

# Delayed Mimicking: The Timing of Fiscal Interactions in Europe

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April, 2016

## Abstract

Fiscal interactions in Europe are a major challenge. Countries can cooperate or be engaged in a tax or a yardstick competition process. This paper uses a Spatial Dynamic Panel Data model (SDPD) to test the timing of fiscal stances interactions in Europe. Results show that fiscal interactions are not contemporaneous: governments mimic the behavior of neighboring governments on the last year, leading to a kind of "delayed mimicking" behaviors. This result is then used and deepened to discriminate between the three main rationales for fiscal interactions. Using original weighting schemes based on political proximity and similarities between investment contexts, we show that fiscal interactions in Europe are likely due to yardstick competition.

*JEL Classification:* E62; F42

*Key Words:* Fiscal policy interactions; Spatial Dynamic Panel Data model; Europe

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# 1 Introduction

The issue of spending and revenue interactions among localities is largely addressed by academic literature. Since fiscal choices spill-over localities, governments have strategic interactions to implement their tax and spending policies. Some theoretical papers identify the rationales for these interactions, which can be extended to the case of fiscal policy interactions between countries (Salmon, 2014).

The first rationale for fiscal interactions is tax competition (Wilson, 1986; Zodrow and Mieszkowski, 1986). Governments aim to attract mobile tax basis by lowering fiscal burdens. Theoretically, tax competition should imply positive interactions between states since models predict tax harmonization (Brueckner, 2003).

Yardstick competition is another rationale for fiscal interactions among countries. According to Besley and Case (1992), voters compare home government decisions with those applied abroad and they sanction their government if they believe policies are better abroad. Yardstick competition should lead to positive interactions since each government will mimic another one in order to avoid voters' sanctions.

The last case for fiscal interactions among countries is (non-)coordination. Investments in one country can benefit to another one, both by increasing the external demand (i.e. the trading partners exports) and by implementing infrastructures that are useful for neighboring countries. In such a case, countries may decide to cooperate by financing public goods together, or they may be free-riders taking the advantage from neighbor's choices without any cost. Generally, governments do not have incentives to share the policy costs, but in the particular context of the European Union, institutions had been implemented in order to ensure a certain cooperation between states. Moreover, some papers show that an area-wide fiscal shock is more effective than an (equivalent) isolated one (see for example Hebois and Zimmermann (2013)). Cooperation<sup>1</sup> between countries should lead to positive fiscal interactions, but free-riders behaviors should imply negative ones (Redoano, 2003).

Based on all these theoretical explanations for fiscal interactions, and given that the sign of fiscal interactions remains uncertain, a lot of papers empirically estimate fiscal interactions, both on the spending and the revenue sides. Most of them are related to the national level (see for example Foucault et al. (2008); Gérard et al. (2010); Delgado et al. (2015)), but some papers are interested in fiscal interactions at the international scale. Besley et al. (2001) and Winner (2005) find there are interactions among OECD governments which are consistent with the tax competition hypothesis. More recently, Kammas (2011) finds strate-

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<sup>1</sup>Here, the term "cooperation" refers to the cost sharing of fiscal choices.

gic interdependencies over capital tax rates, but no one over public investment spending, and Cassette et al. (2013) show that fiscal interactions among OECD countries could be due to tax competition as well as yardstick competition. These papers have a common point: they consider public spending and public revenue separately. Only few papers are about the interdependence between global fiscal stances – i.e. considering spending and revenue jointly. A change in tax policy could be offset by an equivalent change in spending, at least partially. Therefore analyzing fiscal stances interdependences seems to be necessary to conclude about the presence of strategic interactions. Another advantage from using fiscal stances, and not only spending or revenue, is that recent years have been characterized by an increasingly agents' taste for fiscal discipline – and a growing stress about fiscal sustainability. Fiscal stances are decisive variables, analyzing their interactions seems relevant, especially because, to the best of our knowledge, only Beetsma and Giuliadori (2008) do it.

Generally, papers dealing with fiscal interactions consider these interactions occur contemporaneously. In the seminal theoretical contributions explaining fiscal interactions (Wilson, 1986; Besley and Case, 1992), government's decisions are taken simultaneously. More recently, some papers show that countries can get benefit from setting their fiscal choices in a second period (Kempf and Rota-Graziosi, 2010).

In addition, fiscal policy is subject to an implementation lag. Blanchard and Perotti (2002) argue that the reaction of fiscal policy to the economic context needs at least one quarter and Beetsma and Giuliadori (2011) support that the budget is often planned once a year, and sometimes revised in mid-year. These points show that governments do not response to the economic context without a delay. In this way, we argue that fiscal interactions should occur with a delay: governments shall react to the last year neighboring fiscal stances, not only to the current ones.

Only a few papers about fiscal interactions take these potential lagged interactions into account. Altshuler and Goodspeed (2015) estimate tax reaction functions for European countries with a delay to identify US potential leadership. Chirinko and Wilson (2013), using the Pesaran's Common Correlated Effects estimator, show that omitting the delayed response of tax policy leads to misspecified model and biased results. Regarding the fiscal stances interactions, to the best of our knowledge, there is no study which consider that interactions can occur with a delay. We therefore test it in this paper.

While most of the papers about international fiscal interactions are interested in OECD countries, the question of strategic interactions is a major challenge in Europe. European countries are increasingly interdependent. Especially, countries from the European Union

(EU) are still called for political cooperation. Since the recent crisis, new councils as the Ecofin Council have been created to reinforce dialogs among European countries. However, even if the financial crisis had lead to a "revival" of cooperation with the implementation of coordinated (expansionary) fiscal policies, debt sustainability concerns can lead to competition among countries which have to face to budgetary austerity (Timbeau et al., 2015). The question of fiscal interactions in Europe is indeed of the highest importance, that is why this paper is interested in.

