Political Science and Political Economy Working Paper

Department of Government

London School of Economics

No. 6/2011

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17th May 2011

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Acknowledgements: We acknowledge comments from Tom Stanley, Ali McGuire and participants at various seminars.

Abstract

The economics literature has traditionally advocated that "governments compete", and hence one should expect non-negligible fiscal interactions between and among different levels of government. This paper uses meta-regression analysis to quantify the size of inter-jurisdictional fiscal interactions and to explain the heterogeneity in empirical estimates. Our results suggest several robust findings. First, government level matters in influencing the extent of fiscal interactions. We find a non-monotonic relationship with much stronger interactions among municipalities and nations than among states. Second, horizontal tax interactions are, in general, stronger than expenditure interactions and vertical tax interactions, though this varies from country to country. Third, both tax competition and yardstick competition are supported by the data, though the former appears to produce stronger interactions than the latter. Fourth, capital controls, voter turnout and the extent of decentralization all shape fiscal interactions. Political competition and fiscal decentralization both increase horizontal tax competition and they decrease vertical tax competition. Finally, much of the variation between estimates can be explained by econometric specification and estimation strategies.

Keywords: fiscal interdependence, meta-regression, strategic interactions, tax competition and intergovernmental competition.

JEL Codes: H5, H73, R1.

Number of words: 13,025

1. Introduction

An increasingly large proportion of the world's population is governed by federations and decentralized states.[1] One notable feature of such structures is the possibility of inter-jurisdictional rivalry and inter-jurisdictional interactions. Theoretical models have addressed three key aspects of this feature. First, one stream of the literature maintains that political and fiscal incentives can result in fiscal interdependence, with governments competing with each other in taxing their constituents and offering publicly funded programs. Second, the existence of several competing territorial governments and different government layers paves the way for inter-government (horizontal) and intra-government (vertical) fiscal and political interactions. These are driven by factor mobility and the mechanisms of the political agency that can give rise to fiscal outcomes that differ substantially from monolithic government structures. A third stream within this literature offers various explanations of the existence and magnitude of strategic and spatial interactions. Whilst these three issues are intertwined, most of the theoretical attention has focused on the *effects* of federalism on welfare and efficiency. In contrast, most of the empirical effort has centered on the *existence* and extent of strategic interactions instead. It is the empirical literature that is the focus of this paper.

The theoretical literature predicts both positive and negative effects from inter-government interactions. Positive outcomes arise when mobility enables citizens to 'vote with their feet', sorting themselves by migrating to a rival jurisdiction. This process helps to solve the preference aggregation problem when preferences are heterogeneous, insofar as it allows individuals to sort themselves into jurisdictions where the supply of public goods (and hence expenditures) matches their willingness to pay (taxation) (Tiebout, 1956). Self-sorting and the threat of self-sorting are said to discipline governments by restricting their spending and their revenue raising, taming the perennial Leviathan (Brennan and Buchanan, 1980) Both the Tiebout

[1] According to Voigt and Blume (2011), about 40% of the world's population lives within a federal state.

and the Leviathan hypotheses predict improved allocative efficiency relative to monolithic institutions[2]. One major side effect is the potential for a "race to the bottom" of the key adjustment variables,[3] most prominently tax and expenditure rates: Inter-government tax and welfare competition can erode redistribution and hamper welfare state development, especially the provision of important public goods.

The degree of inter-government interactions and the intensity of fiscal interactions and its determinants are also contentious issues in the literature. Brueckner (2003) notes that the direction of the reaction to a rival government's tax rate is theoretically ambiguous. Moreover, several authors argue that strategic interactions, especially in the form of downward tax revenue or expenditure might not necessarily occur and, if they do, they need not happen in anything like the way that simple models suggest because other intervening variables, such as the influence of the political agency (Besley, 2006) exert a taming influence (Oates, 1999; Rom, 2006; Simeon, 2006). Some governments might be reluctant to lower social services, even if doing so might enhance overall welfare because the mechanisms of the political agency might inhibit re-election. Some political systems might benefit from the high social standards demanded by median voters, especially from the higher levels of health and education, and the social cohesion that comes from higher standards of social citizenship. Similarly, higher taxes might pay off in the long run if they enable high-skill businesses, risky start-ups, and stable, well-trained, while a good health system .

The evidence on fiscal interactions becomes even more ambiguous when multi-tiered governments and 'vertical' fiscal interdependence is considered. On the revenue side, vertical tax externalities arise when both lower and higher level jurisdictions tax the same base. Keen and Kotsogiannis (2002) argue that while horizontal tax competition can lead to taxes that are too

[2] This idea was first coined almost eighty years ago by Justice Brandeis, who admonished US State governments for competing by decreasing their social expenditures and reducing taxation in order to attract private investment (Schram, 2000). A race to the bottom means a downward bias in benefits rather than necessarily a reduction in benefits to a bare minimum (Brueckner, 2000).

low, vertical tax competition can lead to taxes that are too high. However, the sign of the reaction functions is theoretically unclear, as there are several offsetting effects (Besley and Rosen, 1998; Wilson, 1999).

There is also a lack of consensus on the sources of fiscal interdependence. Fiscal interdependence is said to emerge from geographic, social and economic linkages that result in spatial and informational spillovers. For example, fiscal interactions can arise from yardstick competition, whereby citizens compare tax rates and the quantity and quality of public programs in their residing jurisdiction to other jurisdictions (Salmon, 1987; Besley and Case, 1995; Breton, 1996). The fear of electoral punishment induces incumbent governments to compete with their rivals. Strategic interaction can also occur through tax competition designed to attract/retain business investment. It can also occur as a means of avoiding welfare magnets (discouraging 'undesirable' welfare-seeking residents), or alternatively as a result of competing for desirable citizens (by offering better public goods), or because of shared ideologies and trends in government administration.[4]

Given these factors, the existence and intensity of inter-government competition, the factors that create this competition and its economic consequences are all empirical questions. Empirical studies mainly analyze the intensity and existence of fiscal interdependence in different settings and institutional arrangements. This literature has blossomed since the early studies in the 1980s. However, the existing empirical literature is heterogeneous in its findings and lacks a common interpretation of the existing evidence. Indeed, the empirical literature is now so large and diverse that it is very difficult to digest and understand its quantitative implications for both further theoretical analysis and policy.

The existing heterogeneity in the literature and limited consensus on the nature and intensity of fiscal interactions motivates our paper. We contribute to the literature by applying

[4] Institutional design and the nature of taxation are also important dimensions. Generally, taxation of mobile resources is more likely to give rise to a race to the bottom, while smaller and more homogeneous jurisdictions are likely to be more competitive.

meta-regression analysis (MRA) to the existing empirical evidence from the wealth of studies that test for the existence and degree of fiscal interdependence.[5] The MRA uses data drawn from 83 primary empirical studies that report 1,168 estimates of strategic interactions. In addition to data drawn from the studies themselves, we also consider information external to the studies, such as the degree of capital controls, voter turnout and the degree of decentralization of the countries investigated. That is, we analyze both the heterogeneity considered within the primary studies themselves (through their chosen econometric model), plus the heterogeneity in the samples used by different studies that was not modeled by the studies. By combining the results of different studies, meta-analysis enables us to explore factors that were not considered by the primary studies.

In this paper we take stock of the existing evidence and use MRA to answer a set of questions: (1) Does the existing t evidence indicate governments engage in fiscal interactions? How strong are these interactions? Do governments compete more with respect to their spending or their revenues (taxation)? (2) Is inter-government competition more likely to occur in homogenous communities (e.g. local authorities within states) than at higher levels of aggregation of the government unit (e.g. at the State or national level)? That is, do country reaction functions differ to local government ones? (3) What are the sources of tax and expenditure mimicking: Welfare magnets, tax competition, or yardstick competition? and (4) What factors explain the generally large differences in reported results between studies? Answers to these questions are all very important to understanding the behavior of important federations, such as the U.S. They are also particularly important for European countries, given the processes of fiscal and political decentralization, alongside the increased interactions among European member states due to processes of regional integration in different sectors.

[5] As already noted, the empirical literature on the consequences of such interactions is still relatively infant.

Our primary objective in this paper is the systematic review of the empirical evidence with a thorough statistical analysis of the existing estimates. While the theoretical considerations have been explored extensively elsewhere (Besley, 2006; Bruekner, 2003), a digest of the empirical literature is currently missing. The focus of the paper is purely on dissecting the empirical literature and drawing inferences from it. The paper is divided into four sections. Section 2 describes the selection of studies and data used, while section 3 outlines the meta-regression methodology. The MRA results are reported and interpreted in section 4. The paper is concluded in section 5.

