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International tax competition: A reappraisal[*]

Marie-Pierre Hory[†], Patricia Sanz-Córdoba[‡]

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Abstract

This paper investigates the interactions between tax policies at the international level (OECD countries). Both contemporaneous and time-delayed tax interactions are considered using Spatial Dynamic Panel Data model from Yu et al. (2008). Moreover, we test if the interdependence between governments exists due to the geographic closeness but also due to the proximity in terms of public investment levels. The results show, on one hand, that there are positive contemporaneous but negative time-delayed interactions. It is compatible with the existence of tax competition in a contemporaneus way, but also with the free-riding phenomena in the time-delayed approach. On the other hand, we show that interactions between countries are higher when they have similar levels of public investment than for the geographical closeness. This last result confirms the theoretical assumption that countries with close infrastructure investment are more likely to achieve tax harmonization. However, the negative time-delayed interactions are not consistent with this hypothesis, proving both tax and infrastructure competition between the OECD countries still exists.

JEL Classification: E62, H54, H87

Key Words: Tax Competition; Yardstick Competition; Public Infrastructure Investment; Strategic Interactions; Spatial Dynamic Panel Data model; OECD.

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1 Introduction

The process of economic integration has increased the international mobility of capital since the 1980s. In that sense, governments are engaged in fiscal competition reducing tax rates to an inefficiently low levels (Zodrow & Mieszkowski (1986), Wilson (1986), and Bucovetsky (1991)) or using public infrastructure investment in order to attract more capital (Hauptmeier et al. (2012)). Moreover, the problem of mimicking in the fiscal policy between governments are more evident than before (called yardstick competition), where the domestic country compares the fiscal decisions applied by their neighboring countries. It leads to fiscal interactions since each government takes care about what the other jurisdiction is doing (Besley & Case (1995), Besley & Smart (2002), and Bordignon et al. (2003)). As a response of these increasing tax interactions, the literature has been focused on the coordination of tax rates (Bucovetsky (1991), Kanbur & Keen (1993), Keen & Konrad (2012), Devereux & Fuest (2010)) and it is generally recognized that the global tax harmonization is difficult to achieve. Theoretically, conditions that allow for partial tax harmonization between jurisdictions have been discussed in order to avoid inefficiently low levels of capital taxation ((Konrad & Schjelderup (1999), Burbidge et al. (1997), Brøchner et al. (2007), Bucovetsky (2009), and Vrijburg & De Mooij (2010))). Simultaneously, Redoano (2003) agrees that externalities among jurisdictions exist which affect the fiscal policy choices. An example of these externalities could be the amount of "core infrastructure" of public investment in a country (e.g. transport and communications) whose benefits spill over in neighboring jurisdictions and affect the level of investment in the latter countries. Public investment in one jurisdiction can benefit the neighborhood by implementing common infrastructure which are useful for all of them. Some institutions have increased this kind of core infrastructure in order to ensure some similarity on the level of public investment between states which it would lead to a certain cooperation (e.g. European Union). Sanz-Córdoba & Theilen (2016) find that agreeing on a common investment level can be effective in facilitating partial tax harmonization between jurisdictions, which would cause a decrease in fiscal competition and in the inefficiency of capital taxation. Nevertheless, governments do not have incentive to invest since they can take advantage from infrastructures of fiscal policy in other countries without paying (and to be a free-rider).

Our paper has two main objectives. First, we investigate the existence of tax competition among OECD countries. Second, we test the theoretical assumption that a common public investment level can facilitate partial tax harmonization among countries. The analysis of tax interdependence between governments is an important issue. Both the EU and the

OECD had introduced initiatives in the late 1990s designed to combat the "harmful" tax competition (Devereux et al. (2008)).
In this paper, we focus on tax competition (Besley et al. (2001), Winner (2005), and Cassette & Paty (2008)). Therefore, the paper deals with interactions in terms of corporate tax choices, given that tax competition is more likely to affect firms since capitals are more mobile than labor. Furthermore, to search for tax interactions, we use a SDPD model (Yu et al. (2008)) which, to the best of our knowledge, had never been used before in this specific field. This model allows to test if tax interactions only occur contemporaneously (like in the case of Wilson (1986), Besley & Case (1995)) or if interactions can also occur with a delay. The idea is that governments do not only shall react to the current year but also to the last year neighboring policy decisions. It is well known that fiscal policies are subject to an implementation lag that could lead to a delay between the observation of a change in neighbor's tax policy and the implementation of a new tax policy at home. Moreover, some theoretical papers have shown that countries can benefit from setting their fiscal choices in later periods (see for example Kempf & Rota-Graziosi (2010)).