In sum, this article has two main contributions. First, using fiscal stances, we test the timing for fiscal interactions by estimating a Spatial Dynamic Panel Data (SDPD) model (Yu et al., 2008; Lee and Yu, 2010) over the period 1995-2013 in Europe. Then, our results are used to shed new light on the nature of fiscal interactions in Europe.

The remainder of the paper is organized as follow. Section 2 introduces the model and the variables used, and results are shown in Section 3. In Section 4, the nature of fiscal interactions is investigated. Finally, Section 5 concludes.

## 2 Empirical Design

To empirically estimate in what extent fiscal stances interact in Europe, four preliminary points of methodology have to be discussed. First, the suitable empirical specification and estimator have to be used. Second, it is necessary to discuss the definition and the indicator of fiscal stance. Then, obviously, fiscal stance in one country does not depend only on fiscal stances abroad, that is why the role of other factors has to be discussed and considered. Finally, since the results may crucially depend on the definition of the linkages (i.e. the neighboring) between countries, the weighting schemes used are discussed.

### 2.1 The Model

Spatial econometrics methods allow to account for interdependences. As explained, we consider fiscal interactions in two ways: contemporaneously and time-lagged. Because there likely is a persistence effect, the endogenous variable should also be introduced into the regressors as time-lagged. Governments cannot, indeed, totally change their fiscal stance within one year. Hence, the most appropriate method is the Spatial Dynamic Panel Data (SDPD) model from Yu et al. (2008) and Lee and Yu (2010). This model allows for contemporaneous interactions, delayed interactions, and also for the presence of the (timely) lagged endoge-

nous variable in the regressors. This dynamic model is estimated in two steps. First, it is estimated by the Quasi-Maximum Likelihood (QML) estimator: this estimation is based on the log-likelihood function of the model conditionally to the first observation of each spatial unit in the sample. Second, coefficients are corrected for the presence of fixed effects.<sup>2</sup>

The estimated equation is defined as follow:

$$B_{n,t} = \gamma B_{n,t-1} + \lambda W_n B_{n,t-1} + \rho W_n B_{n,t} + X_{n,t} \beta + c_n + D_t + \varepsilon_{i,t} \quad (1)$$

Where:

- $B_{n,t} = (y_{1,t}, y_{2,t}, \dots, y_{n,t})'$  is a  $n \times 1$  column vector of fiscal stances of countries 1 to  $n$ ;
- $X_{n,t}$  is a  $n \times k_x$  matrix of  $k$  controlling variables;
- $W_n$  is a  $n \times n$  matrix row normalized with all weights between 0 and 1, which is discussed below;
- $\varepsilon_{n,t} = (e_{1,t}, e_{2,t}, \dots, e_{n,t})'$  is a  $n \times 1$  column vector where  $e_{i,t}$  is assumed to be *i.i.d.* across individuals and times with zero mean and with  $\sigma_0^2$  variance;
- $c_n$  is a  $n \times 1$  column vector of individual fixed effects;
- $D_t$  is a  $n \times t$  matrix of dummy variables for each time period.

To be interpreted, the marginal effects of the controlling variables have to be recalculated. Indeed, this dynamic space-time model has two kinds of derivatives: own-partial derivatives and cross-partial ones. The own-partial derivatives show the impact of a change in the  $k$ th variable in country  $i$  on  $B_{i,t}$ , and the the cross-partial derivatives show the spillover effect: the effect of a change in the  $k$ th variable in country  $j$  on  $B_{i,t}$ . Here, we are more interested in the direct effect in order to measure the response of fiscal stance in country  $i$  to a change in country  $i$ 's explanatory variables. Following Debarsy et al. (2012), the response of  $B_{i,t+T}$  to a change in the  $k$ th variable at time  $t$  using the main diagonal elements of the matrix:<sup>3</sup>

$$\frac{\partial B_{i,t+T}}{\partial k_t} = D_T [I_N \beta_k] \quad (2)$$

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<sup>2</sup>See Elhorst (2012) or the original contributions from Yu et al. (2008) and Lee and Yu (2010) for more explanations.

<sup>3</sup>The effect is computed assuming the shock in the  $k$ th  $i$ 's variable at time  $t$  is transitory.

With  $D_T = (-1)^T(F^{-1}C)^T F^{-1}$ ,  $C = -(\gamma I_N + \lambda W)$ , and  $D = (I_N - \rho W)$ .

Since the effect can differ across countries, we take the average effect – i.e. the average of the main diagonal elements of  $\frac{\partial B_{t+T}}{\partial k_t}$ .

The SDPD model is estimated over a sample of 31 European countries<sup>4</sup> and the United States, Canada and Japan over the 1995-2013 period. This choice is constrained by data availability knowing only few data are available for Eastern European countries before 1995, and data are yearly since quarterly data are not available for a large set of countries. The United States, Canada and Japan have been added to European countries because they represent almost 30% of the extra-Europe commerce<sup>5</sup>. These three countries should therefore have a strong influence for Europe. Moreover, they are the three main commercial partners of Europe for which data are widely available.

