.027]	0.057 [0.044]	0.055 [0.035]	0.057 [0.043]	0.046 [0.028]
Openness (lag)	-0.004 [0.476]	-0.352 [0.501]	-0.393 [0.578]	-0.608 [0.629]	-0.395 [0.582]	-0.263 [0.490]
GDP (lag and ln)	0.394*** [0.145]	0.150 [0.141]	0.516* [0.312]	0.398 [0.252]	0.517* [0.308]	0.352* [0.198]
Dependency (lag)	-0.036 [0.058]	-0.028 [0.043]	-0.109 [0.137]	-0.087 [0.102]	-0.113 [0.137]	-0.080 [0.089]
Time trend	0.358** [0.155]	0.127 [0.109]	-0.100 [0.190]	0.059 [0.078]	0.060 [0.251]	0.098 [0.096]
Spatial Lag EU15			-0.059 [0.344]	0.220* [0.122]	0.009 [0.326]	-0.142 [0.119]
Spatial Lag EU13					0.090 [0.117]	0.186** [0.075]
Spatial Lag Non-European					0.216 [0.321]	0.308 [0.255]
Observations	496	496	240	240	240	240
Number of ID	31	31	15	15	15	15
Hansen test P-value	1	1	1	1	1	1
AR(1) P-value	0.0197	0.0260	0.0559	0.0753	0.0581	0.0818
AR(2) P-value	0.101	0.111	0.335	0.355	0.342	0.373

Robust standard errors in brackets; constant included

*** p<0.01, ** p<0.05, * p<0.1

6 Conclusion

-to be completed-

References

- ALTSHULER, R., AND T. J. GOODSPEED (2002): “Follow the Leader? Evidence on European and U.S. Tax Competition,” Departmental Working Papers 200226, Rutgers University, Department of Economics.
- ARELLANO, M., AND S. BOND (1991): “Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations,” *Review of Economic Studies*, 58(2), 277–97.
- BALDWIN, R. E., R. FORSLID, AND J. HAALAND (1995): “Investment Creation and Investment Diversion: Simulation Analysis of the Single Market Programme,” Working Paper 5364, National Bureau of Economic Research.
- BALTAGI, B. H., P. EGGER, AND M. PFAFFERMAYR (2007): “Estimating Regional Trade Agreement Effects on FDI in an Interdependent World,” Center for Policy Research Working Papers 100, Center for Policy Research, Maxwell School, Syracuse University.
- BECKER, J., AND C. FUEST (2011): “Optimal tax policy when firms are internationally mobile,” *International Tax and Public Finance*, 18(5), 580–604.
- BLOMSTROM, M., AND A. KOKKO (1997): “Regional Integration and Foreign Direct Investment,” NBER Working Papers 6019, National Bureau of Economic Research, Inc.
- BLONIGEN, B. A., R. B. DAVIES, G. R. WADDELL, AND H. T. NAUGHTON (2007): “{FDI} in space: Spatial autoregressive relationships in foreign direct investment,” *European Economic Review*, 51(5), 1303 – 1325.
- BLUNDELL, R., AND S. BOND (1998): “Initial conditions and moment restrictions in dynamic panel data models,” *Journal of Econometrics*, 87(1), 115–143.
- CRABBÉ, K., AND H. VANDENBUSSCHE (2008): “Are your taxes set in Warsaw? Spatial tax competition in Europe,” Open Access publications from Katholieke Universiteit Leuven urn:hdl:123456789/386123, Katholieke Universiteit Leuven.
- DAVIES, R. B., AND J. VOGET (2008): “Tax Competition in an Expanding European Union,” Working Papers 0830, Oxford University Centre for Business Taxation.