2. The Meta-Data: background,, description and specification

2.1 Specification and estimation issues

Measuring and identifying strategic interactions between governments is not a simple task. The earlier empirical literature focused on welfare migration caused by competition for mobile resources. Our focus is on the subsequent, and much larger, literature that has specifically accounted for neighborhood effects between local governments by estimating reaction functions.[6] The econometric models used for estimation must account for strategic interactions between local governments (and/or between local and higher level governments). Fiscal interactions are typically modeled as reaction functions of a jurisdiction's fiscal choices (F_{it}, benefits or taxation) in year t, depending on the choices of the j neighboring jurisdiction at time t, plus other variables that also explain domestic expenditure or taxation. This can be expressed as:

$$F_{it} = \gamma_0 + \gamma_1 \sum \omega_{ij} F_{jt} + F_{vt}\gamma_2 + X_{it}\gamma_3 + \mu_{it} \qquad (1)$$

[6] Brueckner (2000:514-519) provides a survey of the empirical studies on welfare migration. This literature has produced many conflicting results. We focus on the more direct tests of the theory by analyzing whether policy makers affect their tax and welfare levels, rather than whether there is welfare migration.

where $\gamma_0, \gamma_1, \gamma_2, \gamma_3$ are parameters to be estimated, F_{jt} refers to the fiscal choices of the j neighboring jurisdiction at time t (horizontal competition) and F_{vt} refers to the fiscal choices of the *v* higher level governments at time t (vertical competition). The vector of controls X_{it} refers to the characteristics of one's jurisdiction including size, political and demographic characteristics, and the type of jurisdiction.[7] The reaction functions are specified with spatial econometric adjustments when spatial weights (ω_{itj}) are introduced to account for the existence of different neighbors ($\omega_{ijt}F_{jt}$). Controls are required for the endogeneity of neighbor's reactions, as well as different forms of unobserved heterogeneity when running empirical analysis of such phenomena.

The heterogeneity of empirical approaches arises partly from specification differences and partly from the difficulty of determining what weight to assign to neighboring jurisdictions and the relevant level of 'neighborliness'. Most specifications (Case 1993 and Case, Rosen and Hines 1999, among others) weigh geographical contiguity positively in the matrix, with studies varying on the weights that they attribute to all the geographical neighbors.[8]

A further important question involves adopting the most efficient econometric specification. The main concern with this type of specification is the simultaneity problem created by the strategic interaction of competing governments. This type of "spatial lag" (Saavedra, 2000:13) creates an omitted variable bias under OLS estimation, resulting in biased and inconsistent results (Edmark, 2007:14; and Kaleijan and Prucha [1998: 99]). The relevant literature deals with this hurdle in different ways. The first approach is to use the Maximum Likelihood estimator. This method is said to guarantee consistency and efficiency of the estimates (Saavedra, 2000:12). However, it is also a restrictive method requiring the assumption

[7] Earlier models did not include the vertical competition term, while some newer studies exclude horizontal competition. Some studies lag some of these variables to account for the delays in the ability of voters to observe some of these variables in real time. The vector *X* can include also characteristics of neighboring jurisdictions.
[8] However other approaches are also used. Most interestingly, Edmark (2007) adds measures of neighborliness based on cross state news media influences, and alternatively weighting by migration patterns. This measure is also present in Figlio, Kolpin and Reid (1999:439).

that the neighborhood matrix is small and that its estimated coefficient cannot exceed unity. These restrictive assumptions, as well as identification problems (Saavedra, 2000: 14) and the mathematical complexities associated with this method (Kaleijan and Prucha [1998:99]) explain why so many more studies prefer to avoid this method. Alternatively, many of the studies included in our dataset use IV to overcome this problem. Some of these studies elaborate on the IV approach through the insights of Kaleijan and Prucha (1998, 1999 and 2004). These authors "introduce a series-type instrumental variable (IV) estimator of the parameters of a spatial first order autoregressive model with first order autoregressive disturbances" (Kaleijan and Prucha 2004, 266). They argue and demonstrate that their method is computationally simple and capable of obtaining equally consistent and asymptotically efficient estimates. Finally, a smaller number of studies use Generalized Method of Moments.

2.2 Study selection and data construction

A comprehensive search was carried out to identify all econometric studies reporting estimates of inter-government tax and welfare competition.[9] Numerous keywords were used for the search process, as well as numerous search engines. We also checked carefully all references cited within empirical, theoretical, and review studies. Both published (books and journal papers) and unpublished studies (working papers, conference papers and dissertations) were searched. We searched for all studies published in either English or French. The search was terminated in June 2010. This search process produced the four sets of studies listed in Table 1, being horizontal tax competition, horizontal benefits competition, vertical tax competition, and vertical benefits competition, respectively.[10] Table 2 reports the country composition of the studies. The studies are listed in Appendix A.

[9] As noted earlier, our interest lies on direct estimates of the effects of inter-government competition. Hence, we exclude studies whose primary focus is welfare migration.

[10] Due to the small number of studies and estimates, we ignore vertical benefits competition in the rest of this paper.

TABLE 1 ABOUT HERE

TABLE 2 ABOUT HERE

Studies differ in the way in which the dependent and key explanatory variables are measured. For example, some studies measure tax competition using tax rates, others use the log of the tax rate, while others use the dollar amount of tax revenue raised. On top of this, there are also differences in the scale of measurement used. Hence, the regression coefficients are not directly comparable across all studies (and estimates) included in the dataset (see Becker and Wu, 2007). Instead of using regression coefficients, we converted study results into partial correlations.[11]

Partial correlations measure the correlation between tax (or benefits) between rival jurisdictions, controlling for the effects of variables that are unrelated to strategic interactions. They are a unit-less measure of the strength and direction of jurisdictional interaction. The higher the correlation, the stronger is strategic interaction. Partial correlations enable analysis of the maximum number of comparable estimates of spatial interaction (1,168 estimates in total).[12]

The partial correlations for horizontal tax competition, welfare competition and vertical tax competition are illustrated in figures 1, 2, and 3, respectively, in the form of funnel plots. Funnel plots trace the association between partial correlations and their associated precision, measured here as the inverse of the associated standard error (Stanley and Doucouliagos, 2010). Funnel plots are a useful way to illustrate the distribution of empirical results of an empirical literature.

[11] To ensure accuracy, all authors were involved with the coding and cross-checking. No research assistants were employed. See Doucouliagos (1995) and Djankov and Murrell (2002) for examples of the use of partial correlations for meta-analysis in economics.

[12] As a second measure of effect, we compiled 450 comparable estimates of spatial lags of horizontal tax rate competition and 138 spatial lags of vertical tax competition, respectively. A third measure is 184 elasticities of own benefits (taxes) with respect to neighbors'.Wherever possible, we calculated elastiticities using information provided in descriptive statistics. In some cases, the scale of the measures used was unclear even though descriptive statistics were available. Since we are interested in drawing inferences from the largest possible datasets, we focus in this paper only on the partial correlations as this gives us 1,168 estimates.

The funnel plots reveal that while the preponderance of estimates show positive strategic interactions, there is a fairly wide range of results reported in the literature. Hence, it is important to explain this wide variation (heterogeneity), and we use MRA to do this in section 4 below.

FIGURE 1 ABOUT HERE

FIGURE 2 ABOUT HERE

FIGURE 3 ABOUT HERE

3 The MRA Methodology

The aim of the MRA is to combine all comparable estimates from different studies and to draw inferences from these with respect to: (a) the existence of horizontal and vertical strategic interactions; (b) the size of the interactions; (c) the factors that explain the wide variation in reported estimates; and (d) identify the sources of tax and spending mimicking, i.e. which factor, welfare magnets, tax competition or yardstick competition receives the greatest empirical support.

The MRA model involves regressing comparable measures of an effect (in our case partial correlations) against a constant and a set of variables that can explain the heterogeneity in estimates, such as data, specification and estimation differences in research design:

$$r_{ij} = \beta_0 + \beta_k Z_{jk} + v_{ij} \qquad (j=1, 2, \ldots L) \tag{2}$$

Where r_{ij} are the partial correlations, i, from study j, such as estimates of γ_1 for horizontal competition or γ_2 for vertical competition from Eq. (1), v_j is the random error term and Z_{jk} are moderator variables used to explain the large within and between study heterogeneity routinely

found in economics research (Stanley and Jarrell, 1989). Hence, the MRA of Eq. (2) involves regressing comparable estimates of intergovernmental competition, which we have collected from the 83 studies, upon a constant, and a set of variables that describe features of the studies. Eq. (2) allows estimates to vary as a result of sampling error (the v_{ij} term) and a set of variables used to capture features of the data used and the way in which the studies were conducted. Examples of the application of MRA in economics include studies by Görg and Strobl (2001), Roberts and Stanley (2005), Mookerjee (2006) and Disdier and Head (2008).

Heterogeneity may arise from genuine empirical differences in the underlying government reaction functions, or it can arise from misspecification of the econometric model. In section 4 below we use the MRA model in Eq. (2) helps us to quantify both the effects of misspecification and genuine differences in strategic interactions.

Four econometric issues need to be addressed when estimating the MRA model, Eq. (2).

3.1. Data comparability

Our search criteria were broad: We included all estimates of tax and welfare competition in published and unpublished studies. The published studies themselves have appeared in different journals. This raises the issue of whether the studies and their estimates (our data) are comparable. We use the MRA to quantify the effects of specification, measurement and data differences between studies in section 4 below. Here, we examine whether the studies differ so fundamentally that they cannot be combined in the MRA.

Our data pass two tests of comparability. First, we explored whether study results differ according to the quality of the journal in which they were reported. To do this, we use the 2009 Social Science Citation Index Journal Impact Factors. Any study that does not appear in this index is assigned a zero, as are all unpublished studies. Regressing the partial correlation against a constant and the Journal Impact Factors gives a coefficient of 0.02, with a t-statistic of 0.76.