## 2.2 Fiscal stance measurement

Generally, the fiscal stance is represented by the budget balance calculated as the difference between public revenue and spending. The budget balance varies according to governments decisions, but also depending on the business cycle due to the so-called *automatic stabilizers*. Analyzing the interactions between fiscal stances in Europe implies that the analyzed fiscal stances must be the results of governments' decisions. Otherwise, the measured interactions could be due to a common shock and not really to governments willingness. Every cyclical and unintentional components of the budget balance are therefore eliminated, and fiscal stances are measured using the Cyclically Adjusted Primary Balance (CAPB). The CAPB is the budget balance prevailing when the economy is at its potential. It is measured in percentage of the cyclically adjusted output. Interest debt payments are also deleted since they are due to past deficits and not really to the current government willingness. CAPB is computed as follow:

$$CAPB = \frac{B^p}{Y^p} = \frac{B}{Y} - \varepsilon * OG \quad (3)$$

With:

- $B$  the budget balance excluding interest debt payments, and  $B^p$  the potential budget

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<sup>4</sup>Countries are: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

<sup>5</sup>Author calculations using Eurostat data.

balance (i.e. the budget balance which should prevail when economy is at its potential level);

- $Y$  the GDP level, and  $Y^p$  the potential output;
- $OG$  the Output Gap;<sup>6</sup>
- $\varepsilon$  the semi-elasticity of  $B$  to  $Y$ .<sup>7</sup>

Using CAPB eliminates the contemporaneous (and unintentional) reaction of fiscal policy to cyclical variation in domestic output, and allows us to measure the governments willingness. CAPB appears as a convincing indicator given our objective. Even if using CAPB does not differentiate revenue variations from spending variations, we measure the real fiscal stance. Conversely, using only public spending leads to conclusion about the effect of spending *ceteris paribus* – assuming public revenue remains unchanged. CAPB therefore represents the *true* orientation of fiscal policy.

Unlike Beetsma and Giuliadori (2008) who use real-time data (planned budget), we use effective data about public budget. Actually, we argue that some governments can announce an expansive fiscal policy under a (relative) coordination programme, but the effective fiscal change can be different. In this paper, the presence of effective coordination is tested, while using planned budget leads to conclude about planned coordination. However, in this way we only consider successful policy: an unsuccessful restrictive fiscal policy is viewed as a decrease in CAPB.

CAPB is introduced in level in Equation 1 since an increase in CAPB can be viewed as a restrictive fiscal policy, and vice versa. In this way, the spatial correlation coefficient represents the impact of an increase in CAPB abroad on the CAPB at home. A positive spatial autocorrelation coefficient means that there are mimicking behaviors: governments mimic their neighbors. At the opposite, a negative spatial autocorrelation coefficient would mean that governments have reverse reactions to their neighbors: when the (weighted) neighboring CAPB increase, CAPB at home decreases.

## 2.3 Controlling variables

To ensure that the estimated interaction effects are really due to interactions among fiscal decisions, the other sources of fiscal stance variations have to be controlled.<sup>8</sup>

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<sup>6</sup>The output gap is computed as the difference between potential GDP and actual GDP using the production function approach, see Roeger (2006).

$$\tau_{\varepsilon} = \frac{d(\frac{B}{Y})}{\frac{dY}{Y}}$$

<sup>8</sup>Data sources and descriptions are presented in appendix, Table 5.

The fiscal stance is first influenced by economic and demographic conditions. A high employment rate (*unemployment*) and a high share of inactive population (*young* and *old* people) imply larger public spending, but also lower revenue: they are expected to deteriorate CAPB.

In reverse, a high GDP per capita in constant terms (*gdp\_perk*) can necessitate smaller public spending, and it implies a larger tax base: CAPB would be higher in countries with higher GDP per capita.

The occurrence of banking crisis (*crisis*) can imply larger spending the following year, reducing the CAPB. Finally, the concerns about high public debt (*debt*) can lead to restrictive measures which would improve CAPB.

All these variables are lagged since the budget is generally decided once a year (and before its execution), and this avoids endogeneity issues.

The fiscal stance is also influenced by political factors. A relaxation of fiscal policy on the election year (*election\_year*) might be expected, and left wings governments (*left*) are expected to be less stressed about fiscal discipline. Note that this result could be affected by the recent responses to the crisis which do not always depend on the political orientation of government. Hence the effect of the *left* variable seems *a priori* unclear. Fiscal stance can also be affected by the size of government: the bigger governments may have more power to intervene in the economy than the smaller. To approximate this government size, a composite index is constructed (*GovSize*) relying on the share of state's employees compensation in GDP and the share of social contributions collected by the government.<sup>9</sup>

We also take into account the peer pressure as suggested in Beetsma and Giuliodori (2008). We construct a variable which equals to zero when CAPB is under the 3% deficit threshold, and equals to the inverse distance from this threshold otherwise. This variable is then multiplied by the inverse of the number of years before the entrance in the Euro Area. The variable *sgp* therefore increases both with the distance to the 3% deficit threshold and the closer the date for entrance in the Euro Area (EA) is.<sup>10</sup>

## 2.4 The Weighting Schemes

The weighting matrix  $W_n$  is a  $n \times n$  matrix whose each element  $w_{i,j}$  represents the interactions between  $i$  and  $j$ .  $W$  has to be exogenous and unvarying across time dimension.

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<sup>9</sup>The quartile of these variables are computed, and a score is assigned to each country (and year) from 1 for countries belonging to the first quartile, to 4 for countries belonging to the higher quartile. The two score are added to form the *GovSize* variable, which therefore ranges from 1 to 8.

<sup>10</sup>We wanted to introduce variables controlling for EU and EA memberships, but their are almost identical with individual (and/or time) fixed effects, which gives poor quality estimates. They are therefore omitting.