- DEVEREUX, M. P. (2007): “Developments in the Taxation of Corporate Profit in the OECD since 1965: Rates, Bases and Revenues,” Working Papers 0704, Oxford University Centre for Business Taxation.
- DEVEREUX, M. P., AND R. GRIFFITH (1998): “Taxes and the location of production: evidence from a panel of US multinationals,” *Journal of Public Economics*, 68(3), 335–367.
- DEVEREUX, M. P., AND R. GRIFFITH (2003): “Evaluating Tax Policy for Location Decisions,” *International Tax and Public Finance*, 10(2), 107–26.
- DEVEREUX, M. P., R. GRIFFITH, AND A. KLEMM (2002): “Corporate income tax reforms and international tax competition,” *Economic Policy*, 17(35), 449–495.
- DEVEREUX, M. P., B. LOCKWOOD, AND M. REDOANO (2008): “Do countries compete over corporate tax rates?,” *Journal of Public Economics*, 92(5-6), 1210–1235.
- DEVEREUX, M. P., AND M. PEARSON (1995): “European tax harmonisation and production efficiency,” *European Economic Review*, 39(9), 1657 – 1681.
- EGGER, P., AND H. RAFF (2014): “Tax rate and tax base competition for foreign direct investment,” *International Tax and Public Finance*, pp. 1–34.
- EKHOLM, K., R. FORSLID, AND J. MARKUSEN (2003): “Export-Platform Foreign Direct Investment,” NBER Working Papers 9517, National Bureau of Economic Research, Inc.
- ELHORST, J. (2010): “Spatial Panel Data Models,” in *Handbook of Applied Spatial Analysis*, ed. by M. M. Fischer, and A. Getis, pp. 377–407. Springer Berlin Heidelberg.
- ELSCHNER, C., J. H. HECKEMEYER, AND C. SPENGEL (2011): “Besteuerungsprinzipien und effektive Unternehmenssteuerbelastungen in der Europäischen Union: Regelt sich die EU?weite Steuerharmonisierung von selbst?,” *Perspektiven der Wirtschaftspolitik*, 12(1), 47–71.
- FOUCAULT, M., T. MADIES, AND S. PATY (2008): “Public spending interactions and local politics. Empirical evidence from French municipalities,” *Public Choice*, 137(1), 57–80.
- FUEST, C., AND T. HEMMELGARN (2005): “Corporate tax policy, foreign firm ownership and thin capitalization,” *Regional Science and Urban Economics*, 35(5), 508–526.

- GORTER, J., AND R. DE MOOIJ (2001): “Capital income taxation in Europe; trends and trade-offs,” CPB Special Publication 30, CPB Netherlands Bureau for Economic Policy Analysis.
- HAUFLER, A., AND G. SCHJELDERUP (2000): “Corporate Tax Systems and Cross Country Profit Shifting,” *Oxford Economic Papers*, 52(2), 306–25.
- KLEMM, A., AND S. PARYS (2012): “Empirical evidence on the effects of tax incentives,” *International Tax and Public Finance*, 19(3), 393–423.
- MADARIAGA, N., AND S. PONCET (2007): “FDI in Chinese Cities: Spillovers and Impact on Growth,” *The World Economy*, 30(5), 837–862.
- MOTTA, M. (1992): “Multinational firms and the tariff-jumping argument: A game theoretic analysis with some unconventional conclusions,” *European Economic Review*, 36(8), 1557–1571.
- MOTTA, M., AND G. NORMAN (1996): “Does Economic Integration Cause Foreign Direct Investment?,” *International Economic Review*, 37(4), 757–83.
- NICKELL, S. J. (1981): “Biases in Dynamic Models with Fixed Effects,” *Econometrica*, 49(6), 1417–26.
- OVERESCH, M., AND J. RINCKE (2011): “What Drives Corporate Tax Rates Down? A Reassessment of Globalization, Tax Competition, and Dynamic Adjustment to Shocks,” *Scandinavian Journal of Economics*, 113(3), 579–602.
- PAIN, N. (1997): “Continental Drift: European Integration and the Location of U.K. Foreign Direct Investment,” *The Manchester School*, 65(S), 94–117.
- RAFF, H. (2004): “Preferential trade agreements and tax competition for foreign direct investment,” *Journal of Public Economics*, 88(12), 2745 – 2763.
- RAZIN, A., AND E. SADKA (1991): “International tax competition and gains from tax harmonization,” *Economics Letters*, 37(1), 69 – 76.
- REDOANO, M. (2014): “Tax competition among European countries. Does the {EU} matter?,” *European Journal of Political Economy*, (0), –.
- ROODMAN, D. (2009): “How to do xtabond2: An introduction to difference and system GMM in Stata,” *Stata Journal*, 9(1), 86–136.
- ROWTHORN, R. (1992): “INTRA-INDUSTRY TRADE AND INVESTMENT UNDER OLIGOPOLY: THE ROLE OF THE MARKET SIZE,” *Economic Journal*, 102(411), 402 – 414.

