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WHAT SHAPES THE FLYPAPER EFFECT? THE ROLE OF THE POLITICAL ENVIRONMENT IN THE BUDGET PROCESS

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What shapes the flypaper effect? The role of the political environment in the budget process

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Abstract

This study investigates the spatial heterogeneity of the flypaper effect in a sample of 2,451 Spanish municipalities over the period 2003-2015 by means of Bayesian spatial panel data econometric techniques including fixed and time-period fixed effects. In particular, we analyse how differences in the degree of political competition and the local government's monitoring and enforcement effort in tax collection affect the size of the flypaper effect. Our results suggest that municipalities with higher tax-collection efficiency and more political strength exhibit a lower flypaper effect.

Keywords: Flypaper effect, Political competition, Tax collection efficiency, Spanish Municipalities, Spatial Econometrics.

JEL codes: C1, H7

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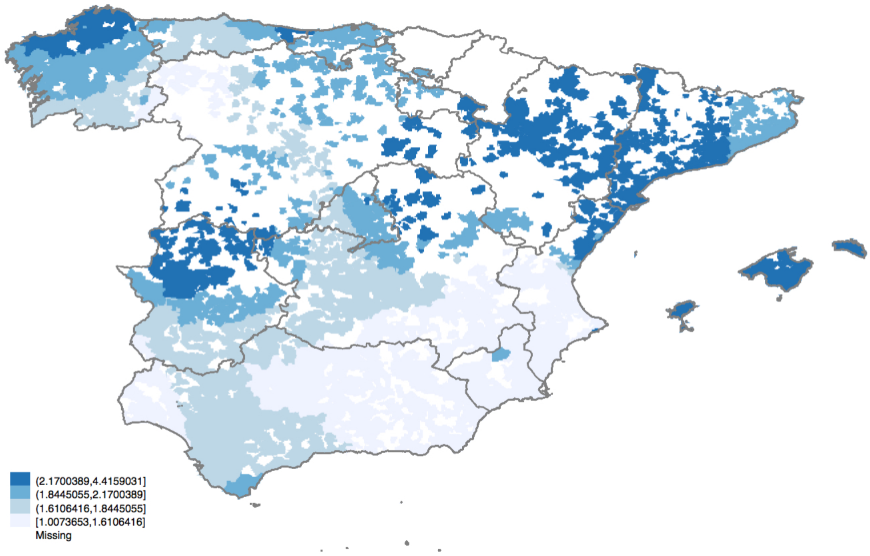
1 Introduction

One of the topics that has received a greater attention in the literature of fiscal federalism is the flypaper effect (FPE). The FPE, which was first discovered by Gramlich and Galper (1973), refers to the empirical observation of a greater stimulatory effect of unconditional grants on local public spending than do comparable increases in private income. As explained by Hines and Thaler (1995) and Oates (1999), in the traditional grants-in-aid theoretical framework, this finding is puzzling given that the standard approach based on the median voter, formalized by Bradford and Oates (1971), predicts that grants to local governments are equivalent to increments of community income and therefore, governments should display the same propensity to spend out of income or lump-sum grants.

Many attempts have been made in the literature to explain the FPE (see Hines and Thaler (1995) or Inman (2008) for an overview), but despite these endeavours, our understanding of the effect is still somewhat limited. One reason could be that many scholars do not take into account that the FPE might occur differently in different locations. As an example, Figure (1) depicts the estimated FPE in Spanish municipalities by means of Geographically Weighted Regression techniques (GWR).