In practice, and to estimate the SDPD model,  $W$  has to be normalized. Here,  $W$  is row-normalized, meaning that each line sums to one. In this way, we test the impact of the weighting average of fiscal stances abroad on fiscal stance at home. Even if Kelejian and Prucha (2010) show that a normalization using the maximal eigenvalue of the matrix is more neutral for the estimation of the spatial correlation parameter, we argue that using relative distance is more suitable in our case. Moreover, this row-normalization is the most frequently used in the literature about fiscal interactions<sup>11</sup>, our results are therefore more comparable using the same method.

Regarding the definition of weights, different schemes have to be used to be sure the results found are not only due to the matrix used.

First, we use a traditional geographical distance matrix ( $W_d$ ) which measures the euclidean distance between economic capitals. For  $i \neq j$ , each element of  $W_d$  is defined as follow:

$$w_{i,j} = \frac{1}{d_{i,j}} \quad (4)$$

With  $d_{i,j}$  the euclidean distance between  $i$  and  $j$  economic capitals.

Second, we use a weighting matrix that represents the intensity of trade between countries ( $W_{trade}$ ). This transmission channel is frequently used to test fiscal interactions, especially cross-country spillovers from fiscal policy (see for example Goujard (2013)). Each element of  $W_{trade}$  is constructed as follow:

$$w_{i,j} = import_{j,i} \quad (5)$$

Where  $import_{j,i}$  is the import average of  $j$  from  $i$  over the period 1980-1994. This matrix is predetermined that ensures its exogeneity.

To test the robustness relatively to the matrix used, we construct another matrix measuring trade intensity using imports over the period 1990-2005.

### 3 Results

Results using the three matrices described above are presented in Table 1, and the marginal effects computed following Equation 2 are shown in Appendix, Table 4.<sup>12</sup>

<sup>11</sup>See for example Beetsma and Giuliodori (2008) or Cassette et al. (2013).

<sup>12</sup>As explained in Elhorst (2012), the stationary conditions imply, regarding our specification, that the spatial and time coefficients ( $\gamma$ ,  $\lambda$  and  $\rho$ ) sum to less than one, which is satisfied here.

Table 1: Results using general weighting schemes

Variables	Coefficients (z-prob)					
	W distance		Trade < 95		Trade < 2005	
Capb_t-1	0.62	(0.00)	0.62	(0.00)	0.62	(0.00)
Wcapb_t-1	0.37	(0.09)	0.28	(0.03)	0.20	(0.10)
Young	-3.47	(0.02)	-3.73	(0.01)	-3.63	(0.01)
Old	-1.29	(0.50)	-0.62	(0.75)	-0.59	(0.77)
Unemployment	0.08	(0.06)	0.07	(0.07)	0.07	(0.07)
Gdp_per_k	-1.53	(0.26)	-1.76	(0.20)	-1.69	(0.21)
Crisis	-0.15	(0.56)	-0.19	(0.46)	-0.18	(0.49)
Debt	0.02	(0.01)	0.02	(0.01)	0.01	(0.01)
Gov Size	-0.47	(0.00)	-0.46	(0.00)	-0.46	(0.00)
Election	-0.31	(0.06)	-0.29	(0.08)	-0.29	(0.08)
Left	-0.10	(0.09)	-0.10	(0.11)	-0.10	(0.11)
SGP	0.72	(0.15)	0.77	(0.13)	0.75	(0.14)
Wcapb	0.01	(0.90)	0.05	(0.48)	0.06	(0.47)
$\sigma^2$	2.85		2.83		2.84	
Log-Likelihood	-977.26		-975.07		-975.80	
Observations	612		612		612	

Regarding the controlling variables, effects are similar whatever the matrix used. First, the lagged unemployment rate has a positive impact on CAPB. This unexpected result can be explained in two ways. On the one hand, the automatic (negative) response of budget balance to an increase in unemployment is not considered here since fiscal stance is cyclically adjusted. Governments can counterbalance this negative automatic response by an improvement of the structural part of budget balance. In the other hand, some papers show that fiscal policy has non-linear effects (Giavazzi and Pagano, 1995; Sutherland, 1997) leading to budgetary consolidation in recession times. Similarly, Corsetti et al. (2011) show that an increase in sovereign risk reduces the global demand. The response to unemployment could therefore be a reduction in fiscal deficit, even more when public debt is high.

These explanations assume public finance sustainability is a major concern. This statement is confirmed by the results we obtained about public debt. Indeed, an increase in public debt a time  $t - 1$  implies an improvement in CAPB at time  $t$ . This result shows that there is a willingness for fiscal discipline.

Concerning the political variables, we find that fiscal stance is highly deteriorated during the election year. This result is consistent with political budget cycles literature (see for example Alesina et al. (1993) and Klomp and De Haan (2013)). The variable *left* also has a negative impact on fiscal stances, meaning that left-wing governments are less stressed about

fiscal discipline than right-wing governments. In the same way, governments which are more interventionist, as measured by the variable *GovSize* have lower fiscal stances.

Regarding the spatial correlation, all these weighting schemes show that there are positive interactions between countries. However, and contrary to the results from previous articles like Beetsma and Giuliadori (2008), Redoano (2007) and Cassette et al. (2013), these interactions are not contemporaneous. Countries consider neighboring fiscal stances of the previous year to set their current fiscal stance, which can be called "delayed mimicking" behaviors.