- SCHÖN, W. (2003): “Tax Competition in Europe - General Report,” W. Schön (Ed.), *Tax Competition in Europe*, Amsterdam: IBFD., 1–42.
- SMITH, A. (1987): “Strategic investment, multinational corporations and trade policy,” *European Economic Review*, 31(1-2), 89–96.
- SØRENSEN, P. B. (2004): “International tax coordination: regionalism versus globalism,” *Journal of Public Economics*, 88(6), 1187–1214.
- ZODROW, G. (2006): “Capital Mobility and Source-Based Taxation of Capital Income in Small Open Economies,” *International Tax and Public Finance*, 13(2), 269–294.

7 Appendix

7.1 Data

7.1.1 Computation of EATR

The concept of Devereux and Griffith (1998, 2003) models a hypothetical investment project of a company and allows to compute the tax burden on this investment. The model allows to include the most relevant tax provisions for corporations of a country.²⁸ We include nominal corporation tax rates, local taxes on profits and surcharges. In addition, real estate, property and net-wealth taxes are considered. The computations also consider the depreciation rules for buildings and machinery and the valuation method for inventories. Overall, the modelled investment is assumed to be financed by a mix of new equity, retained earnings and debt. In case of debt financing the possibility of interest deductability is taken into account. With respect to the underlying economic parameters 5 states the assumptions made when computing the EATR. The assumptions are listed in Table 5.

Table 5: Assumptions for EATR computation

Types of assets	industrial buildings (0.28%), machinery (0.5%), inventories (0.22%)
Source of finance	retained earnings (33.33%), new equity (33.33%), debt (33.33%)
True economic depreciation (declining balance)	Buildings: 3.1% Machinery: 17.5%
Lifetime (for tax purposes)	Buildings: 25 years Machinery: 7 years
Inflation Rate	2%
Real interest rate	5%
Pre-tax rate of return	20%

²⁸Taxation at the level of the shareholder is not taken into account since it does not affect decisions of corporations when assuming that there is significant international portfolio investment. Please also see Devereux and Pearson (1995, p. 1660) for this.

7.1.2 Dataset

Table 6: Dataset European Countries from 1996

Country	Country
Austria	Latvia
Belgium	Lithuania
Bulgaria	Luxembourg
Croatia	UK
Cyprus	Malta
Czech Republic	Netherlands
Denmark	Norway
Estonia	Poland
Finland	Portugal
France	Romania
Germany	Slovakia
Greece	Slovenia
Hungary	Spain
Italy	Sweden
Ireland	Switzerland
	Turkey

Table 7: Dataset Non-European Countries from 1996

Country	Country
North America:	
USA	Canada
Asia-Pacific:	
Australia	Korea
New Zealand	Japan
China	India
Indonesia	
Latin America:	
Mexico	Argentina
Brazil	Chile

Table 8: Mean EATRs in Europe over time

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
EU 15	31.4	31.1	29.7	29.4	29.2	28.8	28.6	28.4	27.9	26.9	26.3	25.4	26.3	25.3	24.5	24.3	24.3
EU13	27.3	26.9	26.4	26.0	23.4	22.4	21.2	19.9	19.8	16.5	17.7	17.8	16.4	16.6	16.0	16.0	15.9
EU28	29.5	29.1	28.1	27.8	26.5	25.9	25.2	24.5	24.1	22.0	22.3	21.8	21.7	21.2	20.5	20.5	20.4
EU28 +3	29.5	29.1	28.2	27.5	26.3	25.8	25.1	24.5	24.2	22.1	22.1	21.7	21.6	21.2	20.5	20.5	20.4

7.2 Illustration of tax reaction function and instrumenting of spatial lag by matrix notation:

Example: (n=)4 countries (A, B, C, D) and (m=)3 control variables (1, 2, 3)

(abstracting from different regions: $\mathbf{t} = \alpha \mathbf{W} \mathbf{t} + \mathbf{X} \boldsymbol{\delta} + \boldsymbol{\varepsilon}$)

$$\mathbf{W} = \begin{matrix} & \begin{matrix} A & B & C & D \end{matrix} \\ \begin{matrix} A \\ B \\ C \\ D \end{matrix} & \begin{pmatrix} 0 & w_{AB} & w_{AC} & w_{AD} \\ w_{BA} & 0 & w_{BC} & w_{BD} \\ w_{CA} & w_{CB} & 0 & w_{CD} \\ w_{DA} & w_{DB} & w_{DC} & 0 \end{pmatrix} \end{matrix} \quad \mathbf{t} = \begin{pmatrix} t_A \\ t_B \\ t_C \\ t_D \end{pmatrix}$$

