

What drives the decreasing corporate tax rates?

An empirical research on tax competition

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ABSTRACT

This paper uses panel data from 34 OECD countries over the period 1981-2014 to find out what the determinants of corporate income tax rates are. Dividing previous literature on the topic of tax competition in three different strands, it is found that strategic fiscal interactions between countries are the main driver of corporate tax rate setting behaviour by countries. Moreover, in line with previous literature a permanent positive shock in capital mobility due to economic integration is found to decrease the statutory tax rate. Year-to-year effects in capital mobility due to openness appear to be insignificant. No evidence is found for a moderating effect of economic integration due to increased cooperation on strategic fiscal interactions.

1. Introduction

One of the most active discussions revolving around taxation in the European Union, but also well outside of it, is the topic of tax competition. Ireland e.g. with its relatively low tax rates and “beneficial” tax laws has managed to attract a lot of financial prowess of mainly multinational companies. As a consequence, a lot of other countries forgo this financial prowess. It is needless to say therefore, that not all countries agree with Ireland’s tax climate. Changing tax rates within the EU as well as opaque tax rulings have given rise to a large call for change. It seems we are stuck in a race to the bottom in which the individual citizen will be the biggest loser. From 1981 up to 2014 the average corporate income tax rate in the European Union has dropped from an average of 45% to less than 22% (Worldbank Data, 2015). However, there is much debate about what drives tax competition and how harmful it is for society. Considering the relatively small amount of research done with respect to tax competition in the era after the 2008 banking crisis in particular, the focus of this research is thus to analyse the determinants of corporate tax rates. This will pave a more well-defined road to address the impact of tax competition.

Tax competition is a rather broad concept. In general it is the strategic competition in which different jurisdictions interact in order to attract mobile production factors. Since capital is far more mobile than other production factors, the focus of research on tax competition lies on the taxation of capital income. That is, the elasticity for the supply of capital is relatively high, making reduction of the cost of having capital, such as corporate income taxes, an attractive opportunity for governments to attract capital. The potential danger to this is, as Zodrow and Mieszkowski (1986) tried to point out with their model for tax competition, that corporate income tax rates will inevitably be driven down to zero, a so-called “race to the bottom”. In particular small economies appear to be partaking in this race, since these countries face a more elastic curve for capital supply (Wilson, 1991). Other country-specific

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factors that help in explaining corporate tax rates, as amongst others Slemrod (2004), Mutti (2003) and Clausing (2007) point out, are the openness of an economy and the level of the individual tax rate of a particular country. Lately, the effect of economic integration on statutory tax rates has started to receive significant attention as well. Since economic integration tends to increase the mobility of capital, it is generally accepted that economic integration leads to lower taxation on corporate income. Both Clausing (2007) and De Nood (2012) managed to confirm such an effect. Finally, whereas previous literature focuses on an individual setting of determining corporate tax rates, a key notion of tax competition is "strategic interaction". This means that countries react to the policies applied by their neighbours, so no strategic advantage is lost. This is tax competition in its most strategic sense and controlling for such effects might mitigate previously discussed effects on statutory tax rates, yet little research has been done on it. Examples include Devereux et al (2008) and Overesch and Rincke (2011). Both studies found significant evidence for strategic interactions to be pushing down corporate income tax rates.

The purpose of this research is to integrate the three strands of literature discussed above into one single model. Using this, this paper investigates how a certain country actually determines its statutory corporate tax rate. Up to now, research has mainly focussed on one or two of the previously discussed strands. To my knowledge, no previous study has investigated the effects of economic integration and strategic fiscal interactions in conjunction. My research will add to existing literature by integrating all three strands of literature into a single model and thus providing to some extent a completer picture of the determination of corporate tax rates. By using this approach, the effect of in particular strategic fiscal interactions and how it relates to economic integration will become most apparent. On top of that a confirmation of already existing theory can be given with a more recent dataset.

In short, my research question is the following: What are the determinants for corporate income tax rates? This research paper will attempt to answer that question by adopting a similar structure as that in Clausing (2007) and Overesch and Rincke (2011). The question will be empirically analysed by using a panel of the 34 OECD countries over the time span of 1981 till 2014. First, a theoretical framework will be built in section 2. Based on this, models for estimating corporate tax rates will be specified and data descriptions will be given in the methodology section (section 3). Subsequently, section 4 will show the results, which will be further discussed in section 5. Finally, section 6 provides an overall conclusion.

2. Theoretical Framework

2.1 Background on tax competition

A good literature overview on the topic of tax competition has been given by Wilson (1999). As he correctly points out, the main problems surrounding tax competition stem from wasteful tax competition. With wasteful tax competition is meant the departure from a Pareto- efficient point. Pareto efficiency is achieved at the point at which, in a two-party model, no party can be made off better by reallocating resources without making the other party worse off. In interregional settings, reaching such an efficient situation is a practical impossibility. That is, each region is only concerned with the welfare of its own citizens. Therefore, it does not care if its fiscal policy, while increasing the welfare in its own region, decreases the tax base and thus eventually welfare in another region in the process. Such inefficiencies are called fiscal externalities.

In particular, the international mobility of the production factor capital facilitates these fiscal externalities: because of its international mobility, the elasticity of capital is relatively high. A slight decrease in the cost of holding capital, the tax rate, can increase the supply of capital in a certain country with a relatively high proportion. This explains why countries are willing to compete over who has the lower tax rate. This goes in particular for corporate tax rates, as companies derive their profits from capital. However, the consequence of such competition for capital will most likely include a departure from Pareto efficiency. The first to point out this possible inefficient provision of public goods due to competition for capital by means of different fiscal policies were Bradford and Oates (1971). It took however some time before the literature on tax competition started to arise and models for tax competition were created. The earliest of such models was constructed by Zodrow and Mieszkowski (1986). The model they constructed reflected a situation in which two small economies, that are not able to influence interest rates, compete with each other for capital. By lowering its own tax rate, in the model a country is able to extract capital from the other country, as capital will locate itself where the cost is lowest. Since both countries will adopt the same strategy, this will inevitably lead to a "race to the bottom".