Regarding the role played by the proximity in terms of investment levels in the tax competition process, a specific matrix is constructed to account for it in the second part of the paper. This would help us to shed new light on the conditions that facilitates/hinders tax competition and the possibility of agreeing for partial tax harmonization between jurisdictions. Kammas (2011) and Hauptmeier et al. (2012) analyze the fiscal interactions among governments introducing public investment in their analysis. Kammas (2011) finds evidence of positive interdependence over capital tax rates in neighboring countries, but negative interdependence over changes in public investment spending in neighboring countries. However, Hauptmeier et al. (2012) find that if neighbors cut their tax rates, governments lower their own tax rates and increase the level of public inputs in order to restore competitiveness. While our model is based on the capital tax competition between international countries, the main difference here is that we focus on fiscal interactions which are not only contemporaneous but also time-delayed. Moreover, and most importantly, we do not analyze interdependence on infrastructure investment between jurisdictions but we test if similar levels of infrastructure investment could affect on fiscal interactions between countries. To the best of our knowledge, we provide the first empirical analysis of tax competition that allows for infrastructure investment to be included in the fiscal interactions in this way.

The remainder of the paper is organized as follow. Section 2 shows the data used in the model, Section 3 explains the empirical methodology, and results are shown in Section 4.

Finally, Section 5 concludes.

2 The data

In order to analyze tax policy interactions among governments, we consider a dataset of annual data for 28 OECD countries[1] over the period 1995-2014. This section discusses the choice of the data. Data sources can be found in Appendix, Table 1.

In the empirical literature, several variables are used to account for tax policy. At the macroeconomic level, Cassette et al. (2013) measure interactions in fiscal policy by isolating the discretionary part of tax receipts. Redoano (2003) shows that there are fiscal interactions between EU member states which are consistent with the tax and yardstick competition hypothesis by using statutory and income tax rates. Altshuler & Goodspeed (2015) test the assumption of a US leadership in tax competition by using country tax revenue in percentage of GDP in order to reflect an average corporate and individual tax rate. Tax revenue is also used in Bond et al. (2000) to statistically analyze tax rate trends in Europe or Keen & Simone (2004) who test whether tax competition is more problematical for developing countries than for advanced economies.

Following these papers, we use the corporate tax revenue in percentage of GDP. Using tax revenue does not allow to deal with the issue of the timing in data collection.[2] The best indicator to account for tax policy could be the corporate tax rate. However, the corporate tax rate has a really small variability, which does not allow for testing our main assumption – i.e. interactions between countries can be contemporaneous but also time-delayed. That is why we use the *Total income and profit taxes on corporations* from the International Centre for Tax and Development (ICTD) Government Revenue dataset. The advantage here is that the database has been constructed by harmonizing different data sources that makes our dependent variable broadly available in a comparable format.[3]

To estimate tax interactions between OECD governments, we need to control for the determinants of our dependent variable. On one hand, the corporate tax revenue in percentage

[1] Austria (AUT), Belgium (BEL), Canada (CAN), Czech Republic (CZE), Denmark (DNK), Estonia (EST), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hungary (HUN), Iceland (ISL), Ireland (IRL), Italy (ITA), Japan (JPN), Latvia (LVA), Luxembourg (LUX), the Netherlands (NLD), Norway (NOR), Poland (POL), Portugal (PRT), Slovak Republic (SVK), Slovenia (SVN), Spain (ESP), Sweden (SWE), Switzerland (CHE), the United Kingdom (GBR), the United States (USA)

[2] Taxes are, in several countries, levied on the previous year's profits (see Cassette & Paty (2008)).