This indicates that partial correlations do not vary according to the journal quality. We also regressed the precision of the estimated partial correlations against the same Impact Factors. The associated coefficient is -1.91, with a t-statistic of -0.89. We find that the precision with which estimates are reported does not vary according to journal Impact Factors.[13] We also explored whether there were differences between published and unpublished studies: Differences were detected for neither the average partial correlation value nor their precision of the coefficients. Given these results, we can safely conclude that the estimates included in our dataset do not vary by publication status or by journal quality. We do show, however, in section 4 that the estimates vary as a result of measurement, data, specification, and estimator differences.

3.2 Data dependence

Many studies report more than one estimate. Indeed, studies report, on average, 14 estimates. Estimates reported within a single study might not be statistically independent of each other, violating one of the OLS assumptions. A number of proposals have been made in the literature for handling this problem, with the most common approaches being to either use Clustered Data Analysis or a linear hierarchical model (typically estimated using Restricted Maximum Likelihood, or REML). Unfortunately, there are good reasons to believe that the random effects introduced by REML may not be independent of the underlying heterogeneity in the meta-data. If this is the case, then random effects estimates will be biased (see Stanley, 2008). Accordingly, our approach here is to use Clustered Data Analysis. We use two different clusters. First, we use each of the 83 studies as a distinct cluster (estimates are assumed to be clustered within studies). Second, we use author ids to cluster studies, as some authors have reported more than one study (estimates are assumed to be clustered around authors). It turns out that there is little difference in

[13] Impact Factors can change over time. We are assuming that the 2009 impact factors are representative of the relative quality ranking of the journals over time.

the results and, hence, we have opted to report results using study ids to cluster the observations and adjust standard errors.[14]

3.3 Selection bias

There is now extensive evidence that selection is a widespread problem in empirical economics (see Roberts and Stanley, 2005 and Doucouliagos and Stanley, 2008). In many literatures, authors, reviewers and editors, appear to have a preference for statistically significant results and, in some cases, a preference for results consistent with a prevailing theory. This selection takes the form of an overrepresentation of statistically significant results and/or an underrepresentation of results that conflict with prevailing theory. The effect of this truncation in the reported results is to magnify and, hence, bias the overall evidence on a particular topic. This is highly problematic for both meta-analyses as well as conventional literature reviews, as it can severely distort statistical inference (see Roberts and Stanley 2005 for examples).

We have reasons to believe that publication selection bias might be limited in this literature. Doucouliagos and Stanley (2009) argue that where theory is contested, publication selection will be reduced. In the case of the fiscal interactions literature, theory "allows" both positive and negative effects. This is particularly so if the spending under scrutiny is something like education, where governments might compete by increasing spending to either attract students or in a response to voters demands (a race to the top) or decrease spending if the spending is viewed as redistributive (a race to the bottom). Nevertheless, given the seriousness of selection bias, it is prudent to test its existence and if necessary to correct a literature from the effects of such bias.

[14] The rank correlation between the study and author ids is 0.84, rejecting the null of independence (prob-value is 0.00).

The conventional model of publication selection in both economics and medical research is a simple MRA between a study's estimated effect and its standard error (SE_{ij}).[15] Eq. (2) can be modified to allow for this effect by estimating:

$$r_{ij} = \beta_0 + \beta_k Z_{jk} + \beta_{se} SE_{ij} + u_{ij} \quad (3)$$

Estimates should not be correlated with their standard errors. Hence, if β_{se}=0, then we conclude that a literature is free of selection effects. A finding that estimates are correlated with their standard errors ($\beta_{se} \neq 0$) is consistent with selection bias: Researchers search for estimates that are statistically significant by re-estimating models until the relationship between r and SE achieves some acceptable standard of statistical significance.[16] In equation 3, β_0 and β_k are the coefficients corrected for selection bias (see Stanley, 2008).[17]

3.4 Precision

The fourth statistical issue is that estimates of strategic interactions will have different variances (heteroschedasticity). We use weighted least squares (WLS) to correct this heteroschedasticity. The WLS version of Eq. (3) can be obtained by weighting the squared errors by the inverse of the estimates' individual variances (i.e., $1/SE^2_i$). The advantage of WLS in our context is that it assigns larger weights to those estimates that have greater precision. As can be seen from the funnel plots, some estimates are reported with greater precision than others. Hence, we do not treat all 1,168 estimates of strategic interaction equally. We do, however, explore the

[15] The basic test involves running the regression: $r_{ij} = \beta_0 + \beta_{se} SE_{ij} + \varepsilon_{ij}$. For details on this regression see Egger *et al.* (1997), Stanley (2005), and Stanley (2008). This test for selection bias indicates the presence of selection bias with respect to horizontal tax competition (coefficient is 1.32 with a t-statistic of 1.92) but not for welfare competition (coefficient of 1.21 with a t-statistic of 1.59) and not for vertical tax competition (coefficient of 1.90 with a t-statistic of 1.61). Section 4 reports multivariate versions of this test based on Eq. (3).

[16] We estimate Eq. (3) separately for horizontal tax, horizontal welfare and vertical tax competition. Most of the studies report estimates of only one of these interactions, so that there is relatively little dependence between estimates for these different types of spatial interactions.

[17] Stanley and Doucouliagos (2008) show that publication selection is analogous to sample selection biases and produces the conventional 'Heckman regression'. In essence, the MRA with selection bias adjustment model replaces the inverse Mills ratio term with $\beta_0 SE_i$, giving rise to Eq. (3).

robustness of the results by treating all estimates equally and, alternatively, by using different weights, such as journal impact factors.

3.5 Testing rival theories

An important issue in this literature is the empirical support for the alternative theories of the causes of strategic interactions. Strategic interaction might be driven by welfare competition, tax competition, or yardstick competition. Unfortunately, these tend to be observationally equivalent. Our approach to this issue is twofold.

First, we compare the partial correlations for horizontal tax and welfare competition, in order to test the relative strength of the different types of strategic interactions. Second, we construct three variables using data that are exogenous to the studies.[18] First, we construct the variable *Capital Control*. Spatial interactions that are tax driven require capital mobility. If capital is not mobile, then tax competition is less likely. Hence, we expect to find that the degree of tax competition will be influenced by the degree of capital mobility.[19] In order to test this hypothesis, we use data from the Fraser Institute on International Capital Market Controls.[20]

The second constructed variable is *VoterTurnout*. Yardstick competition theory predicts that voters make inter-jurisdictional comparisons as an attempt to overcome agency problems (Besley and Case 1995). Hence, we expect to find a positive correlation between spatial interactions and the degree of political competition. We considered the Polity series on political competition,[21] however it displayed no variation for the countries included in our dataset.

[18] The variables are exogenous in the sense that the information used to construct the variables is not derived from within the studies themselves.
[19] In one sense, the important factor is whether decision makers believe that capital is mobile. However, knowledge of capital controls affects these perceptions.
[20] This is the series 4E, International Capital Market Controls. The maximum value of the series is 10, which denotes the most liberal regime, free of international capital market controls.
[21] This is the Polcomp series.

Instead, we chose to use data on voter turnout from the International Institute for Democracy and Electoral Assistance.[22]

The third constructed variable is *Fiscal decentralization.* Spatial interactions are driven by decisions makers with autonomy over benefits and/or taxes. Hence, we expect that spatial interactions will be correlated with the degree of decentralization. There are several series that can be used. One of the most popular series is the expenditure and revenue decentralization ratio reported in the IMF's Government Finance Statistics. This series, however, suffers from several problems (see Stegarescu, 2005 and Boex and Simatupang, 2008). Consequently, we use the series on tax revenue decentralization constructed by Stegarescu (2005).[23] Table 3 reports descriptive statistics on these institutional variables for the main countries included in our dataset. Note that the voter turnout for Switzerland is the lowest among the countries listed in Table 3. This is basically because voting is frequent in Switzerland, and generally experiences of direct democracy seem to means a median voter timing of governmental action. Similarly, the nature of competition in Switzerland is generally larger because cantons tend to have highly devolved tax responsibilities.

TABLE 3 ABOUT HERE

Both tax competition and yardstick competition can co-exist. We use the MRA results to infer which effect is stronger. We do this by taking advantage of heterogeneity in the samples. Countries differ in the degree of capital controls and voter turnout. Tax competition should increase as capital controls ease, while yardstick competition should increase as voter turnout rises. If the effects of capital controls on strategic interactions are greater (lower) than the effects

[22] Voter turnout is defined as: "The total number of votes cast (valid or invalid) divided by the number of names on the voters' register, expressed as a percentage".
[23] There are other series available, for example, the Fiscal Empowerment series by Boex and Simatupang (2008). However, these tend to overstate the degree of decentralization (Stegarescu, 2005).

of voter turnout, then we can conclude that tax competition (yardstick competition) is more prominent. Hence, by comparing the coefficients on *CapitalControl* and *VoterTurnout* variables in the MRA, we can test which theory draws the most empirical support. If the coefficient on *CapitalControl* is larger (smaller) than for *VoterTurnout*, then we can conclude that tax competition (yardstick competition) is more important.