Based on the models such as that of Zodrow and Mieszkowski (1986), a small body of literature started to develop that tried to give insight in how countries determine their corporate tax rates. This body can be divided into three separate strands. The first deals with country-specific determinants, such as the level of openness of a country, the second relates to the effect of economic integration within a region and the last strand of literature discusses the effect of strategic fiscal interactions between countries. All three will be discussed below.

2.2 Country-specific determinants of corporate tax rates

Early empirical literature started with research on the effect of the level openness of an economy. The first contributor to this was political scientist Garret (1995). His research dealt for a great deal with the effects of capital mobility. Focussing on the effect of what he called financial liberalization, he found a significant negative relationship between openness and corporate tax burdens, calculated by total corporate revenues divided by GDP. That is, a higher level of financial liberalization leads to higher capital mobility and thus to a higher elasticity of capital supply. Later researches on only country-specific determinants all confirm this tendency. However, they started using economic or trade openness as a more general variable instead of financial liberalization, like Slemrod (2004).

Moreover, Slemrod (2004) identified a second possible determinant of corporate tax rates, being the personal income tax rate. His reasoning is that corporate income taxes work as a sort of "backstop" to personal income taxes. That is, as personal income tax rates increase, corporations will try to reclassify labour income as general business income, to defer taxation on the personal level. For this reason, governments might be inclined to raise their corporate tax rates. Whereas the evidence of Slemrod (2004) was not too convincing, Overesch and Rincke (2011) did find enough supporting evidence for a positive relationship between the two variables.

Equally striking is Slemrod's (2004) lack of evidence for expenditures of a government having an effect on the determination of corporate tax rates. One would reasonably expect that there would be a relationship between revenue needs for expenditures and corporate tax rates. However, when controlling for expenditures relative to GDP, Slemrod (2004) failed to find any significant relation to statutory tax rates.

Finally, the size of the economy of a certain country based on GDP is expected to have a positive impact on statutory tax rates. This is explained by Wilson (1991). He argued that smaller countries have less capital in stock to begin with and thus face a more elastic supply of capital curve. As a consequence, lowering corporate tax rates will have relatively a larger beneficial effect in terms of attracting capital. As a result, these countries they are more inclined to actually lower their tax rates. This is also referred to as asymmetric tax competition. However, empirical research on this matter found mixed results. When looking at the effects of wealth, size and openness, e.g. Mutti (2003) did find consistently significant support for Wilson's claim when analysing three different periods by using dummy variables to distinguish between small and large countries based on population size. Bretschger and Hettich (2002), using size as an exogenous variable and openness as an endogenous one, found a negative relationship between the effective capital tax rates and size. Although, this too was not statically significant. Other empirical researches with less focus on the size-factor, also find mixed results. De Nood (2012) for example does find rather strong evidence for a positive relationship between statutory tax rates and the size for European countries between 1981 and 2010, when using a multitude of proxies for the size factor. However, Overesch and Rincke (2011) did not find such a relationship at all for a rather similar data set, including 32 European countries between 1983 and 2006. These discrepancies raise the question whether there in fact is a difference between small and large countries, as Wilson (1991) explained it.

2.3 Economic Integration

In more recent literature, a more international factor has gained a lot of attention: economic integration. Mainly the case of the European Union is interesting in this respect. European countries have pursued closer market integration for the last half century, while retaining a lot of autonomy regarding their fiscal policies. The case of the European Union thus provides a very useful experiment in studying the effects of closer economic integration on corporate income tax rates.

By taking away economic barriers, tax bases become more mobile. This is particularly interesting for the capital tax base, since this has more practical implications. As Persson and Tabellini (1992) have shown in their model study, taking away the barriers of mobility allows the decision of where to locate capital to be altered more easily, hence increasing the mobility of capital. As a result, the capital tax base becomes more responsive to changing tax rates. Recently, more expansive data on the case of the European Union allowed empirical confirmation to be given on the effect of economic integration on corporate income tax rates. Both Clausing (2007) and De Nood (2012) e.g. managed to give such a confirmation by using OECD data and subsequently comparing the development of statutory tax rates for EU members and non-EU members. Clausing (2007) used three separate dummy variables in his model, capturing membership of the European Union, application for membership and no membership at all. De Nood (2012) on the other hand introduced a dummy variable in his model capturing the effect of the enactment of the European Union in Maastricht in 1992. Despite using different methods, both found a negative relationship between statutory tax rates and closer economic integration.

However, the effect of integration is not necessarily as clear-cut as presented above. In particular the relationship between small and large countries is important in this respect. Next to the fact that demand of capital by large countries by reducing tax rates can distort interest rates, so called agglomeration effects can also occur. Agglomeration theory was established by Dixit and Stiglitz (1977)

and further extended by Krugman (1991). Briefly, it relates to the notion that large firms can benefit from lower fixed costs per unit and thus enjoy relatively higher profits. Hence, large industrialized countries, that host relatively more large firms, have an advantageous position regarding capital income. Once markets integrate and trade costs are reduced, these large firms that agglomerate in large countries receive extra agglomeration rents from cheaper exports. These agglomeration rents may outweigh the benefits from reducing capital tax burdens. Moreover, firms in small countries may want to invest in large countries because of larger consumption markets and higher density of technology. Rademacher (2013) indeed found, when comparing the development of effective capital tax burdens from EMU countries versus Non-EMU countries and disaggregating the data for large and small countries, that the effect of economic integration on capital tax burdens of small countries was negative and for large countries was positive. Although the metric of interest was different than it will be in this research, Rademacher's results do give an extra reason to control for country size.