[3] See Prichard et al. (2014) for a complete description of the dataset.

of GDP is influenced by demographic and economic factors.

First, the corporate tax rate (*Tax level*) should affect it in a positive way if tax revenue increases when tax rate also increases (equivalent to the increasing part of the Laffer's curve), or in a negative way if an increase in the tax rate discourages firms to pay tax (equivalent to the decreasing part of the Laffer's curve). The corporate tax level is introduced contemporaneously and with a one year lag.

Second, since the dependent variable is in percentage of GDP, it is necessary to control for GDP. The growth domestic product (GDP) can have a negative effect by reducing the tax revenue-to-GDP ratio, but also a positive impact if higher GDP means a larger tax base. GDP is introduced with one lag in order to avoid the endogeneity issue.

Third, governments set their tax levels and revenue depending on the level of public expenditure they want since they have to balance their budgets. In this way, we control for public investment: *Invest* is the total inland transport infrastructure investment measured as a share of GDP in order to control for a size effect of each country. An increase in infrastructure investment level may lead to an increase of tax revenues as governments need to compensate the expenditures on infrastructures via taxes. This variable is introduced with one lag to avoid endogeneity.

Public expenditure are also affected by the share of inactive population: young and old people, but also unemployed workers. Therefore, we introduce the sum of young and old population in percentage of total population (*Inactive pop*) and the unemployment rate (*Unemploy*). Moreover, in case of crisis, larger public spending can be necessary, that is why a dummy variable controlling for the year of crisis is introduced (*Crisis*).

Government tax collection also depends on cumulative past deficits, that means on public debt. A high public debt is expected to increase tax revenue in order to allow government to reduce public debt. The public debt (*Debt*) is introduced in the control variables in percentage of GDP, once again with a delay to prevent endogeneity problems.

The last considered economic factor that can influence tax revenue is openness to trade which is measured as the share of import and export in GDP (*Trade*). Countries that face larger openness could be encouraged to reduce their tax level to attract more capital and also because of the freer trade that may lead to a loss of tax revenue as tariffs and other trade taxes are cut (Gropp et al. (1999), and Bretschger & Hettich (2002)).

On the other hand, tax revenue can be affected by political factors.

Firstly, being part of an Economic and Monetary Union (EMU) like the European Union can induce smaller tax revenue. The mobility costs of capital are significantly lower within the EU countries as compared to outside investments that increases the degree of competition to attract private investments and firms (Genser & Haufler (1996)). A dummy variable *EMU* is introduced and takes the value 1 for countries belonging an EMU (the Euro Area in our case).

Secondly, it is often argued that left wings parties experiment larger public spending than right wings parties (Blom-Hansen et al. (2006)). In this way, a higher tax revenue would be necessary to finance left wings spending. Another argument that justifies to control for the political orientation of government can be found in Profeta & Scabrosetti (2016) who show that left wings parties rely on individual income taxes more than on corporation taxes to increase public revenue. We therefore introduce the variable *Left* that is measured on a 1 to 5 scale where 1 indicates hegemony of right wing parties, and 5 hegemony of left wing parties.

Thirdly, it could be expected that a government reduces the corporate tax rate the year of an election in order to attract voters and to be re-elected. At the opposite, government could increase spending to attract voters which could imply an increase in tax revenue. The effect of election is therefore uncertain but it seems still necessary to control for it. Referring to Franzese (2000) and Herwartz & Theilen (2014), the dating of elections is quantified as:

$$Election = \frac{(M-1) + d/D}{12} \tag{1}$$

where M and d are respectively the month and the day of an election, and D is the total number of days in the election month. Note that $Election = 0$ for years without elections.

The model is also estimated with a common trend in order to ensure that interactions are not only due to a coincidence or to common changes among countries. In this way we introduce the world GDP in logarithm (*World GDP*), and the results with and without it will be compared.