4. MRA Results

4.1 Horizontal Tax Competition

The MRA results for horizontal tax competition are presented in Table 4. Column 1 reports sample means and standard deviations of the MRA variables. Column 2 reports the baseline model of nine variables that control for data differences. Studies were largely heterogeneous with regards to the units of analysis. Indeed, we have collected studies that use data at four broad levels of government, namely municipality, county, region or state and the National level. The variables *County, State* and *Nation are* covariates that allow us to test how the level of government affects the magnitude of the tax competition effect, with municipality as the base. Arguably, the higher the level of government, the greater the number of units to be compared and, hence, units are less standardized for citizens to run comparisons. Similarly, mobility is expected to decrease with the level of government, due to institutional and social barriers. Hence, greater competition and interactions is expected among lower levels of government in line with the expectation that local governments are more homogeneous and have less capacity to override competition.

Differences in the measurement of the dependent variable are reflected in the four binary variables, *Profit tax*, *Income tax*, *Property tax* and *Sales tax*, which take the value of 1 if the measure of tax competition is based on profit, income, property, or sales, respectively. The baseline refers to total tax revenues at the municipality jurisdiction level.

We include a control for the type of empirical analysis undertaken, namely *Panel*, which is a binary variable taking the value of 1 if panel data are used, with cross-sectional data as the base. We also include *AverageYear* which is the average year of the sample used, testing whether the degree of tax competition varies over time.[24]

In column 3 we add eight variables relating to estimation differences. The literature devotes much attention to the issue of estimating models with spatially dependent observations. One reason for an empirical finding of strategic interaction is the existence of some specific spatial heterogeneity and more specifically spatial dependence in the data, which can lead to a false positive. Hence, it is important that studies correct for this effect. If there are strategic interactions, then expenditure and taxation policies are endogenous and determined jointly by competing policy makers. The variable *IV* is included in the MRA to capture any difference in estimates that address this endogeneity by instrumenting tax competition. Regarding empirical strategies, *GMM* is included for studies that use the spatial GMM estimator, while *ML* is included as a control for studies that use maximum likelihood estimation.[25] Some studies use other estimators, such as random effects Tobit, and these are grouped into the single dummy variable *OtherNonOLS*. Where panel data are used, fixed and time period effects might be incorporated. The effects of these are explored by *Fixed effects* and *Time effects*.[26] Finally, there is the issue of the weights assigned to the tax/benefit levels of rival jurisdictions. We combine the various alternative weights used in the literature into three groups. The baseline is studies that use contiguity or distance to assign weights to rival jurisdictions: The further away a region is, the less weight it is assigned. *NoWeight* represents studies that take a simple average of other

[24] *AverageYear* is normalised at the mean of the sample, 1991.
[25] The IV estimator is consistent and asymptotically normally distributed but it is less efficient than maximum likelihood estimator (Kelejian and Prucha, 1998). However, IV is computationally simpler and distribution free.
[26] There is some collinearity amongst these variables: The first order correlation between *Fixed effects* and *Time effects* is 0.52, while the correlations between *Panel* and *Fixed effects* and *Time effects* are 0.65 and 0.52, respectively.

regions. The variable *OtherWeight* represents all other weights (including income and population).

TABLE 4 ABOUT HERE

Country differences in strategic interactions can be explored by including several dummy variables to capture national differences. Column 4 includes six country dummy variables - *Canada*, *France*, *Switzerland*, *UK*, *OECD* and *AllOthers* - to capture national differences, with the USA as the base. *OECD* takes the value of 1 for studies that include data for the entire OECD rather than individual European countries. *AllOthers* includes estimates from countries that have been studied only once (Belgium, Brazil, Germany, Italy, the Netherlands, Sweden, and Norway). Column 4 also considers the three (continuous) institutional variables (capital market controls, voter turnout and degree of federalism). Since the MRA also includes these institutional variables, the country dummies are picking up any remaining unobservable differences between countries that might affect estimates of government strategic interactions.

Then, column 5 sees the addition of nine variables that capture differences in the specification of the regressions used to generate results. These variables capture the effect of including specific controls in the primary studies. *Grants*, *Income*, *Population*, *Tax Base*, *Unemployment*, *Politics*, and *Verticalcomp* are all binary variables that control whether the primary study includes grants, income, population, tax base, unemployment, the politics of the ruling party, and vertical competition, as control variables, respectively. *Neighborlag* denotes estimates that use a lagged measure of the neighbor's tax, instead of a contemporaneous value.[27] *Neighborchar* denotes estimates that control for the characteristics of neighboring jurisdictions, rather than just controlling of the characteristics of the own jurisdiction. These nine variables

[27] This is often done to get around the endogeneity between the own and neighbouring jurisdiction's tax.

capture the effect of including specific controls in the primary studies. Column 5 is the general model that includes all 36 variables, quantifying the effects of using different measures, samples and data, specifications and estimators.

Column 6 presents our final and preferred model. This is attained through a general-to-specific modeling strategy, sequentially removing any variable that was not statistically significant at least at the 10% level.[28] The MRA variables that reflect data, country and specification differences can be taken to be capturing genuine heterogeneity in strategic interactions. That is, these variables quantify the extent to which strategic interactions differ according to the level of government, between countries, over time and according to institutional differences. In contrast, the estimator and specification variables help to quantify the impact of research design as reflected by specification and estimator differences.

Consistent with the hypothesis that capital is more mobile than labor, we find that tax interactions are smaller for less mobile factors, namely personal income tax (-0.07 partial correlations smaller), though the level of statistical significance is low. Interactions are much lower when State level data is used (-0.22) as compared to the municipal level, consistent with the hypothesis that lower levels of aggregation exhibit higher standardization. However, when larger units, namely nations are examined, other dimensions might drive inter-jurisdictional competition: Tax competition appears to be larger among nations than municipalities (0.19 higher than municipalities).[29] Taken together, these coefficients on *State* and *Nation* suggest a non-monotonic association.

There appears to be no time dimension in the data. Both panel and cross-sectional data appear to generate the same degree of spatial interaction. Cross-sectional data capture long-run effects while panel data captures medium-term (transition) effects. Hence, the MRA suggests that

[28] The constant in Table 4 is the baseline and measures the degree of tax competition (as measured by partial correlations) for studies using US data on *total* tax charged at the municipality level, using cross-sectional data for 1991, estimated by OLS, without any of the controls listed in the table, using distance to weigh neighbors' tax *and* setting the three institutional data variables to zero.
[29] The first order correlation between *Profit tax* and *Nation* is 0.55.

horizontal tax competition is the same across these different time periods. Moreover, *AverageYear* is not statistically significant, indicating no time variation in the degree of horizontal tax competition.

As expected, the estimator used also matters. Controlling for region fixed effects results in smaller tax competition effects, pointing to the important role of unobserved effects which are captured when fixed effects are introduced, and the specification concentrates on the within variability. Interestingly, we find no significant difference between OLS and IV estimators, once other aspects of research design are controlled. One explanation for this result is the often questionable validity of the instruments used, and the extent to which inference with IV should be used when instruments are weak. [30] However, we find other important results: Compared to OLS, spatial GMM results in larger tax competition estimates, while maximum likelihood (ML) results in similar estimates to OLS, which calls for the influence of potential issues of endogeneity and spatial dependence which are likely to be captured in GMM unlike the ML estimator. The weighting scheme has no effect once other aspects of research design are controlled for.

While there are no time differences, the MRA indicates important country differences. The level of homogeneity of a country makes units of analysis (municipalities) more homogeneous, and accordingly competition will tend to take place mainly in terms of prices (e.g. tax rates), whilst in highly heterogeneous countries there are dimensions other than taxes that individuals take into account when choosing a jurisdiction. With this in mind holding other institutional differences constant, we find that tax competition, primarily among local

[30] The relationship between OLS and IV is complicated by the existence of spatial error correlation. Normally, endogeneity means that the OLS coefficients will be larger than the true one, so that 2SLS with a correct instrumentation strategy should result in a smaller coefficient than OLS. However, spatial error correlation provides a second source of bias in OLS coefficients. Hence, the statistical insignificance of *IV* in table 4 is consistent with: (a) the literature using correct instrumental variables (IVs) and there is no endogeneity; (b) there is endogeneity but the literature has not used correct IVs; and (c) negative spatial error correlation offsets the upward bias from OLS.

government, is larger in more homogeneous countries such as France than it is in the US, while it is smaller in Switzerland, where states have a larger capacity to differentiate among themselves.

All three institutional variables are statistically significant with a positive coefficient. As expected, spatial interactions increase as capital controls are relaxed, as voter turnout increases, and as the degree of decentralization rises. Of these, the biggest effect arises from the *CapitalControl* variable.[31] Figure 4 presents the partial regression plot of the effects of capital controls on tax competition (holding other factors constant), while figure 5 illustrates the effects of fiscal decentralization.

FIGURE 4 ABOUT HERE

FIGURE 5 ABOUT HERE

Given that tax competition is only one dimension of spatial competition, other controls of the econometric specification are likely to be also important. The MRA indicates that controlling for income and population results in larger horizontal tax competition effects, while controlling for the tax base results in smaller effects. Taken together, the MRA variables explain about 36% of the variation in partial correlations, which is a reasonably large proportion for a meta-analysis.