The weighting schemes used here are not really informative about the reason why fiscal stances interact. Regarding geographical distance, neighboring countries can interact because of tax competition since the closer countries are, the easier investing there is. Geographical distance can also imply yardstick competition since the nearest neighbors are better known than the farthest; it is therefore easier to compare our own government to its nearest neighbors. Finally, geographical proximity can also imply common investments, both for infrastructures or international projects (such as educational or health programs for example).

Concerning the trade matrix, it is often considered that this scheme represents the transmission channel for cross-country spillovers. The idea is that an increase in public spending (or a decrease in public revenue) leads to a rise in imports that therefore benefits to trading partners by boosting their growth. Since trading partners can benefit from positive spillovers without spending any money, they have incentive to being free-riders.

However, the trading proximity could also imply other forms of interactions. Hence, since trading partners are likely to have language, history and/or institutions similarities (Srivastava and Green, 1986; Linders and Slangen, 2015), it is easier for capitals to move there, and even more in case of trade agreements. Tax competition is therefore not excluded. In the same way, an important trading partner is often much more known than a less important one since our main trading partners are likely to have similar language, history and/or institutions. Aside from a few exceptions, it is easier to compare government efficiency to trading partner countries' one. The positive interaction coefficient found using trading proximity could therefore be due to cooperation, tax competition as well as yardstick competition.

While the geographical and trading weighting schemes do not allow to identify the rationale for fiscal interactions, our results are informative. Finding positive interactions allows to exclude potential free-rider behaviors since free-riding should imply negative interactions (Redoano, 2007; Brueckner, 2003). Then, the cooperation hypothesis does not seem to be realistic since the interactions are not contemporaneous. In fact, if countries cooperate, their

are expected to implement their fiscal policies at the same time, and the observed mimicking would be contemporaneous, not delayed. Even in the case of a potential delay, one year seems too long. Since countries mimic the others one year after, a situation in which there are leader(s) and follower(s)<sup>13</sup> is more likely than a cooperation case.

In this way, two reasons for fiscal interactions remain: tax competition and yardstick competition. Both of them are compliant with the presence of positive interactions, and the delay between neighbor and domestic actions is not inconsistent with them. What we know is that governments mimic the others the year after, whatever the reason is. However, it should be interesting to discriminate between tax and yardstick competition since each one of them does not imply the same consequences in normative terms.

## 4 On the interpretation of fiscal interactions

In the following section, we model different transmission channels to confirm our results about cooperation and attempt to discriminate between tax and yardstick competition, by using different transmission channels.

First, in order to confirm our previous result about the absence of cooperation among countries, we test whether the political proximity between governments induces some interactions or not. In case of cooperation, interactions should be stronger among governments with similar political guidelines.<sup>14</sup> We therefore construct a matrix  $W_{politics}$  as follow:

$$w_{i,j} = \left| \frac{1}{gov\_party_i - gov\_party_j} \right| \quad (6)$$

Where  $gov\_party_i$  is an indicator ranged from 1 to 5, with 1 for governments with hegemony of right-wing parties; 5 for governments with hegemony of left parties. The average of this indicator over our period analysis is used.<sup>15</sup> In this case, countries are supposed to interact more when there are politically close. Results from Table 2 show that this assumption does not reflect what is really going on. Actually, we find that governments politically close do not interact each other. This result confirms that cooperation among European countries is unlikely to be the reason for the positive interactions that we found.

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<sup>13</sup>See for example the paper of Altshuler and Goodspeed (2015) that shows the American leadership by introducing the US' lagged tax policy in the regressors. For a theoretical model, see also Kempf and Rota-Graziosi (2010).

<sup>14</sup>Data sources for weighting matrices construction are presented in Appendix, Table 6.

<sup>15</sup>For this matrix, as well as for the following ones, in each case where there is no differences between  $i$  and  $j$ ,  $w_{i,j}$  is replaced by  $Max w_{i,j} + 1$  to ensure that a stronger weight is given to countries exactly similar.

Table 2: Results using political similarities as weighting scheme

	Coefficients (z-prob)	
Variables	W Politics	
Capb_t-1	0.64	(0.00)
Wcapb_t-1	0.49	(0.21)
Young	-3.53	(0.02)
Old	-1.88	(0.33)
Unemployment	0.07	(0.07)
Gdp_perk	-1.43	(0.29)
Crisis	-0.16	(0.55)
Debt	0.01	(0.01)
Gov Size	-0.48	(0.00)
Election	-0.29	(0.08)
Left	-0.10	0(.09)
SGP	0.77	(0.13)
Wcapb	0.01	(0.96)
$\sigma^2$	2.86	
Log-Likelihood	-977.94	
Observations	612	

Second, tax competition has to be differentiate from yardstick competition. We argue that tax competition is more likely to occur between countries with similar investment contexts. To compete for new capitals using fiscal policy (i.e. corporate taxes and infrastructure or firm-oriented expenditures), countries have to be similar on other determinants of foreign investments. The necessary time to contract, to business, or the number of procedures to set a business relationship represent an opportunity cost which can influence the choice of country to invest. Hence, it seems that countries with same initial conditions are in a direct competition about tax levels. In this way, the more similar countries are, the stronger the interactions are expected to be.

To test this assumption, we construct four matrices measuring this proximity in terms of investment context. To begin, we consider the *kaopen* indicator from Chinn and Ito (2006) that measures the *de jure* financial openness. This index takes into account the presence of multiple exchange rate, restrictions on current and capital accounts transactions, and the requirement of the export proceeds surrender. Two countries with a close *kaopen* index should share some characteristics making them comparable for foreign investors. In this way, we construct a weighting matrix  $W_{kaopen}$  as follow:

$$w_{i,j} = \left| \frac{1}{kaopen_i - kaopen_j} \right| \quad (7)$$

Where  $kaopen_i$  is the average of the index value for country  $i$  over our analysis period.