2.4 Strategic fiscal interactions

The concepts discussed previously in this section only take into consideration a country's own tax environment or the environment the country in question is part of. However, a key component in tax competition is the strategic fiscal interaction between countries. That is, a country does not only determine its statutory corporate tax rate based on its own situation, but also needs to put this into perspective by comparing itself to surrounding countries. Expected is that the statutory tax rate of a neighboring country links positively to that of a country, as countries are to compete with each for who has the lowest statutory tax rate.

Compared to the previous two strands of literature, the discussion of strategic fiscal interactions between countries is methodologically more involved. Devereux et al. (2008) indeed found a strong interdependence in the statutory tax rates as well as effective marginal tax rates between countries in an OECD dataset, causing a downward trend on these tax rates. However, the main issue with the approach of Devereux et al (2008) is that it assumes a static situation of fiscal interactions. As a result, long-run effects and permanent shocks cannot be appropriately addressed. Overesch and Rincke (2011) therefore expanded on models such as that of Devereux et al (2008). They do so by taking the lagged variable of the dependent variable in question, the statutory tax rate, and the lagged variable of the tax rates of neighboring countries. This allowed for an analysis of short-term effects as well as permanent shocks, leading to some rather interesting results. They found the short-term effects of the fiscal interplay between countries only to be moderate. Because of sluggish adjustment by national governments to the fiscal policy of their neighbors, permanent shocks constitute the factor that has a heavy influence on the determination of statutory corporate tax rates. A main factor that was however absent in the model of Overesch and Rincke (2011) was the level of economic integration of countries, a factor on which will be further elaborated in this research.

3. Methodology

In this section the empirical approach used to finding out what determines corporate income tax rates will be discussed. First, a model specification follows below. Subsequently, a data description will be given. Finally, the estimation method will be explained.

3.1 Empirical specification

Literature has shown many different models that try to assess certain effects on the determination of corporate tax rates. As the aim of this paper is to integrate all these effects, the model of interest will be constructed here, based on the discussion in the previous section. Later in the results section, the results from these models using a fixed-estimators regression will be discussed.

A first base model explaining corporate tax rate T_{it} that can be constructed is one that includes all the country-specific effects that were identified earlier:

$$T_{it} = \alpha + \beta_1 Openness_{it} + \beta_2 PITR_{it} + \beta_3 Size_{it} + \beta_4 \frac{GovernmentSpending}{GDP}_{it} + u_{it} \quad (1)$$

where u_t is the residual value. In the above model, openness is expected to carry a negative sign. That is, greater capital mobility increases the elasticity of capital supply and hence drives down corporate tax rates. It is measured as the fraction of imports and exports of GDP. The personal income tax rate (PITR) on the other hand is expected to have a positive effect on the corporate income tax rates. This will mainly be due to governments using the corporate income tax as a backstop from personal income tax avoidance (Slemrod, 2004). To assess this effect, the top marginal income rates from the countries to be researched have been used. Also, the size of the economy has been included in the equation, measured by a country's GDP. As one can remember from the literature discussion previously, there is little consent on the size-effect. However, as theory suggests smaller countries have lower capital stocks and thus face a higher elasticity of capital supply, one can reasonably expect size to have a positive effect (Wilson, 1991). The final country-specific effect included in the model is the government spending as a fraction of GDP. As explained previously, the coefficient of this variable should be insignificant. Country and time-invariant effects will already be captured by the fixed-estimators regression and are thus left out from the equation.

Next, the model is expanded upon by included variables that capture economic integration. This results in model (2). The effect of economic integration will be examined by looking at the case of the European Union. The integration method Clausing (2007) will be adapted here as well. This method includes three levels of integration. The first level includes the application for EU membership. In order to join the EU, certain criteria regarding harmonization and coordination of economic policy should be met. This can also increase the transparency of the fiscal policy of the applicants, allowing for more tax competition. The second level includes those countries at certain points in time that have completed negotiations for ascension to the European Union and are in the waiting room for receiving their membership. The third and final level is full membership of the European Union. All three levels are accounted for in the model through the use of dummy variables.

$$T_i = \alpha + \beta_1 Openness_{it} + \beta_2 PIR_{it} + \beta_3 Size_{it} + \beta_4 \frac{GovernmentSpending}{GDP}_{it} + \beta_5 EUapply_{it} + \beta_6 EUascend_{it} + \beta_7 EUmember_{it} + u_{it} \quad (2)$$

As economic integration takes away trade barriers, capital is allowed to move more freely, causing the elasticity of capital supply to rise. As a result, it can be expected that all three dummies will have a negative effect on the corporate income tax rate.

Finally, a strategic interaction variable is added to the model. This variable accounts for a country i 's rate-setting behavior as a response to the corporate tax rate changes by countries in that country's vicinity.

$$T_i = \alpha + \beta_1 Openness_{it} + \beta_2 PIR_{it} + \beta_3 Size_{it} + \beta_4 \frac{GovernmentSpending}{GDP}_{it} + \beta_5 EUapply_{it} + \beta_6 EUascend_{it} + \beta_7 EUmember_{it} + \beta_8 Ts_{i,t-1} + u_{it} \quad (3)$$

Variable $Ts_{i,t-1}$ denotes the weighted average corporate tax rates of all the other countries included in the sample at time $t-1$. That is, the model expects a country i to adopt a reactionary policy. To assure that countries give more importance to bigger and nearby other countries, the tax rates are weighted based on geographical distance as well as size measured by GDP. The coefficient is expected to be positive, as the country i will try to keep up with the decreasing trend of the other countries.