3 Empirical methodology

3.1 The Model

In this section, the empirical methodology is presented. In the literature, spatial econometrics is often used to analyze tax interactions between governments. However, the interactions are always considered to be contemporaneous rather than time delayed dependence. We can find evidence of delayed interactions in the theoretical literature about tax competition (see for example Kempf & Rota-Graziosi (2010)). Moreover, some persistence in tax rate and revenue can exist, it is therefore necessary to control for it. In this way, we estimate a

Spatial Dynamic Panel Data (SDPD) model (Yu et al. (2008)) in this paper that accounts for contemporaneous and time delayed cross-sectional dependence. The model to be estimated is the following:

$$y_{n,t} = \lambda W_n y_{n,t} + \rho W_n y_{n,t-1} + \gamma y_{n,t-1} + X_{n,t}\beta + \upsilon_n + \varepsilon_{n,t} \quad (2)$$

where $y_{n,t}$ is the $n \times 1$ vector of tax revenue for the n countries at time t, $X_{n,t}$ is the $n \times k$ matrix containing specific control variables at time t for the n countries, υ_n is a $n \times 1$ vector of country fixed effects, and $\varepsilon_{n,t}$ is a vector of error term which is assumed to be normally distributed. W_n is the weighting matrix used to model interactions between countries; the choice of W_n is discussed in the next section.

The variable $W_n y_{n,t}$ is the spatially lagged variable and $W_n y_{n,t-1}$ is the spatially-timely lagged variable. They respectively measure the (potential) contemporaneous interactions and the time delayed interactions among tax decisions across countries. Therefore, λ and ρ measures the intensity of the contemporaneous interactions and the intensity of time lagged interactions, respectively. Starting from this general model, we can conclude that interactions exist only when λ and/or ρ are significant. If they are not, using spatial econometrics is not appropriate.
The SDPD model is estimated by the quasi-maximum likelihood estimator following Yu et al. (2008) that discuss the theoretical properties of the model.

3.2 Interactions matrices

The weighting matrix is used to model the relationship between countries. It is composed of elements $w_{i,j}$ that measure the link between country i and country j. More specifically, each weight $w_{i,j}$ measures the impact of country j on country i. In the case of tax interactions, the weighting matrix models the transmission channels between the implementation of tax policy in each country. A high $w_{i,j}$ assumes that fiscal choices of country j strongly affects the fiscal choices in country i. Estimating Equation 2 using a specific weighting matrix allows to conclude there are (not) interactions between countries that pass through the specific channel modeled by the matrix.

A way to model interactions between tax revenue among government is using the geographical distance. First, countries that are close are more likely to be engaged in the tax competition process. Second, the closer countries are, the stronger commercial relationships have, so the probability of tax competition between close countries is therefore higher. Another advantage of using distance to construct the weighting matrix is that it is fully exogenous. To measure the geographical distance, we use the radial distance between capitals of countries i and j ($d_{i,j}$). To test the robustness of the estimation, three matrices are constructed. The first one considers the inverse distance between countries: the closer countries are, the stronger the associated weight is. The elements of this matrix are computed as follow:

$$w_{i,j} = \frac{1}{d_{i,j}} \tag{3}$$

With the second matrix, another functional form is considered to model distance: we use the exponential distance. Each element is computed as follow:

$$w_{i,j} = exp(-d_{i,j}) \tag{4}$$

Finally, we also use a matrix considering only the 5-nearest neighbors: $w_{i,j}$ takes the value $1/d_{i,j}$ if j is one of the five nearest neighbors of i, 0 otherwise.

If the coefficient associated to the spatially lagged variable $W_n y_{n,t}$ is not significant, it means that there is no tax interactions between countries according to the weighting schemes used. In contrast, if the coefficient associated to the spatially lagged variable $W_n y_{n,t}$ is significant, it means that countries interact more with close neighbors than with the others. A positive coefficient implies that countries mimic their neighbors: countries increase their tax revenue when neighboring countries increase their own tax revenue. A negative coefficient means that countries act in the opposite direction of their neighbors: they reduce their tax revenues when their neighbors increase their own tax revenue. We test these interactions in two ways: firstly, we test whether interactions exist in a contemporaneous way, secondly, we test whether delayed interactions also exist.

The estimation of Equation 2 requires the normalization of the weighting matrix. We therefore row-normalize each matrix. This means the transformed variables $W_n y_{n,t}$ and $W_n y_{n,t-1}$ can be interpreted as averages of the y values in neighboring countries, respectively at time t and at time $t-1$.