Another way to measure the investment context is using the *Invest Profile* variable from International Country Risk Guide (Howell, 2011). This index assesses the risk to investment measuring the contract viability, profits repatriation and payments delays. A score is attributed to each of this component, and the index is the sum of these three scores, ranging from 0 (very low risk) to 12 (very high risk).

$$w_{i,j} = \left| \frac{1}{InvestProfile_i - InvestProfile_j} \right| \quad (8)$$

Where  $InvestProfile_i$  is the index value for country  $i$ , in average over our analysis period.

Then, we use the Doing Business database from the World Bank to analyze differences in terms of time to contract. Assuming that similar countries are in a direct competition about tax, we construct two matrices measuring the time difference among countries – i.e. the spread between opportunity costs.

$W_{contract}$  is constructed with regard to the spread between the time needed to enforce a contract for country pairs. Each element is computed as follow:

$$w_{i,j} = \left| \frac{1}{ContractTime_i - ContractTime_j} \right| \quad (9)$$

Where  $ContractTime_i$  is the number of days needed, in average over our analysis period, to enforce a contract in country  $i$ .

The last matrix  $W_{procedures}$  measures the similarities between countries in terms of procedural difficulties to implement a business.  $W_{procedures}$  is computed as follow:

$$w_{i,j} = \left| \frac{1}{Procedures_i - Procedures_j} \right| \quad (10)$$

With  $Procedures_i$  the number of procedures needed to legally operate a commercial or industrial firm in country  $i$ .

Results using these four matrices are presented in Table 3. They show that there is no more interactions between countries that are close in terms of investment conditions than between countries without similarities. Even if this result may be incomplete, it may reveal that tax competition is unlikely to be the best explanation for fiscal interactions in Europe.

Testing for yardstick competition is very difficult since a lot of weighting schemes could

Table 3: Resulting using investment similarities weighting schemes

Variables	Coefficients (z-prob)							
	Kaopen		Contract		Procedures		Invest Profile	
Capb_t-1	0.62	(0.00)	0.63	(0.00)	0.63	(0.00)	0.63	(0.00)
Wcapb_t-1	-0.10	(0.37)	-0.10	(0.34)	-0.09	(0.60)	-0.14	(0.21)
Young	-3.76	(0.01)	-3.59	(0.01)	-3.66	(0.01)	-3.54	(0.02)
Old	-1.13	(0.57)	-1.70	(0.38)	-1.56	(0.42)	-1.69	(0.38)
Unemployment	0.08	(0.04)	0.07	(0.06)	0.08	(0.06)	0.07	(0.08)
Gdp_per_k	-1.32	(0.33)	-1.42	(0.29)	-1.41	(0.30)	-1.46	(0.28)
Crisis	-0.17	(0.52)	-0.13	(0.62)	-0.17	(0.52)	-0.18	(0.49)
Debt	0.01	(0.01)	0.02	(0.01)	0.02	(0.01)	0.02	(0.01)
Gov Size	-0.48	(0.00)	-0.46	(0.00)	-0.47	(0.00)	-0.46	(0.00)
Election	-0.27	(0.09)	-0.29	(0.08)	-0.28	(0.08)	-0.29	(0.08)
Left	-0.10	(0.10)	-0.10	(0.09)	-0.10	(0.11)	-0.10	(0.10)
Sgp	0.75	(0.14)	0.73	(0.15)	0.69	(0.17)	0.72	(0.15)
Wcapb	0.00	(0.98)	0.00	(0.99)	-0.01	(0.93)	0.04	(0.59)
$\sigma^2$	2.86		2.86		2.86		2.86	
Log-Likelihood	-977.41		-977.53		-977.77		-977.49	
Observations	612		612		612		612	

reflect both tax competition and yardstick competition. However, this is the last theoretical rationale for fiscal interactions that is not rejected by our analysis. This is therefore likely to be the explanation for the observed *delayed mimicking* behaviors.

As explained in Revelli (2005) certain approaches could be explored to test for yardstick competition by using natural experiments. In case of yardstick competition, fiscal interactions should be stronger when governors run for re-elections or after the implementation of an assessment system that brings public information. According to Redoano (2007), interactions should be stronger during elections periods if they are due to yardstick competition. This last case can be tested using a two-regime spatial Durbin model as in Elhorst and Fréret (2009) or Cassette et al. (2013), but our analytical framework prevents us from doing that. Precisely, we have shown that it is necessary to introduce spatial dependence at a one-period time lag, which seems not fully compatible with a two-regime model. Nevertheless, this point should be further analyzed and can constitute a subject for future researches.

## 5 Concluding remarks

There is an abundant literature about fiscal interactions among local governments. While economies are increasingly interdependent, only few papers are interested in that at the international scale.

There is even less papers which investigate the interactions between fiscal stance (i.e. without separating spending and tax receipts), rather than deficit has become a strategic variable for governments.

This paper therefore analyzes fiscal stances interdependence at the international level, focusing on European countries. Using a SDPD model and weighting matrices based on geographical distance and trade intensity, positive interactions are found out. However, these interactions occur with one year delay. In fact, countries mimic their previous year neighbors' decisions leading to what we call *delayed mimicking* behaviors. It is therefore shown that introducing spatial dependence at a one-period time lag is necessary to analyze fiscal interactions.