Figure 1: GWR Flypaper Effects in Spanish Jurisdictions



GWR estimates of the FPE

$$\tilde{E}_i = \tilde{X}_i \beta_i + \epsilon_i \tag{1}$$

$$\beta_i = (w_{i1} \otimes I_k \dots w_{n1} \otimes I_k) \begin{pmatrix} \beta_i \\ \vdots \\ \beta_n \end{pmatrix} + u_i \quad (2)$$

where $\tilde{E}_i = W_i y$, $\tilde{X}_i = W_i X$ and β_i is a $k \times 1$ parameter vector associated with observation i. The dependent variable y is per capita current spending, and the explanatory variables X are private average income and per capita current transfers together with a constant. Here W_i is a distance-based weight vector based on a exponential decay function such that $W_i = e^{\left(\frac{-d_i}{\theta}\right)}$ where θ denotes the bandwidth. In this setting β_i is smoothed using a combination of neighbouring areas. θ based on the minimization of the score function such that $\theta = argmin \sum_{i=1}^{n} \left[E_i - \hat{E}_i\left(\theta\right)\right]^2$.

As it can be seen, there exists considerable variability in the FPE estimates across jurisdictions, suggesting a marked degree of spatial heterogeneity and hotspots in the asymmetric response of spending to changes in private income and grants.

Previous theoretical and empirical studies highlight the importance of factors such as the level of political competition (Borge *et al.*, 2008; Fiva and Natvik, 2013; Gennari and Messina, 2014; Kjaergaard, 2015), ideology (Baekgaard and Kjaergaard, 2016) and the efficiency in tax collection (Aragon, 2013; Mattos *et al.*, 2011) as plausible moderators of the size of the FPE. Nonetheless, none of these analyses consider the spatial dimension of the data. In this paper we use Spanish municipal data to empirically analyse the underlying geographical dimension of the FPE and those variables that could help explaining the spatial heterogeneity observed in Figure (1). For this reason, the specification employed here consists on a spatial model that considers cross-jurisdictional interactions in the process of government spending, allowing us to investigate the role played by spatial spillovers in the determination of the FPE.

In this regard, our paper is related to a recent stream of empirical literature, starting with Acosta (2010) and followed by Bastida *et al.* (2013), Kakamua *et al.* (2014) and Yu *et al.* (2016), that analyses the FPE accounting for the presence of spatial interdependence and strategic interactions among local government spending by means of spatial econometric modelling techniques. These studies integrate the strand of the literature analysing the FPE with that of local fiscal policy interdependence, which recognizes the fact that fiscal choices made by a local government may affect the fiscal decision of the neighbouring jurisdictions due to the existence of benefit spillovers, yardstick competition and political trends, among others (Case *et al.*, 1993; Brueckner, 2003; Santolini, 2008).

The testing ground for our analysis is at the Spanish local level. We focus on Spanish municipalities because they are highly decentralized. Indeed, according to the Local Government Index developed by the Varieties of Democracy Project, Spain is among the countries with a highest level of local authority.[1] In the same vein, the World Bank's Fiscal Decentralization Index ranks Spain among the top twenty worldwide highly decentralized countries. In Spain, as in many other countries, local governments finance their budget mostly from two sources: local revenues (65%) and grants from upper tiers of government (35%). However, the over-reliance of municipalities on grants has several perils, as this apparent softening of local governments' budget constraints could distort local policy decisions. One the one hand, it opens the room for inefficient spending, due to either fiscal illusion or rent seeking. On the other hand, grant-based financing also highlights a potential moral-hazard problem, as it encourages municipalities to spend without necessarily considering the full fiscal consequences of such policies. In addition, the current debate on the policy reform regarding the Spanish local funding system pleads for increasing local governments' autonomy and their efficiency in spending by reducing the share of grants in local budgets and increasing revenues from local taxes. Our findings will contribute to this debate.

This paper adds to the foregoing literature in three ways.

First, empirically, we explore the underlying political processes that govern the budget behaviour of local decision-makers and that could ultimately explain the spatial heterogeneity of the FPE across jurisdictions. To that aim, we use a rich local dataset to calculate the effects of (i) the strength of political leadership and (ii) tax-collection efficiency on the responsiveness of local spending to grants. These variables enter the equation as interaction terms and their effects are simulated so as to explore how differences in these variables affect the estimated size of the FPE.