$$\mathbf{X} = \begin{matrix} & \begin{matrix} 1 & 2 & 3 \end{matrix} \\ \begin{matrix} A \\ B \\ C \\ D \end{matrix} & \begin{pmatrix} x_{A1} & x_{A2} & x_{A3} \\ x_{B1} & x_{B2} & x_{B3} \\ x_{C1} & x_{C2} & x_{C3} \\ x_{D1} & x_{D2} & x_{D3} \end{pmatrix} \end{matrix} \quad \boldsymbol{\delta} = \begin{pmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \end{pmatrix}$$

$$\begin{pmatrix} t_A \\ t_B \\ t_C \\ t_D \end{pmatrix} = \begin{pmatrix} \alpha(w_{AB}t_B + w_{AC}t_C + w_{AD}t_D) \\ \alpha(w_{BA}t_A + w_{BC}t_C + w_{BD}t_D) \\ \alpha(w_{CA}t_A + w_{CB}t_B + w_{CD}t_D) \\ \alpha(w_{DA}t_A + w_{DB}t_B + w_{DC}t_C) \end{pmatrix} + \begin{pmatrix} \delta_1 x_{A1} + \delta_2 x_{A2} + \delta_3 x_{A3} \\ \delta_1 x_{B1} + \delta_2 x_{B2} + \delta_3 x_{B3} \\ \delta_1 x_{C1} + \delta_2 x_{C2} + \delta_3 x_{C3} \\ \delta_1 x_{D1} + \delta_2 x_{D2} + \delta_3 x_{D3} \end{pmatrix} + \begin{pmatrix} \varepsilon_A \\ \varepsilon_B \\ \varepsilon_C \\ \varepsilon_D \end{pmatrix}$$

Instrumenting Wt :

where

ξ is a $(m \times 1)$ -vector

$$Wt = WX\xi \quad (2)$$

$$\begin{pmatrix} w_{AB}t_B + w_{AC}t_C + w_{AD}t_D \\ w_{BA}t_A + w_{BC}t_C + w_{BD}t_D \\ w_{CA}t_A + w_{CB}t_B + w_{CD}t_D \\ w_{DD}t_D + w_{DB}t_B + w_{DC}t_C \end{pmatrix} = \begin{pmatrix} w_{AB}x_{B1} + w_{AC}x_{C1} + w_{AD}x_{D1} \\ w_{BA}x_{A1} + w_{BC}x_{C1} + w_{BD}x_{D1} \\ w_{CA}x_{A1} + w_{CB}x_{B1} + w_{CD}x_{D1} \\ w_{DA}x_{A1} + w_{DB}x_{B1} + w_{DC}x_{C1} \end{pmatrix} = \begin{pmatrix} w_{AB}x_{B2} + w_{AC}x_{C2} + w_{AD}x_{D2} \\ w_{BA}x_{A2} + w_{BC}x_{C2} + w_{BD}x_{D2} \\ w_{CA}x_{A2} + w_{CB}x_{B2} + w_{CD}x_{D2} \\ w_{DA}x_{A2} + w_{DB}x_{B2} + w_{DC}x_{C2} \end{pmatrix} = \begin{pmatrix} w_{AB}x_{B3} + w_{AC}x_{C3} + w_{AD}x_{D3} \\ w_{BA}x_{A3} + w_{BC}x_{C3} + w_{BD}x_{D3} \\ w_{CA}x_{A3} + w_{CB}x_{B3} + w_{CD}x_{D3} \\ w_{DA}x_{A3} + w_{DB}x_{B3} + w_{DC}x_{C3} \end{pmatrix} \begin{pmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \end{pmatrix}$$