This result is informative about the reason why fiscal stances interact. First, since interactions are positive, free-riding phenomena are excluded (Redoano, 2007). Then, the timing of interactions reasonably allows us to eliminate cooperation since cooperation would induce contemporaneous common measures. This statement is confirmed by using a weighting scheme that measures political proximity. In case of cooperation, politically close governments should experiment stronger interactions together than with others. Since no interactions are found for politically close governments, cooperation does not seem, once again, to be the *true* explanation for fiscal stance interactions. This result emphasizes the need for European agencies for fiscal cooperation.

In order to discriminate between tax competition and yardstick competition, we argue that tax competition can be depicted using specific weighting schemes. In case of tax competition, countries that have similar investment conditions should experiment direct competition between themselves. The time and difficulties to set a business can be interpreted as an opportunity cost for foreign investors. Between two countries with similar opportunity (entry) costs, tax competition is even more likely to occur. In that way, four weighting schemes that approximate these similarities are tested. Since we find no interaction between similar countries, it seems that tax competition is not the most appropriate explanation for fiscal interactions in Europe.

Since tax competition cannot be confirmed with our data, yardstick competition remains possible and seems to be the most likely assumption for fiscal interactions in Europe.

In order to be sure that interactions are due to yardstick competition, it could be necessary

to deepen analyze what is going on election periods. However, the model used here is not really suitable to do this, but we believe that it will be an interesting point for further research. Besides, some papers present a theoretical framework for interactions between leader(s) and follower(s). Our results seem consistent with this literature, but we think that this kind of model could be extended to a more general case where the leader would not only be one country, but may be the rest of the world.

# Appendix

Table 4: Marginal (average) effects at time t+1 following a transitory shock at time t

	W2	Trade < 95	Trade > 90
Young	-2.1854	-2.3113	-2.2475
Old	-0.8118	-0.3874	-0.3638
Unemployment	0.0475	0.0441	0.0447
GDP_per_k	-0.9613	-1.0901	-1.0485
Crisis	-0.0938	-0.1182	-0.1117
Debt	0.0098	0.0096	0.0093
Gov Size	-0.2956	-0.2822	-0.2845
Election	-0.1937	-0.1773	-0.177
Left	-0.0629	-0.0589	-0.0595
SGP	0.4552	0.4782	0.4655

Table 5: Data sources

Variable	Description	Unit	Source
Capb	Cyclically Adjusted Primary Balance, adjustment based on potential GDP	% of potential GDP	Ameco
Young & Old	People under 15-years and over 64-years	% of total population	World Development Indicators, World Bank
Unemployment	Unemployment rate	% of total working force	Ameco
Gdp_per_k	GDP per capita at constant price	USD base 2005	World Economic Outlook, IMF
Crisis	Variable =1 when a banking crisis occurs, 0 otherwise	Dummy	Laeven and Valencia (2012)
Debt	Public debt	% of GDP	IMF, Historical Dataset
GovSize	Compensation and Social contribution	% of GDP	World Development Indicators, World Bank
ElectionYear	Variable = 1 the year of election (presidential or parliament)	Dummy	Comparative Political Data Set, Klaus et al. (2015)
Left	From 1 (for hegemony of right-wing parties) to 5 (for hegemony of social-democratic and left parties)	1 to 5	Comparative Political Data Set, Klaus et al. (2015)
SGP	Variable = 0 if current deficit < 3%, and equal to 1/time before entrance in the EU		Own calculation using Eurostat

Table 6: Data sources for weighting matrices

Variable	Description	Unit	Source
GDP	GDP at constant price (2005 USD)	Average over 1980-1994	World Development Indicators, World Bank
Bilateral trade flows	Imports from origin to destination	USD; average	United Nations Comtrade Database
Political proximity	Government composition	From 1 to 5; average over 1995-2013	Comparative Political Data Set (Armingeon et al., 2015)
Kaopen	Index of <i>de jure</i> financial openness	Average over 1995-2013	Chinn and Ito (2006)
Time to Contract	Number of days to enforce a contract	Average over 1995-2013	Doing Business, World Bank
Procedures	Number of procedures required to start a business	Average over 1995-2013	Doing Business World Bank
Invest Profile	Index measuring the investment risk	From 0 to 12; average over 1995-2013	ICRG, Howell (2011)

## References

- Alesina, A., Cohen, G. D., and Roubini, N. (1993). Electoral business cycle in industrial democracies. *European Journal of Political Economy*, 9(1):1–23.
- Altshuler, R. and Goodspeed, T. J. (2015). Follow the leader? evidence on european and us tax competition. *Public Finance Review*, 43(4):485–504.
- Armingeon, K., Isler, C., Knopfel, L., Weisstaner, D., and Engler, S. (2015). Comparative political data set 1960-2013. *Bern: Institute of Political Science, University of Berne*.
- Beetsma, R. and Giuliodori, M. (2008). On the relationship between fiscal plans in the european union: An empirical analysis based on real-time data. *Journal of Comparative Economics*, 36(2):221–242.
- Beetsma, R. and Giuliodori, M. (2011). The effects of government purchases shocks: Review and estimates for the eu. *The Economic Journal*, 121(550):F4–F32.
- Besley, T. and Case, A. (1992). Incumbent behavior: Vote seeking, tax setting and yardstick competition. *National Bureau of Economic Research Working Paper*, 4041.
- Besley, T., Griffith, R., and Klemm, A. (2001). *In: World tax competition conference, London, 01-01-2001*.
- Blanchard, O. and Perotti, R. (2002). An empirical characterization of the dynamic effects of changes in government spending and taxes on output. *The Quarterly Journal of Economics*, 117(4):1329–1368.
- Brueckner, J. K. (2003). Strategic interaction among governments: An overview of empirical studies. *International regional science review*, 26(2):175–188.
- Cassette, A., Creel, J., Farvaque, E., and Paty, S. (2013). Governments under influence: Country interactions in discretionary fiscal policy. *Economic Modelling*, 30:79 – 89.
- Chinn, M. D. and Ito, H. (2006). What matters for financial development? capital controls, institutions, and interactions. *Journal of Development Economics*, 81(1):163–192.
- Chirinko, R. S. and Wilson, D. J. (2013). Tax competition among us states: racing to the bottom or riding on a seesaw? *Federal Bank of San Francisco, Working Paper Series*, (2008-03).