Finally, the statistical significance of the *Standard error* in columns 5 and 6 indicates that there is some degree of selection bias in this branch of this literature.[32] Doucouliagos and Stanley (2008) show that if the selection bias coefficient is greater than 1, then there is significant selection bias. The MRA corrects the partial correlations for any distorting effects that this

[31] Converting the MRA coefficients into elasticities, we get 4.94 for *CapitalControl*, 1.61 for *VoterTurnout* and 0.85 for *Fiscal Decentral*. That is, a 1% increase in capital control deregulation increases spatial interaction by 5%, whereas a 1% increase in fiscal decentralization increases spatial interactions by less than 1%.
[32] This is consistent with the simple selection bias tests, reported in footnote 20.

selection might create. That is, the MRA coefficients show the relationships corrected for any selection bias.[33]

The MRA provides robust evidence of a race to the bottom in taxes such that a decrease in the tax rate of one jurisdiction leads to a decrease in taxes of neighboring jurisdictions. Using the MRA coefficients, we can derive the (meta-) average strategic interaction. This varies according to the type of tax considered, the level of analysis and the country considered. For the USA using municipality data, the MRA indicates a partial correlation of +0.32, which falls to +0.10 for interactions among States.[34] The equivalent correlations for France are +0.56 and +0.35, while for Switzerland these are +0.45 and +0.23. The MRA indicates that tax competition among nations has a partial correlation of about +0.47, on average. For the purpose of distinguishing statistical from practical significance of correlations, Cohen (1988) offers the well-known and plausible guidelines: 0.2 for a small effect, medium (0.50), and anything larger than 0.8 is a large effect. By this criterion, there is a medium spatial interaction. Hence, the partial correlations indicate that there are significant spatial interactions with respect to taxes.

4.2 Horizontal Expenditure Competition

Our second set of multivariate MRA relates to welfare/expenditure competition. The results are presented in Table 5 and follow the format of Table 4. Column 2 presents the baseline model that includes ten variables relating to data differences. Differences in the measurement of the dependent variable are reflected in five binary variables, *Welfare*, *Education*, *Health, Security* and *Infrastructure*, which take the value of 1 if the measure of competition is based on spending on welfare, education, health, security or infrastructure, respectively. The base is total

[33] In separate regressions we also included in the MRA a variable for whether the study was published (*Published*), as well as the Journal Impact Factors (*ImpactFactor*). These were not statistically significant. For example, adding these variables to the MRA model reported in column 5 gives a coefficient of 0.01 (t-statistic = 1.14) for *Published* and -0.01 (t-statistic = -0.03) for *ImpactFactor*.

[34] This is calculated by using the constant in the MRA and coefficients for the three institutional variables, substituting their average values of the US.

expenditure. *County, State, Nation,* and *Panel*, are defined as above. In column 3 we add the eight estimator dummies. Country dummies and institutional variables are added in column 4,[35] econometric specification differences are added in column 5, and column 6 presents the results of the general-to-specific modeling strategy.

The positive coefficient on *Health* indicates that expenditure competition is slightly greater in terms of health expenditure, while the coefficient on *Security* indicates that it is much smaller with respect to security. As was the case with horizontal tax competition, the use of state level data results in smaller expenditure competition effects, compared to municipality data: Strategic interactions are weakest amongst rival states. *Panel* has a positive coefficient indicating that the long-run effects are smaller than the medium-term (transition) effects. *AverageYear* is not statistically significant in the specific model, indicating that welfare competition is time invariant.

The use of an IV or GMM estimator results in smaller strategic interaction compared to OLS. Controlling for time effects also results in smaller strategic interactions. In contrast, use of the maximum likelihood estimator results in larger effects, as does the inclusion of fixed region effects. Studies that do not use weights report larger effects.

Welfare interactions are much smaller in Sweden and the UK than they are in the US, due to its federal structure of devolved taxes. Generally, we find that relaxing capital controls and increasing voter turnout both increase interdependence because capital is a mobile factor and political participation activates the mechanisms of yardstick competition. In contrast, decentralization slightly reduces welfare competition.

Econometric specification also matters. Including grants, the politics of the party in office and population all result in larger interaction effects, while controlling for income,

[35] Note that the countries included in *AllOthers* differs to those included in *AllOthers* in Table 4.

unemployment and the neighbor's spending levels lagged, all result in smaller effects. Collectively, the MRA variables explain just over half of the variation in the partial correlations.

The MRA coefficients indicate that for the US, the partial correlation for strategic interactions is 0.31 if estimation is via maximum likelihood and 0.11 if estimation is via GMM.

TABLE 5 ABOUT HERE

4.3 Vertical Tax Competition

The number of studies (and estimates) of vertical tax competition is much smaller than for horizontal competition, thereby limiting the number of potential moderator variables that can be included in the MRA. Our approach was to calculate first order correlations between the partial correlations and the potential moderate variables. Variables with a first order correlation less than 0.20 were excluded from the MRA presented in Table 6.[36] Subsequent tests for omitted variable bias confirm that these variables can be excluded from the MRA. We introduce two new variables, *StateVertical* and *NationVertical*, which are binary variables taking the value of 1 if the estimate relates to vertical interactions with state governments and national governments, respectively.

The MRA results are presented in Table 6, where the base compares a municipality vertically competing with a county. The type of tax does not appear to be important: Interactions are similar whether profit, sales, income, or total tax is involved. The negative coefficient on *StateVertical* indicates slightly weaker interaction with State governments. The coefficient on *AverageYear* indicates no time variation in vertical strategic interactions. Estimator does not

[36] Some variables automatically dropped out as they were not relevant in the vertical tax competition MRA, even though they were relevant for horizontal tax competition.

appear to be important, nor does the weighing scheme.[37] However, the inclusion of fixed effects increases the size of the vertical interactions.

Interestingly, there do not appear to be any country differences in vertical interactions. However, smaller vertical interactions are established when the analysis is conducted using national OECD data. *Voter turnout* is again important. The negative coefficient indicates that political competition *reduces* vertical interactions. Interestingly, *FiscalDecentral* indicates that decentralization also reduces vertical interactions. That is, political competition and fiscal decentralization both increase horizontal tax competition and they decrease vertical tax competition. Controlling for party politics produces larger effects, while controlling for tax base produces smaller effects (as it does for horizontal tax competition, see Table 4). The MRA explains 74% of the variation in partial correlations.

TABLE 6 ABOUT HERE

Robustness

We explored the robustness of the MRA in several ways. First, the MRA models were re-estimated without adjusting standard errors for data clustering. All the variables listed in the general-to-specific models (column 6 of Tables 4, 5 and 6) remain statistically significant. The one main difference is that many more MRA variables emerge to be statistically significant once the standard errors are not adjusted. Second, the MRA models were also re-estimated without using precision to weight observations. Once again, all the MRA variables from column 6 remain statistically significant, and some others also appear as statistically significant. For horizontal tax competition, these are: *Panel* (coefficient = -0.17, t-statistic = -3.29); *County* (coefficient = -0.12,

[37] If the GMM dummy variable is added back into the specific model (column 6), it has a coefficient of -0.066 with a t-statistic of -1.25. The output for IV is a coefficient of -0.0007 and a t-statistic of -0.10. Similarly, ML has a coefficient of -0.019 and a t-statistic of -0.30.

t-statistic = -2.62); *Grants* (coefficient = -0.05, t-statistic = -1.70); *IV* (coefficient = -0.08, t-statistic = -3.55) and *ML* (coefficient = -0.13, t-statistic = -3.22). While these estimates suggest that IV and maximum likelihood estimation does matter, we prefer the results presented in Table 4 because they do assign greater weight to the more precise estimates.

5. Conclusions and Discussion

This paper applies meta-regression analysis to the evidence on the existence and intensity of fiscal inter-jurisdictional interactions in both taxes and expenditures. We have drawn upon the findings of 83 studies that collectively report 1,168 comparable estimates of strategic interaction. We can draw several conclusions from the available empirical evidence.

First, the evidence points to the existence of spatial interdependence among jurisdictions. The MRA coefficients can be used to construct estimates of average spatial interactions. These are summarized in Table 7 for several countries, as well as the average for all countries. We report three sets of estimates, depending on the estimator used, IV, GMM, or maximum likelihood. When the average of all countries is considered, all three types of spatial interactions are positive, regardless of the estimator used. The average of all countries, however, disguises significant country differences in spatial interactions. For example, for Sweden, Switzerland and the UK, expenditure competition appears to take the form of negative spatial interactions – an increase in welfare payments in one jurisdiction results in reduced welfare payments in another. One explanation for this lies in the presence of equalization mechanisms. In contrast, for the USA, Canada, France, and Germany, there are positive spatial interactions with respect to horizontal expenditure competition. Columns 4, 5, and 6 show that horizontal tax competition is positive in all the countries listed: A decrease in taxes in one jurisdiction induces a reduction in another. In the case of vertical tax competition, the MRA shows that this is limited in Canada and Germany. It is significant in Sweden and the UK where the interactions are negative: An

increase in the tax rate at a higher jurisdiction induces a reduction in tax at a lower level jurisdiction. In contrast, an increase in the tax rate in France and the US at a higher jurisdiction induces an increase in the tax rate at a lower level jurisdiction. These results are consistent with the lack of firm prediction on the direction of vertical competition (Wilson, 1999). These MRA results suggests that for France and the US, the revenue and deadweight loss effects might dominate the expenditure and tax substitutability and complementarity effects that arise from vertical interactions.[38]

With the exception of Germany, spatial interactions amongst jurisdictions at a similar level of government appear to be larger with respect to horizontal tax competition than they are with respect to welfare competition. The absolute degree of spatial interaction is larger in the UK and Sweden in terms of vertical tax interactions than horizontal tax interactions.