4 Results

Before interpreting the results, we have to ensure that the series and our estimates are stationary, both in time and space dimensions. Following Elhorst (2012) the reduced form of the estimated SDPD model in Equation 2 can be written as follow:

$$y_{n,t} = (I_n - \lambda W_n)^{-1}(\gamma I_n + \rho W_n) y_{n,t-1} + (I_n - \lambda W_n)^{-1}[X_{n,t}\beta + v_n + \varepsilon_{n,t}] \tag{5}$$

Denoting $S_n = (I_n - \lambda W_n)$ and $A_n = S_n^{-1}(\gamma I_n + \rho W_n)$, Lee & Yu (2010) and Yu et al. (2012) show that all the eigen values of A_n have to be less than 1 in absolute value to ensure stationarity. Testing for this is equivalent to ensure that the sum of the space-time coefficients is less than 1, i.e. $\gamma + \lambda + \rho < 1$. Also, two cases of non-stationarity are highlighted in Yu et al. (2012): First, if we observe $\gamma + \lambda + \rho = 1$ and $\gamma = 1$, the SDPD model becomes a unit root SDPD model. Second, we have a spatial co-integration model if $\gamma + \lambda + \rho = 1$ and $\gamma < 1$. In order to test these different specific cases we implement Wald test in two ways. In its first version, we test if $\gamma + \lambda + \rho = 1$ and $\gamma = 1$, and then we test if $\gamma + \lambda + \rho = 1$ considering γ is less than 1. Results are shown at the end of Table 3. We can see that the null hypothesis is always rejected, whatever the weighting matrix used, that leads to the rejection of the non-stationarity assumption. The estimated model is therefore stable.

4.1 Interaction between governments

In what follow, results are discussed. Table 3 shows the results obtained using the three weighting schemes presented above. For each weighting matrix, the left columns show the results without common trend, and the right ones depict the results with a common trend measured by the world GDP.

First of all, we can see that all the matrices give very similar results, at least in terms of significance and sign for all the variables.

Regarding the spatial correlation, on one hand, all the weighting matrices show that there are positive interactions contemporaneously. It means that countries mimic their neighbors at the same period. This phenomena is compatible with the existence of tax competition.

On the other hand, results show that there are negative time-delayed interactions between governments. It means that some governments increase their revenues at time t when others had reduced their own revenue at time $t - 1$. This result seems compatible with behaviors similar to free-riding. Assume that, at time t, country j implements an expansive fiscal policy, for example, by reducing corporate tax rate. The first consequence is a reduction of its revenue at time t. Then, the reduction of tax revenue leads to an increase in available revenue for firms which can hire more workers or simply increase their production at the next period. This reaction may imply an increase in import of country j at time $t + 1$, which means an increase in export of country i. If country i's exports increase, the revenue of firms increases, leading to a higher amount of tax levied. In other words, by boosting growth, the expansive tax policy of country j can lead to an increase in the revenue of country i. With this explanation we do not affirm that countries are voluntary free-rider, but the result is equivalent.

Regarding the impact of the tax rate on the tax revenue, at time t, the tax level positively impacts the revenue of governments. This result seems show that countries are on the increasing part of the Laffer curve: an increase in tax rates leads to an increase in tax revenue. However, the year after, at time $t+1$, the revenue of governments decreases following an increase in tax level at time t. This second point seems more compatible with the decreasing part of the Laffer curve: an increase in tax rates leads to a decrease in tax revenue.

This result can be explained by the timing a firm needs before leaving a country. Following an increase in tax rate, firms do not leave immediately, hence the tax revenue increases. However, the year after, the revenue decreases because firms have left the country. This result is fully compatible with the existence of tax competition: OECD countries are in competition among themselves, firms reallocate their capitals after a change in tax rate.

Regarding the other variables, the share of inactive population negatively affects the corporate tax revenue. An increase in the non-working population means that less people pay the corresponding labor tax. Hence, government has to increase capital taxes in order to maintain a certain level of tax revenue (as capital and labor are strategically substitutes). However, government cannot increase the percentage of capital taxation in the same proportion than the percentage of non-working population increases, so there is a decrease in tax revenue. Another explanation can be the time period covered in our sample. In fact, our sample includes large economic downturns, so such changes in economic conditions are particularly included.