The inclusion of both the economic integration dummy variables and the strategic interaction variable is of much importance. Up until now, no research has been done that examined the effect of economic integration and strategic fiscal interaction in conjunction. Due to economic integration, trade barriers are taken away and capital bases are allowed to move more freely among countries. To establish this, better cooperation and more transparency in national tax laws and rulings among countries is needed, causing a side-effect of economic integration. Transparency is an important driver of strategic fiscal interactions. That is, national tax laws can be very opaque. This is particularly the case from the perspective of other countries, which usually do not have a very thorough understanding of the tax laws of countries other than themselves. As a result, increased transparency leads to more strategic competition. On the other hand, better coordination and increased monitoring due to economic integration might actually impede countries in strategically setting their corporate tax rates. In other words, economic integration should not only affect the statutory corporate income tax rates directly, but is also expected to moderate the effect that the strategic fiscal interactions variable has on the dependent variable. Without the inclusion of the strategic interaction variable in the model, some of the variance in the statutory corporate tax rates that was otherwise explained by strategic fiscal interactions would also be captured by our economic integration dummies. Including however both the dummy variables and the strategic interaction variable, avoids this and thus gives a better understanding of how corporate tax rates are determined.

3.2 Data description

The empirical method in this paper is to address the question of what determines corporate tax rates. To answer this panel data on the corporate tax regimes of 34 OECD countries between 1981 and 2014 is used. A discussion of the main variables follows below.

Dependent Variable: Corporate tax rates

The dependent variable in this study is the corporate tax rate. In earlier studies, such as Quinn (1997), corporate tax revenues as a percentage of GDP were often used to proxy the tax rate. However, corporate tax revenues are influenced by both statutory rates and tax bases. National tax laws on the determination of tax bases can be rather opaque, in particular from the perspective of other countries which usually do not have a very thorough understanding of the tax laws of countries other than themselves. It is thus reasonable to expect that when addressing strategic fiscal interactions between countries the tax rate is the main factor of interest, since this is more transparent.

The next question that should be asked is which measure of the corporate tax rate is to be used. The most common measure to use is the (top marginal) statutory corporate income tax rate. However, recent work on tax competition also focuses on effective average tax rates (EATR) as a proxy for tax the burden. The EATR is a measurement that includes the statutory rate, as well as deductions, exemptions and other credits. Hence it gives a more comprehensive view of what the tax burden for individual actually is. It tries to simulate the effective tax burdens for a hypothetical investment project. The method of Mendoza et al. (1994) of calculating EATRs is mostly used in this respect. Because the EATR is so comprehensive and applicable to individual cases, it is very effective when analyzing the location decisions of corporations and thus where their economic activities are located (Devereux & Griffith, 1998).

However, the use of the measurement with regard to this study is not ideal for several reasons. First, the calculation of EATR is subject to many assumptions, as it tries to simulate a real investment decisions. Thus, it is not coherent in its use across multiple researches. For example, one has to decide for what type of investments the EATR is used. When this includes next to financial assets also e.g. real estate, the EATR also should comprise tax expenses on real estate. As an added effect of all these assumption the calculations can be very complex as well. Second, the EATR is a measure used when investigating if and how countries compete with each other over companies or their subsidiaries and not necessarily the capital they produce and the profits they derive from that. Additionally, the added value of using EATRs is debatable. That is, Overesch (2005) argued that the main driver in the differences of EATRs between different countries is in fact the statutory corporate income tax rate component.

Statutory corporate income tax rates do influence corporations in their decision where to shift their profits to (Devereux et al., 2008). Moreover, it is a measurement of the corporate tax burden that is a lot easier to work with. For these reasons, it is also the dependent variable of interest in this study.

Strategic interaction variable

The strategic interaction variable in the model of interest is a summed variable:

$$TS_{i,t-1} = \sum w_{ij} T_{j,t-1} \quad (4)$$

The above variable consists of two separate components. T_j denotes the statutory tax rate of a country other than the country of interest. The second part of the strategic interaction variable $TS_{i,t-1}$ is the

weight w_{ij} which country i will assign to the lagged statutory corporate tax rate of the other countries in the dataset. The weighted corporate tax rates of the other countries at time $t-1$ is considered by country i when determining its corporate tax rate. That is, the model assumes country i to conduct a reactionary policy.

The weight w_{ij} can be disaggregated further into two more components. These include geographical distance and the size of the other countries. The geographical distance component has a more intuitive understanding. One can expect FDI flows will decrease as geographical distance increases, because of lower affiliation. Empirical evidence shows that such a relationship is indeed true (see e.g. Guerin, 2005). Also, geographical distance increases information costs (Portes & Rey, 2005). This is particularly important regarding information about tax policy of other countries. Larger geographical distance will thus affect the weight of importance a certain country will assign to another country's tax rate. The distance between country i and country j is denoted as d_{ij} . Moreover, the size of a country is also of importance. A country like the Netherlands for example will be more concerned with small changes in statutory tax rates in Germany than in Luxemburg. The resulting weight function is

$$w_{ij} = \frac{\ln(GDP_j)/d_{ij}^2}{\sum_{k \neq i} \ln(GDP_k)/d_{ik}^2} \quad (5)$$

where $j \neq i$. This is the exact same weight function is that of Overesch and Rincke (2011), except for the fact that in this function the proxy for size is GDP (in billions) instead of population. The reasoning behind this is that countries will be more attentive of other countries if they boast more economic power. Population is merely a demographic variable, yet GDP can capture this effect for some extent. In this function, the geographic distance in kilometers is squared, in order to discount those countries that lie farther away more than proportionately.

The descriptive statistics regarding these variables and all the others used throughout this research are given in Table 1. Data regarding the top statutory corporate tax rates have been retrieved from the *OECD Tax Database*. The personal income tax rates have been found using a combination of the *OECD Tax Database* (post 2000 period) and the *World Tax Database* (pre 2000 period). Other macroeconomic variables are from the *World Bank Indicators*. The distances in kilometers used to construct the weight variable in equation (5) have been retrieved from the *Geodist Database*, of CEPII. These are the distances between the main agglomerations of two countries (Mayer & Zignago, 2011).