Second, econometrically, we extend traditional FPE modelling approaches accounting for the possibility of spatial spillovers in a spatial panel data framework. This helps us to address the arguments and concerns rose by Hines and Thaler (1995), who point out that the failure to account for spatial interdependence may induce a specification error and biased computations of the true FPE. Unlike previous studies of Acosta (2010), Bastida *et al.* (2013), Yu *et al.* (2016) or Kakamua *et al.* (2014), which are based on spatial cross-sectional data, the present analysis is based on panel data, which allows us to control

[1] The Local Government Index covers 178 countries and measures if countries have elected local governments and to what extent they are able to operate without restrictions from unelected actors at the local level with the exception of judicial bodies. Spain is one of the 13 countries with the highest value of this index, along with Belgium and Canada, among others. For further details, visit *www.v-dem.net/en/*

for unobserved spatial and temporal heterogeneity by introducing municipal fixed effects and time-period fixed effects.

Third, our spatial panel data specification is more flexible than the specifications employed in previous studies as it includes both endogenous and exogenous spatial interactions effects. This gain in flexibility is due to the estimation of a Spatial Durbin Model (SDM) by means of the Bias Corrected Maximum Likelihood (BCML) estimator developed by Lee and Yu (2010).[2]

The paper proceeds as follows. After this introduction, Section 2 provides a review of the literature on FPE and its drivers. Section 3 discusses the econometric strategy while Section 4 presents the main empirical findings. Finally, Section 5 concludes.

2 Literature Review

2.1 The Flypaper Effect

The FPE represents a major focus of theoretical and empirical work in the fiscal federalism literature. Despite the huge amount of empirical studies on this topic[3], doubt remains about the size, and even existence, of this effect.

Many attempts have been made to explain the FPE, but no theoretical consensus has been reached so far. One the one hand, a strand of the literature considers that the anomaly of the FPE is related to the theoretical framework of the median voter and the prediction of equal reactions of spending to changes in transfers and private income. The reason is that in political and economic environments characterized by voters' irrationality (Hines and Thaler, 1995) or fiscal illusion (Oates, 1979), one should no longer expect symmetric reactions in government expenditures. From a supply side, alternative explanations suggest that the FPE may be caused by costly and/or distortionary taxation (Hamilton, 1986; Aragon, 2013; Vegh and Vuletin, 2016), as well as by inefficient political institutions (Chernick, 1979), where both self-interested budget maximizing bureaucrats (Niskanen, 1971) and self-interested politicians exact rents from the uninformed citizens they serve (McGuire, 1975; Brollo *et al.*, 2013).

[2] The estimation strategy of Acosta (2010) and Bastida *et al.* (2013) is based on the IV estimator, which in the context of spatial regressions has as a main drawback the fact the coefficient estimate of the spatial autoregressive term may fall outside its parameter space (Elhorst and Fréret, 2009).

[3] For a comprehensive survey, see Gamkhar and Shaw (2007) or Inman (2008).

On the other hand, some authors base the explanation of this paradox on the validity of the methodological strategies implemented to analyse the relationship between government spending and its determinants (Bailey and Conolley, 1998). As explained by Inman (2008) the potential methodological problems posed by the literature are diverse and refer to issues of (i) model specification, (ii) omission of relevant variables, (iii) failure to distinguish matching grants from unconditional aid, (iv) failure to consider the simultaneous determination of grants and local spending, (v) measurement errors, (vi) as well as the endogeneity bias caused by possible reverse-causality relationships. If empirical studies suffer from these problems, statistical inference derived therefrom would be invalid causing FPE estimates to be biased and miss leading.

The two main variables involved in the analysis of the FPE are grants and private income. The former only includes per capita current transfers from upper tiers of government. These kinds of transfers are totally non-earmarked and are hence unconditional. Capital grants, which are earmarked grants that mainly finance capital expenditure projects proposed by local governments, have been considered separately as a control variable. Distinguishing between these two types of transfers is important because, as noted in King (1984), conditional grants have a greater stimulatory effect on spending than a lump-sum grant of the same amount. This is because, while unconditional grants only shift forward the local government budget constraint (income effect), conditional grants are also designed to stimulate local spending in subsidized public goods by reducing their relative price (substitution effect). Then, if transfers are erroneously classified as unconditional grants, the FPE will artificially arise. With respect to the income variable we use as a proxy of the median voter's gross income the average personal income tax base stated in the database on income tax returns of the Spanish Tax Administration Office.