Another variable that has a significant impact on tax revenue is the dummy *crisis*. It is found that one year after a crisis, the tax revenue decreases that can be due to two main factors. Firstly, in case of slowing economy, the revenue of the government automatically decreases because of the automatic stabilizers, which is true for all kinds of taxes. Secondly, it is possible that governments want to decrease the levies on corporations in order to restore growth. In any case, the tax revenue decreases after a year of crisis.

About the common trend introduced in the regressions, it does not change the results, the results we obtained are therefore not due to a common change or to a coincidence. Moreover, the trend is significant and we see that the world GDP has a positive impact on tax revenue in OECD countries. It mainly means that public revenue increases in good time and decreases in recessions.

Concerning the political variables included in the estimates, neither the occurrence of an election nor the political orientation of government impact tax revenue. This result leads to reject the existence of politico-economic cycles, and the fact that left-wing governments could be less stressed about fiscal discipline for our sample.

Finally, we can see that investment has no significant effect on tax revenue. However, in a coordination perspective, maybe this is not really the level of investment that matters but more the difference between the levels of investment among countries. The next section discusses this point.

4.2 Tax competition and public investment

In this section, we test whether governments which have similar infrastructure investment levels interact more together when they set their tax policies. The existing literature has already analyzed the role of public goods differentiation in relaxing fiscal competition. Many authors argue that jurisdictions compete not only in taxes but also in the provision of infrastructure (see Hindriks et al. (2008), Zissimos & Wooders (2008), Pieretti & Zanaj (2011)). Han (2013) finds that partial tax harmonization harms both member and non-member jurisdictions of a tax union when jurisdictions compete both in taxes and infrastructures. However, Sanz-Córdoba & Theilen (2016) find that agreeing a common infrastructure investment level facilitates partial tax harmonization. In this case, governments could be more likely to set similar tax policies if they have similar investment levels. If governments interact more when they have similar investment levels it means that the "coordination" of infrastructure investment leads to similar tax policy choices, reducing the tax competition between these countries.

Therefore, we construct a weighting matrix that accounts for the distance in terms of public investment levels. Each element $w_{i,j}$ is computed as follow:

$$w_{i,j} = |\frac{1}{invest_j - invest_i}| \tag{6}$$

In this way, we test if governments interact more with governments that have similar public investment levels than with the others.

Note that to ensure the exogeneity of the matrix, we consider the average of public investment before 1995, that means before the beginning of our estimation period.

Results are presented in Table 2. They are very close to the previous ones: we find positive contemporaneous interactions but negative interactions with one year delay. It means that governments mimic governments that have similar public investment levels at the same period. The negative time-delayed interactions show that some governments increase their revenue at time t leading, the year after, to a decrease in the revenue of governments that have similar investment levels.

While the explanations of this phenomena are the same than the ones given in the previous subsection, these results give us new information. In fact, the coefficients associated to the spatially lagged variables are higher than with the more traditional weighting scheme. The interactions implied by the proximity in terms of public investment levels are higher than the ones implied by geographical distance. Moreover, the log-likelihood is also higher for this case than before meaning that this weighting scheme seems more appropriate to model tax revenue interactions.

On one hand, this result confirms that, contemporaneously, countries with common or close investment levels could be more likely to achieve tax harmonization (Sanz-Córdoba & Theilen (2016)). On the other hand, the negative time-delayed interactions are not consistent with that. An explanation can be that countries compete on both taxes and infrastructure investments. If they share the same level of investment, they change their taxes to be more attractive than their rivals, and this adjustment occurs with a delay.

5 Conclusion

Recent empirical studies have found that fiscal interactions occur contemporaneously but only few papers take into account potential lagged interactions. Our paper considers both contemporaneously and time-delayed fiscal interactions using a Spatial Dynamic Panel Data (SDPD) model in order to complete the existing literature. We also test if the interdependence between governments exists due to the proximity of their infrastructure investment level, in addition of analyzing the role of economic and political variables play on tax revenues.