- Corsetti, G., Kuester, K., Meier, A., and Müller, G. (2011). Sovereign risk and the effects of fiscal retrenchment in deep recessions. *FRB of Philadelphia Working Paper*.
- Debarsy, N., Ertur, C., and LeSage, J. P. (2012). Interpreting dynamic space–time panel data models. *Statistical Methodology*, 9(1):158–171.
- Delgado, F. J., Lago-Peñas, S., and Mayor, M. (2015). On the determinants of local tax rates: new evidence from spain. *Contemporary Economic Policy*, 33(2):351–368.
- Elhorst, J. P. (2012). Dynamic spatial panels: models, methods, and inferences. *Journal of Geographical Systems*, 14(1):5–28.
- Elhorst, J. P. and Fréret, S. (2009). Evidence of political yardstick competition in france using a two-regime spatial durbin model with fixed effects. *Journal of Regional Science*, 49(5):931–951.
- Foucault, M., Madies, T., and Paty, S. (2008). Public spending interactions and local politics. empirical evidence from french municipalities. *Public Choice*, 137(1-2):57–80.
- Gérard, M., Jayet, H., and Paty, S. (2010). Tax interactions among belgian municipalities: do interregional differences matter? *Regional Science and Urban Economics*, 40(5):336–342.
- Giavazzi, F. and Pagano, M. (1995). Non-keynesian effects of fiscal policy changes: international evidence and the swedish experience. *National Bureau of Economic Research Working Paper*, (5332).
- Goujard, A. (2013). Cross-country spillovers from fiscal consolidations. *OECD Working Paper*.
- Hebous, S. and Zimmermann, T. (2013). Estimating the effects of coordinated fiscal actions in the euro area. *European Economic Review*, 58:110–121.
- Howell, L. (2011). International country risk guide methodology. *East Syracuse, NY: PRS Group*.
- Kammas, P. (2011). Strategic fiscal interaction among oecd countries. *Public Choice*, 147(3-4):459–480.
- Kelejian, H. H. and Prucha, I. R. (2010). Specification and estimation of spatial autoregressive models with autoregressive and heteroskedastic disturbances. *Journal of Econometrics*, 157(1):53–67.

- Kempf, H. and Rota-Graziosi, G. (2010). Endogenizing leadership in tax competition. *Journal of Public Economics*, 94(9–10):768 – 776.
- Klaus, A., Isler, C., Knöpfel, L., Weisstanner, D., and Engler, S. (2015). Comparative political data set 1960–2013. *Bern: Institute of Political Science, University of Bern*.
- Klomp, J. and De Haan, J. (2013). Do political budget cycles really exist? *Applied Economics*, 45(3):329–341.
- Laeven, L. and Valencia, F. (2012). Systemic banking crises database: An update. (12/163).
- Lee, L.-f. and Yu, J. (2010). A spatial dynamic panel data model with both time and individual fixed effects. *Econometric Theory*, 26(02):564–597.
- Linders, G.-J. M. and Slangen, A. (2015). Cultural and institutional determinants of bilateral trade flows. *Journal of Labor Economics*, 33(2):269–296.
- Redoano, M. (2003). Fiscal interactions among european countries. Technical report, University of Warwick, Department of Economics.
- Redoano, M. (2007). Fiscal interactions among european countries: does the eu matter? *CESifo Working Paper Series*.
- Revelli, F. (2005). On spatial public finance empirics. *International Tax and Public Finance*, 12(4):475–492.
- Roeger, W. (2006). The production function approach to calculating potential growth and output gaps estimates for eu member states and the us. *European Commission, Directorate-General for Economic and Financial Affairs*.
- Salmon, P. (2014). *A Handbook of Alternative Theories of Public Economics – Chapter 14. How significant is yardstick competition among governments? Three reasons to dig deeper*. Edward Elgar Publishing.
- Srivastava, R. K. and Green, R. T. (1986). Determinants of bilateral trade flows. *Journal of Business*, pages 623–640.
- Sutherland, A. (1997). Fiscal crises and aggregate demand: can high public debt reverse the effects of fiscal policy? *Journal of Public Economics*, 65(2):147–162.
- Timbeau, X. et al. (2015). A diverging europe on the edge: The independent annual growth survey 2015. Technical report, Sciences Po.

- Wilson, J. D. (1986). A theory of interregional tax competition. *Journal of urban Economics*, 19(3):296–315.
- Winner, H. (2005). Has tax competition emerged in oecd countries? evidence from panel data. *International Tax and Public Finance*, 12(5):667–687.
- Yu, J., de Jong, R., and Lee, L.-f. (2008). Quasi-maximum likelihood estimators for spatial dynamic panel data with fixed effects when both n and t are large. *Journal of Econometrics*, 146(1):118–134.
- Zodrow, G. R. and Mieszkowski, P. (1986). Pigou, tiebout, property taxation, and the underprovision of local public goods. *Journal of urban Economics*, 19(3):356–370.