$$\begin{pmatrix} w_{AB}t_B + w_{AC}t_C + w_{AD}t_D \\ w_{BA}t_A + w_{BC}t_C + w_{BD}t_D \\ w_{CA}t_A + w_{CB}t_B + w_{CD}t_D \\ w_{DD}t_D + w_{DB}t_B + w_{DC}t_C \end{pmatrix} = \begin{pmatrix} \xi_1(w_{AB}x_{B1} + w_{AC}x_{C1} + w_{AD}x_{D1}) \\ \xi_1(w_{BA}x_{A1} + w_{BC}x_{C1} + w_{BD}x_{D1}) \\ \xi_1(w_{CA}x_{A1} + w_{CB}x_{B1} + w_{CD}x_{D1}) \\ \xi_1(w_{DA}x_{A1} + w_{DB}x_{B1} + w_{DC}x_{C1}) \end{pmatrix} = \begin{pmatrix} \xi_2(w_{AB}x_{B2} + w_{AC}x_{C2} + w_{AD}x_{D2}) \\ \xi_2(w_{BA}x_{A2} + w_{BC}x_{C2} + w_{BD}x_{D2}) \\ \xi_2(w_{CA}x_{A2} + w_{CB}x_{B2} + w_{CD}x_{D2}) \\ \xi_2(w_{DA}x_{A2} + w_{DB}x_{B2} + w_{DC}x_{C2}) \end{pmatrix} = \begin{pmatrix} \xi_3(w_{AB}x_{B3} + w_{AC}x_{C3} + w_{AD}x_{D3}) \\ \xi_3(w_{BA}x_{A3} + w_{BC}x_{C3} + w_{BD}x_{D3}) \\ \xi_3(w_{CA}x_{A3} + w_{CB}x_{B3} + w_{CD}x_{D3}) \\ \xi_3(w_{DA}x_{A3} + w_{DB}x_{B3} + w_{DC}x_{C3}) \end{pmatrix}$$

7.3 Robustness

Table 9: **Statutory tax rates:** Global tax competition vs. global tax competition without Europe

Dependent variable τ_{it}	(1)	(2)	(3)	(4)
	All countries uniform	distance	Without Europe uniform	distance
Lagged statutory tax rate	0.975*** [0.005]	0.979*** [0.001]	0.830*** [0.097]	0.883*** [0.049]
Average EATR (Spatial Lag)	-0.160 [0.227]	-0.005 [0.009]	0.324 [0.345]	0.023 [0.050]
Gov't consumption (lag)	-0.061 [0.053]	-0.208 [0.199]	0.100 [0.074]	0.042 [0.041]
Urban (lag)	0.015** [0.006]	0.017 [0.020]	0.005 [0.008]	-0.003 [0.005]
Openness (lag)	0.600 [0.415]	1.531 [1.532]	-1.277 [1.278]	-1.731 [1.274]
GDP (lag and ln)	0.197** [0.084]	0.145 [0.180]	0.497* [0.273]	0.196 [0.176]
Dependency (lag)	0.035* [0.020]	0.099* [0.057]	0.072** [0.033]	0.070** [0.035]
Time Trend	-0.181 [0.288]	0.086 [0.083]	0.067 [0.100]	0.020 [0.051]
Constant	368.504 [597.293]	-179.445 [165.097]	-159.034 [216.032]	-45.716 [99.975]
Observations	704	704	208	208
Number of countries	44	44	13	13
Hansen test P-value	0.995	1	1	1
AR(1) P-value	0.304	0.306	0.0191	0.0134
AR(2) P-value	0.329	0.328	0.659	0.648

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 10: **Statutory tax rates:** Regional and European Tax Competition

Dependent variable τ_{it}	(1)	(2)	(3)	(4)	(5)	(6)
	All countries		European countries		European countries	
	uniform	distance	uniform	distance	uniform	distance
Lagged statutory tax rate	0.979***	0.979***	0.975***	0.979***	0.971***	0.979***
	[0.000]	[0.000]	[0.007]	[0.001]	[0.010]	[0.001]
Average EATR - own region	-0.005	-0.002	-0.142	-0.003	-0.257	-0.004
	[0.005]	[0.003]	[0.208]	[0.007]	[0.296]	[0.007]
Average EATR - non-European					-2.282	-0.370
					[1.729]	[0.386]
Gov't consumption (lag)	-0.023	-0.037	-0.056	-0.073	-0.057	-0.066
	[0.071]	[0.068]	[0.123]	[0.157]	[0.124]	[0.154]
Urban (lag)	0.012*	0.014**	0.024	0.031	0.027	0.031
	[0.007]	[0.006]	[0.019]	[0.030]	[0.021]	[0.028]
Openness (lag)	0.411	0.423	0.161	0.136	0.011	0.225
	[0.302]	[0.303]	[0.440]	[0.378]	[0.490]	[0.374]
GDP (lag and ln)	0.088	0.120*	0.102	0.143	0.078	0.180
	[0.061]	[0.065]	[0.083]	[0.118]	[0.088]	[0.117]
Dependency (lag)	0.028*	0.030*	0.010	-0.011	0.006	-0.016
	[0.016]	[0.016]	[0.047]	[0.041]	[0.045]	[0.040]
Time trend	0.097	0.102	-0.169	0.160	-1.140	0.017
	[0.113]	[0.115]	[0.320]	[0.151]	[1.053]	[0.253]
Constant	-	-	350.567	-	2,382.605	-26.497
	198.429	209.626		324.156		
	[227.250]	[230.022]	[664.351]	[302.180]	[2,198.097]	[518.475]
Observations	704	704	496	496	496	496
Number of countries	44	44	31	31	31	31
Hansen test P-value	1	1	1.000	1	1.000	1
AR(1) P-value	0.307	0.307	0.304	0.307	0.303	0.307
AR(2) P-value	0.328	0.328	0.327	0.328	0.348	0.323