TABLE 7 ABOUT HERE

A second finding from the MRA is that the level of aggregation appears to be important: Interactions differ according to level of government. Compared to the municipality level, horizontal tax and welfare competition are both smaller when the jurisdiction is a State. That is, the strategic interactions are more pronounced at the municipal and county levels, and less so at the national level. However, interactions at the national level are stronger than those at the State level. Hence, the MRA suggests that inter-jurisdictional interactions appear to be non-monotonic and suggests that the level of government can influence the mechanisms in place to reduce competition, primarily the extent of jurisdictional differentiation through regulation primarily.

[38] The revenue effect occurs when increased federal taxes force lower level governments to increase their taxes in order to maintain their revenue. The expenditure effect occurs when lower level governments reduce their expenditures in response to reduced revenues. See Besley and Rosen (1998) for details on these and other effects.

Third, in contrast to the country differences, there is no evidence of time variation in any of the spatial interactions. The evidence to date suggests that spatial interactions have not been growing stronger nor becoming weaker over the time period analyzed. Fourth, the econometric strategy pursued in estimating fiscal interactions matters. More precisely, ignoring fixed effects and ignoring the endogeneity of spatial interactions biases estimates.

Fifth, the MRA indicates that variable specification matters, as it can influence the extent of unobserved heterogeneity. In particular, the inclusion of controls for income, the tax base and population all affect the size of the reported strategic interactions. Sixth, the literature appears to be relatively free of selection bias, except for the horizontal tax competition literature, which also contains the majority of the observations.

Finally, the MRA also sheds some light on the causes of spatial interactions. The institutional variables *CapitalControl* and *VoterTurnover*, enable us compare the relative strength of tax competition versus yardstick competition theories. These variables are statistically significant in determining the degree of both horizontal tax and welfare competition. However, *CapitalControl* exerts a larger effect that does *VoterTurnover*. This suggests that while the evidence supports both of these theories, there is stronger support for tax competition. In addition to factors these, the MRA indicates that the degree of decentralization of a federation shapes the intensity of inter-jurisdictional interactions: It increases horizontal tax competition, but weakens horizontal welfare competition and vertical tax competition. Altogether we can conclude that governments are clearly interdependent and that competition among government exists and takes multiple shapes.

On the basis of the evidence found here we can confirm that fiscal interactions are a significant feature of federations and decentralized systems of government and that they are shaped by institutional design and political incentives.

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Table 1: Estimates of Inter-Jurisdictional Interactions

Interaction:	Number of Studies	Number of Estimates
Horizontal Tax	48	649
Horizontal Benefits	32	349
Vertical Tax	23	150
Vertical Benefits	3	20
Total†	83	1,168

Note: † While several studies report estimates for more than one type of interaction, there are 83 independent studies.

Table 2: Country Composition of Estimates of Inter-Jurisdictional Interactions

Country	Number of Studies (Estimates)	Country	Number of Studies (Estimates)
USA	34 (354)	OECD	3 (70)
EU	3 (126)	Canada	6 (65)
UK	8 (117)	Germany	2 (46)
Sweden	7 (92)	All others#	5 (41)
Switzerland	6 (82)	France	6 (13)

These are the Netherlands, Italy, Norway, Belgium, Brazil and Spain.

Table 3: Institutional Data Used in the MRA

Country	Tax Revenue Decentralization	Capital Controls	Voter Turnout
USA	38.08	8.12	67.53
Sweden	43.77	8.07	83.98
Switzerland	55.32	9.55	45.98
UK	13.97	8.06	69.35
Germany	7.00	7.38	79.69
France	18.71	7.14	65.23

Table 4: Meta-Regression Analysis of Horizontal Tax Competition
(Dependent variable = partial correlations)

Variable	Mean (S.D.) (1)	Base model (2)	Plus estimators (3)	Plus country differences (4)	General model (5)	General to specific model (6)
Constant		**0.28** (6.12)	**0.39** (5.25)	**-0.92** (2.83)	-0.38 (1.09)	**-0.67** (3.13)
Standard error	0.05(0.03)	0.68 (0.96)	-0.54 (0.79)	-0.99 (1.29)	**-1.68** (-2.14)	**-1.87** (2.64)
			Data differences			
Profit tax	0.41(0.49)	-0.06(1.64)	-0.03 (1.03)	0.01 (0.10)	-0.05 (1.67)	-
Income tax	0.13(0.33)	0.01 (0.20)	-0.03 (0.75)	-0.01 (0.01)	-0.07 (1.43)	-0.07 (1.89)
Property tax	0.14(0.35)	-0.03(1.17)	-0.01 (0.52)	0.01 (0.12)	-0.06 (1.50)	-
Sales tax	0.17(0.37)	-0.02(0.65)	0.02 (0.59)	0.03 (1.34)	-0.02 (0.60)	-
County	0.09(0.29)	0.05 (0.91)	**0.10** (2.05)	**0.10** (2.80)	-0.03 (0.58)	-
State	0.32(0.47)	0.03 (0.57)	0.07 (1.71)	-0.01 (0.27)	**-0.15** (2.85)	**-0.22** (9.41)
Nation	0.20(0.40)	0.05 (1.15)	**0.11** (2.69)	**0.35** (5.46)	**0.14** (2.25)	**0.19** (3.31)
Panel	0.86(0.35)	**-0.20**(6.12)	**-0.23** (4.34)	-0.12 (1.83)	-0.07 (1.02)	-
AverageYear	0.71(7.16)	0.01 (0.87)	0.01 (1.10)	0.01 (1.27)	0.01 (0.49)	-
			Estimators			
Fixed effects	0.73(0.44)	-	-0.05 (1.77)	**-0.05** (2.21)	**-0.05** (2.45)	**-0.07** (3.59)
Time effects	0.60(0.49)	-	0.01 (0.02)	-0.04 (1.26)	-0.01 (1.16)	-
IV	0.57(0.50)	-	-0.02 (0.57)	-0.03 (0.67)	-0.05 (1.14)	-
GMM	0.08(0.27)	-	0.06 (1.01)	0.06 (1.25)	0.09 (1.93)	**0.16** (6.90)
ML	0.21(0.40)	-	**-0.11** (2.34)	-0.06 (1.70)	-0.06 (1.51)	-
OtherNonOLS	0.03(0.17)	-	0.01 (0.16)	**0.20** (3.22)	**0.30** (4.29)	**0.35**(10.21)
NoWeight	0.10(0.29)	-	-0.02 (0.50)	0.02 (0.76)	0.04 (1.25)	-
OtherWeight	0.04(0.21)	-	**-0.03** (2.05)	-0.01 (0.96)	-0.01 (0.72)	-
			Country and institutional differences			
Canada	0.06(0.24)	-	-	-0.11 (1.53)	-0.02 (0.28)	-
France	0.04(0.20)	-	-	**0.30** (3.80)	**0.36** (4.73)	**0.40** (7.06)
Switzerland	0.09(0.29)	-	-	**-0.23** (2.60)	**-0.31** (3.93)	**-0.36** (6.24)
UK	0.11(0.31)	-	-	**-0.17** (3.28)	**-0.10** (2.38)	**-0.11** (3.06)
OECD	0.07(0.26)	-	-	0.06 (1.72)	0.04 (1.00)	-
AllOthers	0.29(0.45)	-	-	**-0.17** (3.28)	**-0.12** (2.54)	**-0.15** (5.08)
CapitalControl	7.91(1.07)	-	-	**0.10** (4.01)	**0.07** (3.00)	**0.08** (4.25)
VoterTurnout	69.28(10.78)	-	-	**0.01** (2.85)	0.01 (0.83)	**0.01** (2.01)
FiscalDecentral	31.04(15.35)	-	-	**0.01** (3.94)	**0.01** (2.71)	**0.01** (5.29)
			Specification differences			
Grants	0.50(0.50)	-	-	-	-0.01 (0.29)	-
Income	0.75(0.43)	-	-	-	**0.11** (4.28)	**0.09** (4.08)
Neighborlag	0.20(0.40)	-	-	-	-0.03 (1.72)	-0.03 (1.83)
Neighborchar	0.10(0.30)	-	-	-	0.01 (0.16)	-
Politics	0.38(0.49)	-	-	-	-0.04 (1.27)	-
Population	0.81(0.39)	-	-	-	0.04 (1.95)	**0.05** (3.23)
Tax base	0.20(0.40)	-	-	-	**-0.16** (4.62)	**-0.18** (8.84)
Unemployment	0.45(0.50)	-	-	-	-0.03 (0.95)	-
Verticalcomp	0.18(0.38)	-	-	-	-0.01 (0.49)	-
$Wald_{-joint}$		8.21 [0.00]	39.32 [0.00]	149.09 [0.00]	260.05 [0.00]	73.93 [0.00]
Adjusted R^2		0.15	0.26	0.34	0.38	0.36

Notes: The number of observations is 649 estimates from 48 studies. Figures in bold denote statistical significance at least at the 5% level. Figures in brackets report absolute values of t-statistics derived using clustered data analysis to adjust standard errors, except in column 1 where they report standard deviations. $Wald_{-joint}$ reports the prob-value for a Wald test for the joint significance of all variables included in the meta-regression models. Figures in square brackets are prob-values. All estimates from weighted least squares using precision as weights.