The results show that there are positive contemporaneously and negative time-delayed interactions between OECD countries. This result means that governments mimic their neighbors behavior in tax policies and also act as free-riders if they can. We confirm the existence of tax interdependence in the closest neighboring OECD countries where tax competition still occur. Regarding political variables and infrastructure investment analyzed, neither of them impacts tax revenues. However, the economic variables have some effect on tax revenues, proving that recessions affect the fiscal policy choices of governments and the substitutability between capital and labor tax exists in order to compensate the changes on tax revenues. Finally, we can confirm that this fiscal interdependence is higher for countries which have similar levels of public infrastructure investment and this weighting scheme seems more appropriate to model tax revenue interactions. This result confirms that, contemporaneously, countries with close infrastructure investment levels could be more likely to achieve tax harmonization, but the time-delayed results are not consistent with this hypothesis, proving both tax and infrastructure competition between OECD countries.

As regards of future research, first of all it would be engaging to analyze spatially lagged control variables in order to add new information about the variables that affect tax revenues and the interactions of these variables between countries. Taking into account different policy instruments could yield further insights into the rather complex process of fiscal policy decision making at the macro level and the existence of tax competition between the countries analyzed. Secondly, it would be interesting to analyze the tax competition taking into account the spatial econometric models in a more local level for several countries which can have different results depending on the institutional environment of each government.

Appendix

Table 1: Data definitions and sources

Variable	Definition	Measurement	Source
Tax R	Total income and profit taxes on corporations	Percentage of GDP.	ICTD (2016), Government Revenue dataset.
Tax level	Combined (statutory) corporate income tax rates	Percentage unit.	OECD (2016a), Tax database.
Invest	Total inland transport infrastructure investment	Percentage of GDP.	OECD (2016c), International Transport Forum.
Inactive pop	Inactive population	Sum of young and old population in percentage of total population.	World Bank (2016a), World Development Indicators.
Election year	Year of election	Date of election as time share over year in election years, 0 in years without elections.	Döring and Manow (2011), Parliament and government composition database (ParGov); data for the USA is from Benoit and Laver (2006).
Left	Ideology of the leading party in government	Between 1 (hegemony of right-wing parties) to 5 (hegemony of social-democratic and left-wing parties).	Klaus et al. (2015), Comparative Political dataset.
GDP	Gross domestic product	Per capita in current US dollars.	World Bank (2016a), World Development Indicators.
Crisis	Economic crisis	Dummy variable. 1 = economic crisis occurs, 0 otherwhise.	Laeven and Valencia (2012).
Unemploy	Unemployment rate	Percentage of total working force.	Ameco (2016) **?**; OECD (2016c).
Debt	Public debt	Percentage of GDP.	IMF (2016), Historical Public Debt database (HPDD).
Trade	Total trade	Percentage of GDP.	World Bank (2016a), World Development Indicators.
EMU	Economic and Monetary Union of the European Union countries	Dummy variable. 1 = country belongs to EMU, 0 otherwhise.	Own calculation using European Commission historial data.

Table 2: Results using investment distance weighting matrix

	Distance in investment levels			
Variables	Coefficient (z-probability)			
W*Tax R	0.522	(0.00)	0.515	(0.00)
W*Tax R t-1	-0.423	(0.00)	-0.423	(0.00)
Tax R t-1	0.731	(0.00)	0.714	(0.00)
Tax level	0.032	(0.01)	0.035	(0.00)
Tax level t-1	-0.026	(0.02)	-0.021	(0.06)
Invest t-1	-0.001	(0.26)	-0.001	(0.11)
Inactive pop	0.000	(0.15)	0.000	(0.09)
Election month	-0.001	(0.23)	-0.001	(0.25)
Left	0.000	(0.28)	0.000	(0.16)
GDP t-1	0.000	(0.49)	0.000	(0.77)
Crisis t-1	-0.001	(0.03)	-0.002	(0.00)
Unemploy t-1	0.000	(0.53)	0.000	(0.59)
Debt t-1	0.000	(0.08)	0.000	(0.20)
Trade t-1	0.000	(0.28)	0.000	(0.99)
EMU	-0.002	(0.06)	-0.002	(0.03)
World GDP	-		0.003	(0.01)
Trend	No		Yes	
Individual fixed effects	Yes		Yes	
Observations	532		532	
Log-Likelihood	2194.33		2197.34	
Wald Tests				
$H_0: \gamma + \lambda + \rho = 1$ & $\gamma = 1$				
statistic	157.73		164.05	
p-value	<0.001		<0.001	
$H_0: \gamma + \lambda + \rho = 1$				
statistic	98.79		103.03	
p-value	<0.001		<0.001	