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 11: **Without CH, NO and TR:** Global tax competition vs. global tax competition without Europe

Dependent variable τ_{it}	(1)	(2)	(3)	(4)
	All countries uniform	distance	Without Europe uniform	distance
Lagged EATR	0.788*** [0.036]	0.829*** [0.032]	0.862*** [0.056]	0.865*** [0.041]
Average EATR (Spatial Lag)	0.380* [0.215]	0.219** [0.088]	0.327 [0.306]	0.017 [0.054]
Gov't consumption (lag)	-0.019 [0.035]	0.014 [0.048]	0.079 [0.054]	0.061 [0.039]
Urban (lag)	0.030* [0.016]	-0.000 [0.020]	0.003 [0.007]	-0.006 [0.007]
Openness (lag)	0.197 [0.375]	-0.230 [0.561]	-1.026 [1.046]	-1.452 [1.073]
GDP (lag and ln)	0.612*** [0.128]	0.358** [0.181]	0.297* [0.160]	0.151 [0.148]
Dependency (lag)	0.063** [0.029]	0.062 [0.046]	0.063** [0.027]	0.080** [0.032]
Time Trend	0.085 [0.111]	0.067 [0.055]	0.069 [0.080]	0.016 [0.049]
Constant	-196.686 [228.231]	-148.657 [109.078]	-155.825 [170.321]	-36.366 [96.755]
Observations	656	656	208	208
Number of countries	41	41	13	13
Hansen test P-value	1.000	1	1	1
AR(1) P-value	0.0236	0.0268	0.0160	0.0108
AR(2) P-value	0.106	0.112	0.891	0.830

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 12: **Without CH, NO, TR:** Regional and European Tax Competition

Dependent variable τ_{it}	(1)	(2)	(3)	(4)	(5)	(6)
	All countries		European countries		European countries	
	uniform	distance	uniform	distance	uniform	distance
Lagged EATR	0.886*** [0.024]	0.860*** [0.034]	0.808*** [0.060]	0.827*** [0.055]	0.818*** [0.060]	0.865*** [0.035]
Average EATR - own region	0.064* [0.033]	0.026 [0.028]	0.371** [0.145]	0.214* [0.114]	0.615** [0.240]	0.228* [0.119]
Average EATR - non-European					0.453 [0.333]	0.001 [0.223]
Gov't consumption (lag)	0.009 [0.025]	-0.005 [0.030]	-0.009 [0.047]	0.005 [0.044]	-0.006 [0.046]	0.011 [0.037]
Urban (lag)	0.017* [0.010]	0.021 [0.013]	0.064 [0.048]	0.053 [0.043]	0.063 [0.048]	0.041 [0.030]
Openness (lag)	0.153 [0.186]	0.039 [0.226]	-0.112 [0.553]	-0.405 [0.624]	-0.116 [0.550]	-0.362 [0.555]
GDP (lag and ln)	0.255*** [0.098]	0.320*** [0.098]	0.443*** [0.151]	0.269* [0.141]	0.437*** [0.150]	0.188 [0.141]
Dependency (lag)	0.055*** [0.016]	0.055*** [0.018]	-0.042 [0.077]	-0.042 [0.069]	-0.043 [0.077]	-0.035 [0.055]
Time trend	-0.011 [0.027]	-0.042 [0.029]	0.115 [0.089]	0.055 [0.064]	0.389* [0.212]	0.091 [0.122]
Constant	11.748 [54.376]	73.567 [58.686]	- 248.809 [182.549]	- 119.704 [128.264]	- 816.864* [438.996]	- 190.693 [249.230]
Observations	656	656	448	448	448	448
Number of coun- tries	41	41	28	28	28	28
Hansen test P-value	1	1	1	1	1	1
AR(1) P-value	0.0241	0.0207	0.0218	0.0228	0.0211	0.0290
AR(2) P-value	0.111	0.105	0.0884	0.0885	0.0929	0.102

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1