The basic estimating equation is:

$$E_{it} = \alpha + \delta Y_{it} + \gamma G_{it} + \epsilon_{it} \tag{3}$$

where E_{it} denotes the level of per capita current spending, excluding capital spending and financial operations, measured for every municipality $i = 1, \ldots, N$ at a particular point in time $t = 1, \ldots, T$, G_t measures per capita grants from upper tiers of government and Y_t denotes private mean income. Following Vegh and Vuletin (2015) the FPE is defined as:

$$\frac{\partial E_{it}}{\partial G_{it}} - \frac{\partial E_{it}}{\partial Y_{it}} > 0 \tag{4}$$

and therefore it can be estimated as the difference between γ and δ in Equation (3).

2.2 What explains the FPE Heterogeneity?

Economic theory provides different explanations as to the nature and significance of the FPE heterogeneity. According to previous empirical literature, the size of the FPE may depend on additional characteristics of the jurisdictions. This being the case, a model with interaction terms is then more suitable:

$$E_{it} = \alpha + \delta Y_{it} + \gamma G_{it} + \omega Z_{it} + \psi Y_{it}.Z_{it} + \zeta G_{it}.Z_{it} + \epsilon_{it} \tag{5}$$

where the Z_{it} is a moderator term with associated response parameter ω. The inclusion of interaction terms $Y_{it}.Z_{it}$ and $G_{it}.Z_{it}$ and the interaction coefficients ψ and ζ allows the researcher to capture differences in the grant or income elasticities of spending due to differences in the moderators across the sample of municipalities. In this context, the marginal impact of G_{it} and Y_{it} on E_{it} now explicitly depends on the value of Z_{it} and the estimated values of ψ and ζ are indicative of whether or not the effects of G_{it} and Y_{it} on E_{it} are systematically different over different values of Z_{it}.

We now briefly discuss the conceptual frameworks and key insights for the political variables that could explain the high cross-sectional variability observed in the GWR-based FPE estimates shown in Figure (1).

2.2.1 Political Strength

Political factors might matter explaining the FPE heterogeneity given that they shape the economic performance and the budget behaviour of municipalities (Santolini, 2008; Grassmueck and Shields, 2010). According to the weak government hypothesis (Roubini and Sachs, 1989a,b), a strong government has an advantage in keeping debt and deficits low because of its higher independence when making decisions, while a weak government would be more prone to bargaining and more reluctant to cut spending, as it would find it difficult to resist to pressures from local interest groups. Borge (2005), Borge *et al.* (2008), Tovmo and Falch (2002) and Volkerink and de Haan (2001) argue that the strength of political leadership is negatively related to the size of local budgets. In scenarios with a high fragmentation of political power, and without sustainable coalitions, the bargaining process in the legislature may be complex, and the council is likely to have a relatively low bargaining power in his interaction with interest groups. As pointed out by Tovmo and Falch (2002), in such a scenario, it will most likely be hard to reduce total spending, being the result overspending, deficits, and a high propensity to use grants to finance expenditures. This situation might be reinforced when there is fiscal illusion and the perceived costs of the production of public services are below their true cost. In this context, lobbies and interest groups may push for increased spending, which can be seen as a negative fiscal externality on taxpayers. The ability of internalizing such externalities is likely to depend on the strength of the political leadership. Thus, weak local governments may freeze their tax policy and let the variation in grants from upper tier governments drive the size of the deficit and the spending levels. These arguments suggest that the propensity to increase spending via the tax-base is lower in weak governments.

Evidence supporting this view includes Solé-Ollé (2003), who uses Spanish data to show that higher electoral margins allow local politicians to implement higher tax rates and Tovmo and Falch (2002), who using data on Norwegian local governments in the 1930s find that in weak local councils the effect of grants is larger than that of income. Taken together, these arguments suggest that an increase in the political strength is likely to reduce the FPE.