Table 5: Meta-Regression Analysis of Horizontal Expenditure Competition (Dependent variable = partial correlations)

Variable	Mean (S.D.) (1)	Base model (2)	Plus estimators (3)	Plus country differences (4)	General model (5)	General to Specific Model (6)
Constant		0.14 (1.54)	0.11 (1.12)	-0.65 (1.44)	-0.51 (1.99)	**-0.68** (3.99)
Standard error	0.05 (0.03)	0.66 (0.45)	0.02 (0.02)	0.12 (0.10)	0.08 (0.08)	-
			Data differences			
Welfare	0.38 (0.49)	0.01 (0.02)	0.02 (0.81)	0.05 (1.08)	0.01 (0.04)	-
Education	0.12 (0.33)	-0.02 (0.71)	-0.05 (1.69)	0.04 (1.24)	0.01 (0.13)	-
Health	0.10(0.30)	0.01 (0.02)	0.01 (0.47)	**0.07** (2.30)	0.03 (1.32)	**0.02** (2.27)
Security	0.02 (0.16)	**-0.20** (3.70)	**-0.16** (2.69)	-0.11 (1.96)	**-0.14** (3.87)	**-0.13** (5.50)
Infrastructure	0.03 (0.17)	-0.04 (1.96)	-0.05 (1.72)	-0.01 (0.87)	0.01 (0.53)	-
County	0.16 (0.37)	0.09 (0.05)	0.05 (1.06)	0.08 (1.15)	0.03 (0.69)	-
State	0.40 (0.49)	-0.06 (1.17)	-0.08 (1.53)	-0.05 (0.86)	-0.17 (2.80)	**-0.19** (5.06)
Nation	0.09 (0.28)	-0.10 (1.34)	-0.06 (1.10)	-0.16 (0.91)	-0.05 (0.36)	-
Panel	0.78 (0.41)	-0.04 (0.60)	0.03 (0.35)	0.09 (0.98)	**0.19** (2.11)	**0.22** (3.18)
AverageYear	2.13 (6.96)	**-0.01** (2.33)	**-0.01** (3.19)	-0.01 (1.60)	-0.01 (1.26)	-
			Estimators			
Fixed effects	0.58 (0.49)	-	0.06 (2.12)	0.06 (1.17)	0.07 (1.80)	0.07 (1.87)
Time effects	0.59 (0.49)	-	**-0.06** (1.10)	-0.06 (1.06)	-0.11 (2.94)	**-0.12** (3.06)
IV	0.42 (0.49)	-	-0.05 (1.96)	**-0.06** (3.02)	**-0.06** (2.99)	**-0.04** (2.22)
GMM	0.12 (0.32)	-	-0.01 (0.10)	0.01 (0.26)	-0.04 (2.18)	**-0.06** (3.25)
ML	0.27 (0.44)	-	**0.10** (2.20)	0.11 (1.49)	**0.11** (2.11)	**0.14** (3.24)
OtherNonOLS	0.07 (0.26)	-	**-0.12** (2.29)	-0.10 (1.90)	-0.06 (1.78)	-
NoWeight	0.11 (0.32)	-	0.07 (1.66)	**0.09** (2.21)	0.07 (1.95)	**0.09** (2.32)
OtherWeight	0.34 (0.48)	-	0.02 (0.99)	0.01 (0.31)	-0.01 (0.19)	-
			Country and institutional differences			
Sweden	0.20 (0.40)	-	-	-0.03 (0.33)	**-0.39** (3.01)	**-0.49** (6.05)
Switzerland	0.06 (0.23)	-	-	-0.04 (0.23)	0.03 (0.20)	-
UK	0.08 (0.28)	-	-	0.34 (1.78)	**-0.40** (2.52)	**-0.51** (4.95)
AllOthers	0.16 (0.37)	-	-	0.32 (1.72)	**-0.37** (2.01)	**-0.47** (4.38)
CapitalControl	7.99 (1.18)	-	-	0.01 (0.55)	**0.06** (2.35)	**0.08** (7.15)
VoterTurnout	70.86(11.20)	-	-	0.01 (1.00)	**0.01** (2.92)	**0.01** (4.58)
FiscalDecentral	32.66(14.88)	-	-	0.01 (1.20)	-0.01 (1.87)	**-0.01** (3.71)
			Specification differences			
Grants	0.55 (0.50)	-	-	-	0.05 (1.11)	**0.07** (2.43)
Income	0.72 (0.45)	-	-	-	**-0.19** (3.11)	**-0.20** (4.34)
Neighborlag	0.11 (0.32)	-	-	-	**-0.07** (2.59)	**-0.08** (3.50)
Neighborchar	0.17 (0.38)	-	-	-	**-0.03** (2.23)	-
Politics	0.51 (0.50)	-	-	-	**0.13** (3.31)	**0.12** (4.43)
Population	0.78 (0.42)	-	-	-	**0.09** (2.56)	**0.09** (2.96)
Unemployment	0.51 (0.50)	-	-	-	**-0.11** (3.26)	**-0.14** (4.25)
Verticalcomp	0.06 (0.23)	-	-	-	-0.01 (0.33)	-
$Wald_{-joint}$		4.83 [0.00]	40.30 [0.00]	125.94 [0.00]	10.76 [0.00]	191.60 [0.00]
Adjusted R^2		0.22	0.35	0.35	0.51	0.51

The number of observations is 349 estimates from 32 studies. Figures in bold denote statistical significance at least at the 5% level. Figures in brackets report absolute values of t-statistics derived using clustered data analysis to adjust standard errors, except in column 1 where they report standard deviations. $Wald_{-joint}$ reports the prob-value for a Wald test for the joint significance of all variables included in the meta-regression models. Figures in square brackets are prob-values. All estimates from weighted least squares using precision as weights.

Table 6: Meta-Regression Analysis of Vertical Tax Competition
(Dependent variable = partial correlations)

Variable	Mean (S.D.) (1)	Base model (2)	Plus estimators (3)	Plus country differences (4)	General model (5)	General to specific model (6)
Constant		0.04 (0.94)	-0.01 (0.04)	**1.35** (2.90)	0.88 (1.73)	**0.84**(21.69)
Standard error	0.06(0.04)	0.18 (0.11)	0.48 (0.29)	0.20 (0.12)	0.45 (0.25)	-
			Data differences			
Profit tax	0.29 (0.45)	**-0.09** (2.41)	**-0.09** (2.17)	**-0.22** (3.35)	-0.04 (0.40)	-
Sales tax	0.21 (0.41)	**0.29** (3.64)	**0.29** (3.83)	0.09 (1.05)	0.05 (0.53)	-
StateVertical	0.42 (0.50	-0.03(1.58)	-0.03 (1.49)	**-0.05** (7.16)	**-0.05** (11.69)	**-0.05**(10.56)
NationVertical	0.42 (0.50	0.11 (1.45)	0.11 (1.71)	**0.16** (2.59)	0.08 (1.02)	-
AverageYear	1.76 (7.56)	**0.01** (3.34)	**0.01** (3.49)	0.01 (0.45)	0.01 (0.69)	-
			Estimators			
Fixed effects	0.68 (0.47)	-	**0.03** (2.66)	**0.04** (2.86)	**0.03** (3.84)	**0.03** (3.24)
Time effects	0.31 (0.47)	-	0.03 (0.59)	0.04 (0.97)	-0.01 (0.05)	-
No Weight	0.29 (0.45)	-	-0.01 (0.28)	0.07 (1.68)	0.05 (1.26)	-
			Country and institutional differences			
Canada	0.27 (0.45)	-	-	0.07 (0.59)	0.02 (0.17)	-
OECD	0.04 (0.20)	-	-	**-0.84** (3.43)	-0.37 (1.09)	**-0.19**(6.53)
CapitalControl	8.20 (1.17)	-	-	-0.05 (1.58)	-0.01 (0.24)	-
VoterTurnout	63.54(11.22)	-	-	**-0.01** (4.31)	**-0.01** (4.21)	**-0.01**(21.65)
FiscalDecentral	41.61(13.46)	-	-	**-0.01** (3.60)	-0.01 (1.31)	**-0.01**(2.33)
			Specification differences			
Politics	0.42 (0.50)	-	-	-	**0.17** (2.13)	**0.21**(12.24)
Population	0.85 (0.35)	-	-	-	0.02 (0.15)	-
Tax base	0.21 (0.41)	-	-	-	-0.04 (0.89)	**-0.07**(2.84)
$Wald_{-joint}$		3.66 [0.01]	4.50 [0.00]	213.52 [0.00]	303.68 [0.00]	310.09 [0.00]
Adjusted R^2		0.54	0.55	0.70	0.75	0.74

The number of observations is 150 estimates from 23 studies. Figures in bold denote statistical significance at least at the 5% level. Figures in brackets report absolute values of t-statistics derived using clustered data analysis to adjust standard errors, except in column 1 where they report standard deviations. $Wald_{-joint}$ reports the prob-value for a Wald test for the joint significance of all variables included in the meta-regression models. Figures in square brackets are prob-values. All estimates from weighted least squares using precision as weights.