Table 1: Descriptive statistics

| Variable | Description | Observations | Mean | Std. Dev. | Min. | Max |
|-------------------|---|--------------|-------|-----------|-------|-------|
| SCITR | Top statutory corporate tax rate | 1035 | 0.312 | 0.103 | 0.085 | 0.056 |
| SPITR | Top personal income tax rate | 975 | 0.469 | 0.116 | 0.150 | 0.850 |
| Openness | (Imports+Exports)/GDP | 1035 | 0.701 | 0.492 | 0.113 | 3.633 |
| Gvsp | Government expenses/GDP | 1057 | 0.187 | 0.045 | 0.075 | 0.415 |
| Size | Constant GDP in billions of dollars (base = 2005) as a fraction of US GDP | 1055 | 0.092 | 0.185 | 0.001 | 1 |
| EUapply | Dummy var. EU application | 1172 | | | 0 | 1 |
| EUascend | Dummy var. EU ascension | 1172 | | | 0 | 1 |
| EU member | Dummy var. EU membership | 1172 | | | 0 | 1 |
| $\sum w_{ij} T_j$ | Strategic Interaction Variable | 1122 | 0.342 | 0.081 | 0.165 | 0.544 |

Highly balanced panel of 34 countries (for a period running from 1981 to 2014).

3.3 Estimation method

Models (1), (2) and (3) were estimated using a fixed effects regressions in Stata. A fixed effects model cancels out fixed country and other time-invariant effects. When using macroeconomic data, this is generally preferred. The reason for this is that, when using a panel of countries, regressor variables tend to correlate with unobserved individual effects. As a result, the mean residual will not be the same among the different countries in the panel and thus an ordinary least squared regression or a generalized least squares (random effects regression) will not be justified, because the estimated coefficients will become inconsistent. By taking out any unobserved individual effects, there is no risk of any correlation that may cause an inconsistency in the estimators. Hausman (1978) proposed a test to find out whether the differences between a fixed effects and random effects regression are systematic or not. If systematic, this means a fixed effects regression is preferred. For all the models, the Hausman ruled in favor of using a fixed effects regression, justifying the choice of using it. The outcomes of the Hausman test will be shown along the results of the estimations. A low p-value indicates that there is a systematic difference and thus that the use of a fixed effects regression is preferred.

Also, when estimating the different models, robust estimators will be used in order to correct for heteroscedasticity and serial correlation.

4. Results

4.1 Main results

The results of the estimation of the first two models using fixed effects regressions can be found in Table 2.

In none of the two estimations big surprises arise. All the different variables explaining the development of corporate tax rates have their expected signs as well as significance. In both models, a one percentage-point increase in the level of openness seems to cause an increase of about 0.15 percentage-points in the corporate tax rate level.

Also the effect of the personal income tax rates is steady among both estimations, with a highly significant coefficient of between 0.33 and 0.35. The size-effect does have the expected positive relation to the statutory corporate tax rate. However, the effect is only moderately significant in both cases. In line with previous empirical evidence, the expenditures of a government indeed seem to be insignificant. The three economic integration dummy variables are all significant in our second model. Economic integration at least accounts for a 7.5 percentage-point reduction in the corporate tax rate of a country.

Table 2: Estimation corporate tax rates using model (1) and (2)

| | Model (1) | Model (2) | Model (2)' |
|--------------------------------|----------------------|----------------------|----------------------|
| Openness | -0.151*** (0.043) | -0.147*** (0.048) | -0.138*** (0.045) |
| SPITR | 0.347*** (0.061) | 0.331*** (0.052) | 0.318*** (0.053) |
| Size | 1.29* (0.672) | 1.27* (0.701) | 1.32* (0.713) |
| Gvsp | 0.011 (0.354) | -0.122 (0.377) | -0.105 (0.378) |
| EUapply | - | -0.100*** (0.033) | - |
| EUascend | - | -0.098*** (0.028) | - |
| EUmember | - | -0.075** (0.033) | - |
| EU | - | - | -0.093*** (0.027) |
| Constant | 0.133 (0.109) | 0.213* (0.113) | 0.213* (0.110) |
| <i>N</i> | 902 | 902 | 902 |
| <i>R</i> ² (within) | 0.610 | 0.645 | 0.643 |
| Hausman Test (p-value) | 0.000 | 0.000 | 0.000 |

Fixed effects estimation of models (1) and (2). A balanced panel of 34 countries is used. Standard errors (robust to heteroscedasticity) are in parentheses.

(Two-tailed) significance levels: *10%; **5%; ***1%

The application period and ascension period have a somewhat higher magnitude than the actual membership period. Moreover, it should be noted that the inclusion of the economic integration dummy variables mainly account for previously unexplained variance in model (1). That is, the dummy variables are all significant, yet the coefficients of the other significant variables change relatively little. To see whether these results are robust, the three dummy variables could also be integrated into one single dummy: the dummy EU. With a statistically significant coefficient of -0.093 and a no noteworthy changes to the other coefficients, it can be concluded that disaggregating the economic integration effect into three separate dummies does not in any way bias the results.

Table 3 shows the FE regressions results for an estimation model including the strategic interaction variable. Model(1)' is model(1) extended with $\sum w_{ij} T_{j,t-1}$. In this estimation, the strategic interaction between countries is the most important determinant of corporate tax rates, with a one percentage-point decrease in the weighted average of the lagged statutory tax rates of other countries in the sample causing the statutory corporate tax rate to drop with almost 0.4%. Moreover, the effect is found to be statistically significant on a 1%-level. Noteworthy is also the effect the inclusion of the strategic fiscal interaction variable has on the effect of openness. In the estimation of model (1) in Table 2, Openness was still found to be significantly negative on a 1%-level. However, when including the strategic interaction variable in the model, the magnitude is almost halved and the coefficient is only significant on a 10%-level. As a result of including strategic fiscal interactions, the statutory personal income tax rate is no longer the main driver of the statutory corporate tax rates. The coefficient is diminished by about 25% relatively. However it is still statistically significant on a 1%-level.