Table 3: Results using geographical distance weighting matrices - Row-normalization

	Inverse Distance				Exponential Distance				5-nearest neighbors			
Variables	Coefficient (z-probability)											
W*Tax R	0.434	(0.00)	0.424	(0.00)	0.420	(0.00)	0.396	(0.00)	0.264	(0.00)	0.258	(0.00)
W*Tax R t-1	-0.391	(0.00)	-0.367	(0.00)	-0.380	(0.00)	-0.360	(0.00)	-0.161	(0.02)	-0.155	(0.02)
Tax R t-1	0.726	(0.00)	0.711	(0.00)	0.728	(0.00)	0.714	(0.00)	0.719	(0.00)	0.702	(0.00)
Tax level	0.031	(0.01)	0.034	(0.00)	0.032	(0.01)	0.035	(0.00)	0.032	(0.01)	0.035	(0.00)
Tax level t-1	-0.026	(0.02)	-0.022	(0.05)	-0.027	(0.01)	-0.023	(0.05)	-0.025	(0.03)	-0.020	(0.08)
Invest t-1	-0.001	(0.29)	-0.001	(0.16)	-0.001	(0.28)	-0.001	(0.15)	-0.001	(0.40)	-0.001	(0.21)
Inactive pop	-0.001	(0.03)	-0.001	(0.01)	-0.001	(0.03)	-0.001	(0.02)	-0.001	(0.02)	-0.001	(0.01)
Election month	-0.001	(0.24)	-0.001	(0.26)	-0.001	(0.29)	-0.001	(0.30)	-0.001	(0.26)	-0.001	(0.28)
Left	0.000	(0.32)	0.000	(0.21)	0.000	(0.29)	0.000	(0.19)	0.000	(0.34)	0.000	(0.21)
GDP t-1	0.000	(0.61)	0.000	(0.72)	0.000	(0.52)	0.000	(0.84)	0.000	(0.64)	0.000	(0.64)
Crisis t-1	-0.001	(0.03)	-0.002	(0.01)	-0.001	(0.02)	-0.002	(0.00)	-0.001	(0.01)	-0.002	(0.00)
Unemploy t-1	0.000	(0.79)	0.000	(0.88)	0.000	(0.78)	0.000	(0.88)	0.000	(0.80)	0.000	(0.73)
Debt t-1	0.000	(0.27)	0.000	(0.44)	0.000	(0.27)	0.000	(0.47)	0.000	(0.18)	0.000	(0.36)
Trade t-1	0.000	(0.96)	0.000	(0.42)	0.000	(0.84)	0.000	(0.53)	0.000	(0.75)	0.000	(0.23)
EMU	-0.001	(0.25)	-0.001	(0.18)	-0.001	(0.21)	-0.001	(0.15)	-0.001	(0.48)	-0.001	(0.35)
World GDP	-		0.003	(0.04)	-		0.002	(0.05)	-		0.003	(0.02)
Trend	No		Yes		No		Yes		No		Yes	
Individual fixed effects	Yes		Yes		Yes		Yes		Yes		Yes	
Observations	532		532		532		532		532		532	
Log-Likelihood	2190.30		2192.35		2191.43		2193.37		2186.02		2188.55	
Wald Tests												
$H_0: \gamma+\lambda+\rho=1$ & $\gamma=1$												
statistic	131.09		135.77		131.23		133.83		119.00		124.80	
p-value	<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	
$H_0: \gamma+\lambda+\rho=1$												
statistic	57.69		56.41		59.16		58.05		54.36		57.11	
p-value	<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	

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