Table 7: Summary of MRA Estimates of Spatial Interactions

	Welfare competition			Horizontal tax competition			Vertical tax competition		
	IV (1)	GMM (2)	ML (3)	IV (4)	GMM (5)	ML (6)	IV (7)	GMM (8)	ML (9)
USA	0.13	0.11	0.31	0.18	0.34	0.18	0.14	0.14	0.14
Canada	0.04	0.02	0.22	0.26	0.42	0.26	0.05	0.05	0.05
France	0.20	0.18	0.38	0.42	0.58	0.42	0.20	0.20	0.20
Germany	0.46	0.44	0.64	0.03	0.19	0.03	0.04	0.04	0.04
Sweden	-0.27	-0.29	-0.09	0.24	0.40	0.24	-0.55	-0.55	-0.55
Switzerland	-0.13	-0.15	0.05	0.30	0.46	0.30	0.38	0.38	0.38
UK	-0.18	-0.20	0	0.07	0.23	0.07	-0.38	-0.38	-0.38
Average All Countries	0.18	0.16	0.36	0.14	0.30	0.14	0.13	0.13	0.13

Notes: Calculated from regression coefficients reported in column 6 of tables 4, 5, and 6.

Figure 1: Funnel Plot for Estimates of Horizontal Tax Competition

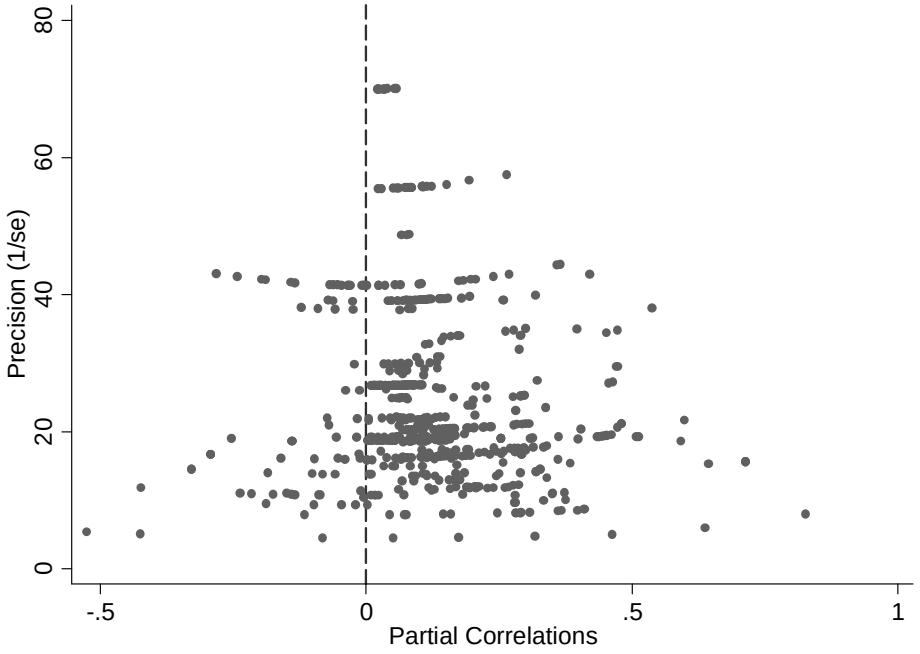

Figure 2: Funnel Plot for Estimates of Horizontal Welfare Competition

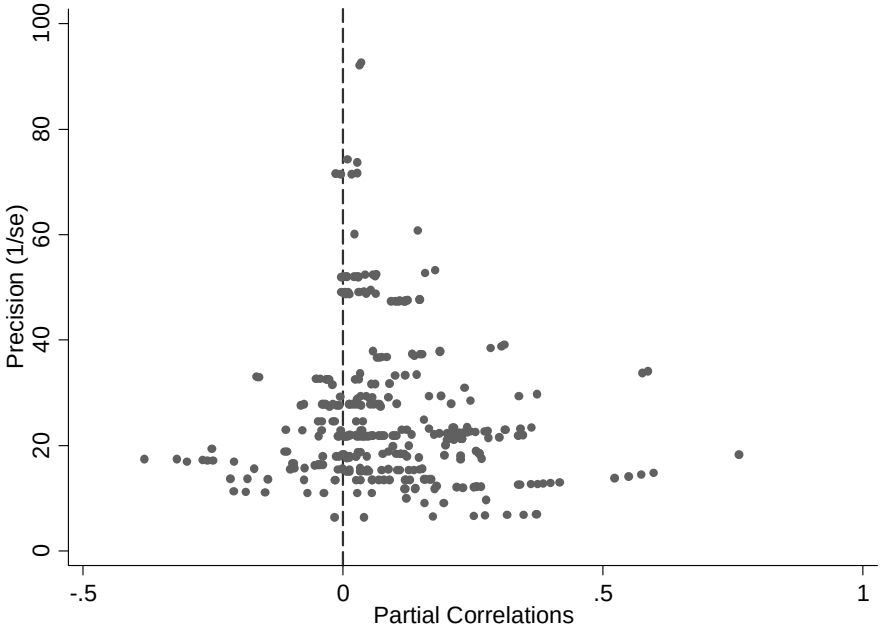

Figure 3: Funnel Plot for Estimates of Vertical Tax Competition

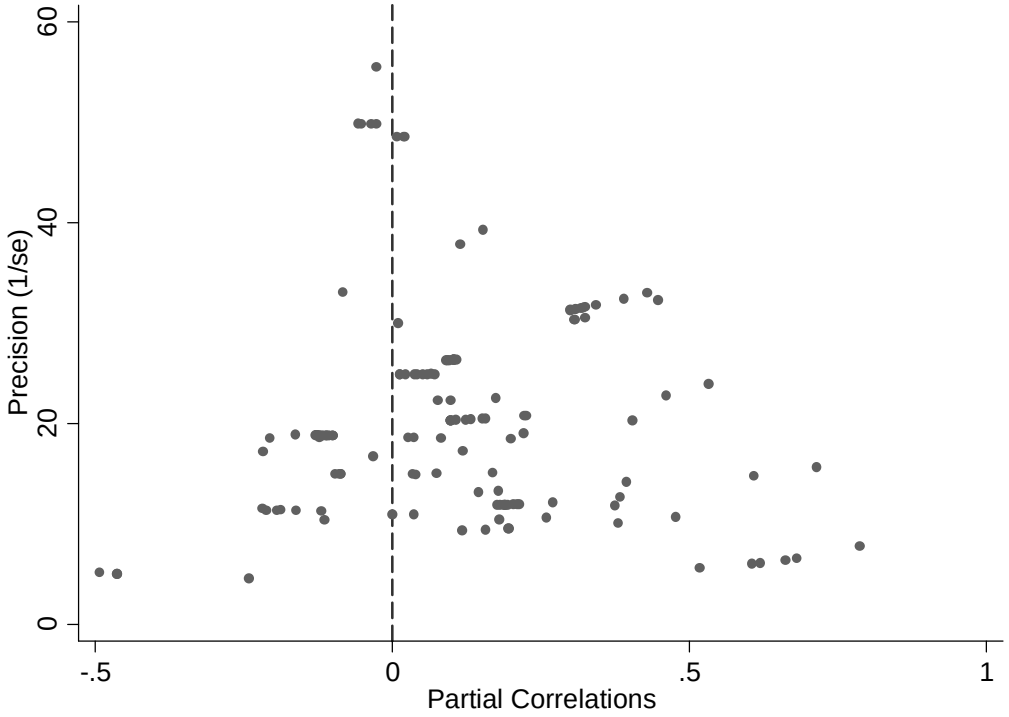

Figure 4: Partial Regression Plot
Effect of Capital Controls

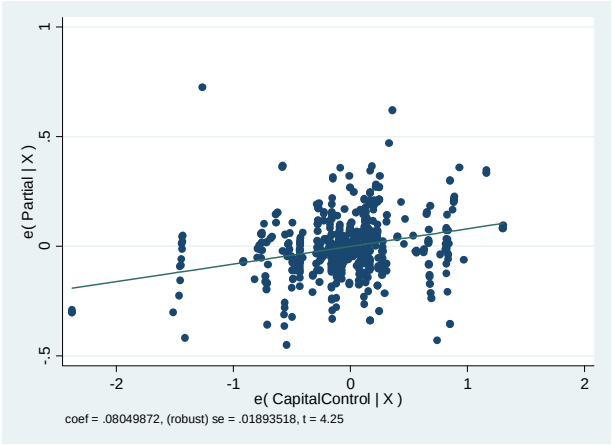

Figure 5: Partial Regression Plot,
Fiscal Decentralization