The second column in Table (3) shows the estimation results of the FE regression of model (3). It can be seen that the country-specific effects remain roughly the same compared to model (1)'. The main difference is that Openness is in model (3) no longer significantly different from zero. Compared to the estimation of model (2) in Table 2, the effects of the dummy variables also largely remain the same. The EUmember dummy is still statistically significant on a 5%-level, whereas the EUascend and EUapply are still significant considering a 1%-level. Including the strategic interaction variable decreases the effect of the dummy variables overall, albeit it only by a small amount.

Table 3: Estimation corporate tax rates using model (3)

| | Model (1)' | Model (3) | Model (3)' | Model (3)'' |
|--------------------------------|---------------------|----------------------|---------------------|----------------------|
| Openness | -0.086* (0.047) | -0.084 (0.052) | -0.082 (0.052) | -0.075 (0.053) |
| SPITR | 0.260*** (0.066) | 0.245*** (0.056) | 0.246*** (0.057) | 0.273*** (0.060) |
| Size | 0.938 (0.675) | 0.938 (0.700) | 0.940 (0.693) | 0.947 (0.746) |
| Gvsp | 0.360 (0.394) | 0.223 (0.404) | 0.226 (0.406) | 0.186 (0.406) |
| EUapply | - | -0.095*** (0.032) | 0.104* (0.059) | -0.094*** (0.031) |
| EUascend | - | -0.096*** (0.028) | -0.104* (0.054) | -0.097*** (0.027) |
| EUmember | - | -0.076** (0.028) | -0.084* (0.050) | -0.078** (0.029) |
| $\sum w_{ij} T_{j,t-1}$ | 0.394*** (0.115) | 0.376*** (0.116) | 0.367** (0.135) | 0.320** (0.130) |
| $\sum w_{ij} T_{j,t-2}$ | - | - | - | -0.137 (0.082) |
| $\sum w_{ij} T_{j,t-3}$ | - | - | - | 0.201** (0.077) |
| EU* $\sum w_{ij} T_{j,t-1}$ | - | - | 0.024 (0.144) | - |
| Constant | 0.032 (0.121) | 0.051 (0.116) | 0.054 (0.119) | 0.037 (0.133) |
| <i>N</i> | 881 | 881 | 881 | 841 |
| <i>R</i> ² (within) | 0.639 | 0.671 | 0.671 | 0.655 |
| Hausman test (p-value) | 0.000 | 0.000 | 0.001 | 0.000 |

Fixed effects estimation of model (3). A balanced panel of 34 countries is used. Standard errors (robust to heteroscedasticity) are in parentheses.

(Two-tailed) significance levels: *10%; **5%; ***1%

To assess whether economic integration intervenes in the effect of strategic fiscal interactions due to increased coordination and transparency, an interaction term has been created and added to model (3). For simplicity purposes as well as to circumvent any issues that may arise because of a lack of observations, the integrated EU dummy variable has been chosen to interact with weighted average variable. The results of this expanded model (3) can be found under model (3)'. According to these estimation results, there is no indication that economic integration amplifies or reduces the effect the weighted average of the corporate tax rates of neighboring countries has on the statutory tax rate. Moreover, the model seems to become somewhat weaker, considering the jump in the standard errors

of the coefficients of the three dummy variables. Thus, the original model (3) seems like a more convincing model to use in order to assess the determination of corporate income tax rates.

Finally, model (3) in Table 3 is different from model (3) in that sense that the strategic interaction variable is further disaggregated in two more lags. With the weighted average statutory tax of the other countries at time $t-3$ also still statistically significant and positive, it indicates the reactionary policy of a government of country i can be rather sluggish.

The strength of model (3) mainly kicks in from the mid 90's. This is clearly shown in figure 1. This is because around that time a lot of countries joined EU or applied for EU membership. This also accounts for the fact that the fitted values kept on decreasing in the period 1991-1996, whereas the true tax rates reached a small plateau around that time. The distinction between model (2) and model (3) becomes also apparent from this figure. Although the intercept is better represented by model (2), model (3) manages to capture the steepness of the decline over time better. This indicates that in particular the speed of the reduction of the corporate income tax rates is well explained by including the strategic fiscal interactions variable.

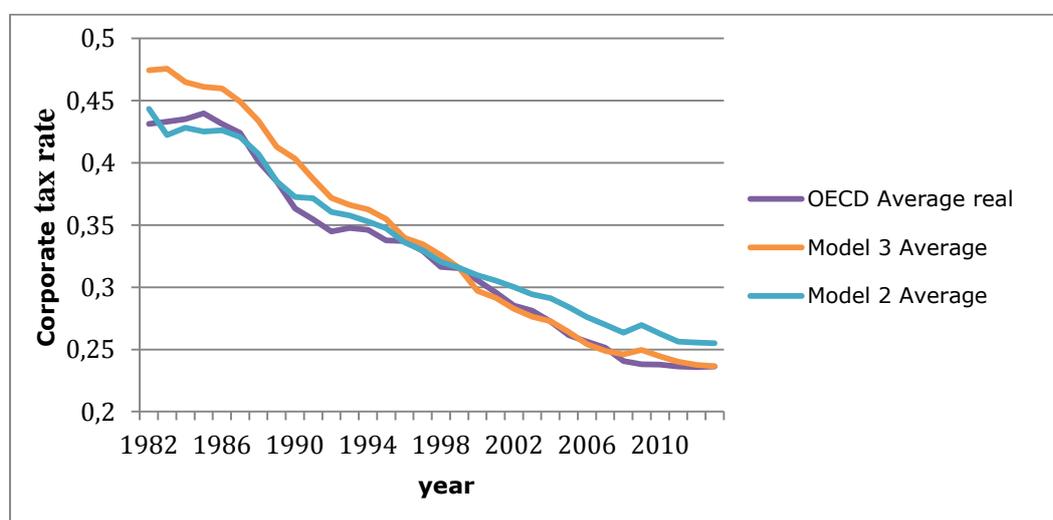


Figure 1: True and fitted tax rate values over time

4.2 Robustness Checks

The first issue that could inhibit the robustness of model (3) relates to the components of the weight function. To assure the model captures the same effects if the weight defined in equation (5) was slightly altered, additional FE regressions have been run. The results of these can be found in Table 4. The first column shows the results in case GDP in the weight function (5) was replaced by population, whereas the second column shows the results in case no size component was integrated in the weight function (5).

As is clear, these results are almost no different from the ones found for model (3) earlier, assuring that the estimation of the model was not specific to the chosen weight components. The second robustness issue relates to the size variable. In the previous analysis, no significant results were found regarding size. This might be because of how the size variable was constructed. The purpose of the size variable was to proxy the effect of smaller and larger capital stocks.

Table 4: Robustness checks

| | Model (3), pop/distance weighted | Model (3), only distance weighted | Model (3), Size is capital stock |
|--------------------------------------|--|---|-------------------------------------|
| Openness | -0.083 (0.051) | -0.082 (0.049) | -0.084 (0.056) |
| SPITR | 0.237*** (0.056) | 0.229*** (0.058) | 0.298*** (0.054) |
| Size | 0.943 (0.690) | 0.922 (0.678) | - |
| Capsize | | | 0.639 (0.563) |
| Gvsp | 0.230 (0.400) | 0.244 (0.395) | 0.055 (0.036) |
| EUapply | -0.097*** (0.032) | 0.096*** (0.033) | -0.094*** (0.031) |
| EUascend | -0.099*** (0.028) | 0.097*** (0.029) | -0.092*** (0.028) |
| EUmember | -0.079*** (0.028) | -0.076** (0.029) | -0.068** (0.029) |
| $\sum w_{ij} T_{j,t-1}$ | - | - | 0.414*** (0.119) |
| $\sum w_{ij} T_{j,t-1}$ (Population) | 0.405*** (0.115) | - | - |
| $\sum w_{ij} T_{j,t-1}$ (No size) | - | 0.425*** (0.113) | - |
| Constant | 0.049 (0.118) | 0.044 (0.116) | 0.075 (0.131) |
| <i>N</i> | 881 | 881 | 813 |
| R^2 (within) | 0.673 | 0.676 | 0.661 |

FE regressions for model (3), using different weights for the strategic interaction variable. Robust standard errors are in parentheses.

(Two-tailed) significance levels: *10%; **5%; ***1%

However, the variable using GDP as a fraction of US GDP can also be bypassed and capital stock could be directly used. The *Penn World Table* tries to measure capital stock using accumulated capital formation throughout the years (Feenstra et al., 2015). Although this also does not completely represent a country's capital stock and the observations are limited compared to the GDP measure, it can be used to see if model (3) is still robust if a measure is used that is closer related to capital. The results however reveal no significant changes. Hence, also the findings relating to the Size variable are robust.

5. Discussion

Several conclusions can be drawn from the results. First of all, countries do not appear to give much attention to their own macroeconomic environment when determining their statutory corporate tax rates. This is represented by the low level of significance the country-specific determinants show in model (3). The only effect that shows consistent significance is the effect of the personal income tax rate, indicating governments very much use the corporate income tax as a backstop for the personal income tax. Other than this backstop effect however, no consistently significant country-specific determinants were found. Corporate tax rates do indeed not appear to be geared towards the spending behavior of governments, as in line with research conducted by e.g. Slemrod (2004). Moreover, the effect size can be contested. That is, even when not including the strategic interaction variable it is only marginally significant. Unexpectedly, when allowing for strategic fiscal interactions, also the effect of openness is open for discussion. This is contrary to findings of Garret (1995) and Slemrod (2004). A possible explanation for this could be that the lagged weighted average of the tax rates of the other countries captures something of the trend the decreasing corporate tax rates are showing. On average the entire OECD sample shows a steady decreasing trend, meaning this (weighted) average could also for a part proxy the trend of the individual country. If this is the case, it means short-run changes in capital mobility due to increasing or decreasing openness over time do not affect the determination of corporate income tax rates.

The previous findings do however not mean that capital mobility has no part to play in the determination of corporate income taxes at all. Specifically, the economic integration dummies also capture the effect of capital mobility, as they represent the periods in which trade barriers were broken and increased economic cooperation started to take place. In fact they represent a permanent change in the capital mobility. The economic integration dummies were consistently found to be significant. This is in line with previously literature such as Clausing (2007), who used the same dummy determination technique. The magnitude of the effect, a decrease of the corporate income tax rates varying between 7,5% and 10%, is also roughly the same as to what Clausing found (between about 6% and 9.5%). He used however a somewhat smaller time span and a smaller amount of countries, which might explain the small deviations. The results signify that due to increased capital mobility owners of capital have more flexibility as to where to invest their capital. As a result, countries that are integrated in some sort of economic institution, such as the EU, face higher elasticities of capital supply. This induces the integrated countries to lower their tax rates, as only a small change can attract now a lot more capital. Compared to variables that affect the elasticity of capital supply year-to-year, a permanent change in capital mobility thus does seem to help in determining corporate income tax rates.

However, the most influential factor that governments pay attention to when determining their corporate income tax rates is what other countries are doing. This strategic tax competition is what has mainly been driving the statutory corporate income tax rates down according to the results. On average, a 1%-point decrease in the weighted average (measured by distance and size) of the tax rates of neighboring countries appears to account for about a 0,37% decrease in a particular country's own statutory corporate income tax rate. This effect is significantly smaller in magnitude compared to Devereux et al. (2008) findings. The most likely reason for this is that instead of using uniform weights when constructing a strategic interaction variable, this research applied a distance/size weight measure. Hence, the results of this research come closer to those of Overesch and Rincke (2011). They found, using a rather similar weight variable used in this research, that a 1%-point decrease in the strategic

interaction variable leads to a decrease in the statutory tax rate of about 0,47%. The difference of 0,1% is most likely explained by the fact that Overesch and Rincke had fewer country-specific determinants included in their model, neither did they account for economic integration. It should however be noted that there is an indication that governments do not react as alertly as our strategic interaction variable in model (3) makes appear. When allowing for two further lags, the sluggishness with which governments react to their neighbors becomes apparent. This is also in line with Overesch and Rincke (2011), who indicated that long-term effects in the strategic setting partially moderate, or even dominate, the short-term effects.

As indicated in the beginning of this paper, tax competition could create fiscal externalities that are harmful to societies. That is, public provision is not fully efficient anymore due to tax competition. As far as countries deem the trend of strategic tax competition harmful to their societies, the current level of coordination does not help to mitigate it however. Economic integration does not only proxy permanent changes in capital mobility, but also increased transparency and coordination between countries. As the interaction variable is clearly insignificant in model (3)', there is no indication of any moderating effect. If the decline of corporate income tax rates is going to pick up speed once more and integrated countries want to combat this, better coordination is definitely needed or even harmonization.

Limitations and future research

This research is not without its limitations though. First of all, this paper focuses on the determinants of corporate tax rates and not on corporate tax bases or revenues. As mentioned before, competition by using tax bases is well possible too. However, to find proper data on this is very difficult, as tax laws regarding tax bases can be very complex and opaque. Second, it should be stressed that the models considered in this paper all represent a static situation. Even though a static model is sufficient to fulfill the objective this paper, a dynamic interpretation of the situation could grant valuable extra insight. Specifically, with regard to the distinction between short-term and long-term effect, a dynamic model is better able to capture yearly changes and permanent effects. Future research could thus delve deeper into the issue of capital mobility in relation to corporate tax rates by using a dynamic model. Finally, the weight variable constructed for the strategic interaction variable now consists of two components: size and geographical distance. However, there are of course many other things countries put weight to when competing with other countries. One could think of trade balances, the legal environment to set up corporations in relation to each other, historical ties between two countries, a common language and so forth. Future research could attempt to also address these sorts of issues, in order to provide an even more comprehensive overview.

6. Conclusion

Over the last three decades, the corporate income tax rates have shown a steady decline. This decline has been in the centre of attention and topic of many discussions that are often driven by a fear for a race to the bottom. This paper set out to give guidance to such discussions by asking the question what determines the corporate tax setting behaviour of nations. To answer this, a model was constructed by dividing previous literature into three different strands: country-specific determinants, economic integration and strategic fiscal interaction.

Using a panel of 34 OECD countries over the time period 1981-2014, mixed support was found for previous literature. Year-to-year effects regarding capital mobility do not seem to affect a country's

behaviour when determining its corporate tax rate. Both the openness of an economy and the size (of the initial capital stock) are insignificant. This contradicts findings of e.g. Wilson (1991). However, permanent changes in the elasticity of capital supply due to economic integration do help to consistently explain corporate income tax rates. Moreover, a backstop effect by the corporate tax rate is clearly apparent. The most important factor determining corporate tax rates is however the strategic fiscal interaction between countries. Using lagged weighted averages of neighbours' corporate tax rates, this paper showed that a one percent decrease by neighbours induces a country to lower its tax rate by almost two-fifth of that. Whether this downward by strategic tax competition should be seen as a problem, is a value judgement. However, as far as it is considered a harmful, further cooperation in the European Union in any case failed to moderate this effect. More extensive cooperation is most likely needed to establish such an effect.

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Appendix: : Dummy variables Economic Integration

| | Country | Member | Application | Completion negotiations |
|----|--------------------------|-----------|-------------|-------------------------|
| 1 | Austria | 1995-2014 | 1989-1992 | 1993-1994 |
| 2 | Belgium | 1981-2014 | | |
| 3 | Czech Republic | 2004-2014 | 1996-2001 | 2002-2003 |
| 4 | Denmark | 1981-2014 | | |
| 5 | Estonia | 2004-2014 | 1995-2001 | 2002-2003 |
| 6 | Finland | 1995-2014 | 1992 | 1993-1994 |
| 7 | France | 1981-2014 | | |
| 8 | Germany | 1981-2014 | | |
| 9 | Greece | 1981-2014 | | |
| 10 | Hungary | 2004-2014 | 1994-2001 | 2002-2003 |
| 11 | Ireland | 1981-2014 | | |
| 12 | Italy | 1981-2014 | | |
| 13 | Luxembourg | 1981-2014 | | |
| 14 | The Netherlands | 1981-2014 | | |
| 15 | Norway* | | 1992 | 1993 |
| 16 | Poland | 2004-2014 | 1994-2001 | 2002-2003 |
| 17 | Portugal | 1986-2014 | 1981-1984 | 1985 |
| 18 | Slovak Republic | 2004-1914 | 1995-2001 | 2002-2003 |
| 19 | Slovenia | 2004-2014 | 1996-2001 | 2002-2003 |
| 20 | Spain | 1986-2014 | 1981-1984 | 1985 |
| 21 | Sweden | 1995-2014 | 1991-1992 | 1993-1994 |
| 22 | Switzerland* | | 1992 | |
| 23 | United Kingdom | 1981-2014 | | |
| | <u>No EU-affiliation</u> | | | |
| 24 | Australia | | | |
| 25 | Canada | | | |
| 26 | Chile | | | |
| 27 | Iceland | | | |
| 28 | Israel | | | |
| 29 | Japan | | | |
| 30 | South-Korea | | | |
| 31 | Mexico | | | |
| 32 | New-Zealand | | | |
| 33 | Turkey | | | |
| 34 | United States | | | |

*: Ascension was stopped by a referendum. However, preparations for ascension were made.