To investigate the link between political competition and the size of the FPE, we measure political strength by means of the margin of majority, defined as the vote share of the largest party in the municipality i minus the 50%. So, positive values of this variable reflect scenarios of absolute majority whereas negative values reflect a minority government.

2.2.2 Tax Collection Efficiency

Similarly, the responsiveness of local spending to grants might depend on the local government's monitoring and enforcement effort. Hamilton (1986) suggests that the FPE may be due to differences in the marginal cost of funds. In his model, local taxes are costlier than grants due to distortionary costs, which motivates governments to increase spending out of transfers rather than through their tax-base. According to Aragon (2013), this argument extends naturally to other factors increasing the relative cost of local taxes, such as tax collection costs (i.e, compliance and administrative costs). Compliance costs reflect the value of the time spent by the taxpayer filling tax returns as well as any expenditure on goods and services for the same purpose whereas administrative costs refer to the resources used by the local tax authority to operate the tax system including the cost of processing tax returns, monitoring tax evasion and the required legal proceeds. Aragon (2013) argues that these costs are not negligible and in some cases may be as important as the distortionary costs of taxation. He theoretically shows that, in scenarios of costly taxation, local governments find more beneficial to use grants from central governments as they lower the marginal cost of public spending. Using data on Peruvian municipalities, he finds that municipalities facing higher tax collection costs are more responsive to additional grants, which should increase the size of the FPE.

Costly tax collection is proxied here with an index of tax collection efficiency since an efficient tax administration reduces tax collection costs which, in turn, reduces the relative costs of local taxes and need of local governments to rely on grant money to finance their expenditures (Aragon, 2013). We follow Mattos *et al.* (2011), who suggests ranking tax-collection efficiency by comparing the fiscal performance of each municipality with a tax frontier (fiscal potential). To that end, Data Envelopment Analysis (DEA) methodology developed by Charnes *et al.* (1978), which generalizes Farrell's definition for multi-output contexts to calculate efficiency scores, is employed. Formally, efficiency can be calculated as the solution to the following maximization problem:

$$\begin{aligned} Max \oslash_0 \\ st: \\ x_{ji0} - \sum_{i=1}^{n} x_{ji}\lambda_i \geq 0, j = 1, \ldots, m \\ -\oslash_0 y_{ri0} + \sum_{i=1}^{n} y_{ri}\lambda_i \geq 0, r = 1, \ldots, k \\ \sum_{i=1}^{n} \lambda_i = 1, i = 1, \ldots, n \\ \lambda_i \geq 0, \forall i \end{aligned} \tag{6}$$

where y denote the outputs, x the inputs and λ_i are the weights on the n municipalities, which allow the construction of the composite efficiency index $1/\oslash_0$ where $\oslash_0 = y\lambda$.

The performance of each municipality is measured relative to an envelopment surface composed of other municipalities from the sample representing current technology. Those that are enveloped by the surface are classed as efficient; while those outside it are classed as inefficient. The closer the municipality is to the border or frontier, the greater its efficiency. We use the per capita total amount of local revenues from local taxes as our output variable. As inputs, we first consider whether the local council has an updated cadaster. In particular, we compute (i) the number of years since the cadaster (Property Assessment Office) was last updated. As noted in Aragon (2013), the rationale for using this proxy is that the cadaster is recognized as an effective tool in implementing and operating property tax systems. In addition, we take into account that the municipalities' responsibility for tax collection varies depending on their population. We use (ii) a dummy to capture the fact that a number of small municipalities are not responsible for collecting local revenues and rather delegate this responsibility to the provincial government. Finally, we also use (iii) the elevation range and (iv) the distance in kilometers of each municipality to the closest tax management office. Tax collection is expected to be more costly and less efficient in high elevation and remote locations, especially when taxpayers need to commute to the Provincial Council to comply with their local taxation obligations. We normalize each of these three measures for each municipality and each period by means of the negative max-min formula so that they become positive inputs in the DEA analysis.

3 Econometric Strategy

3.1 Data

Our sample consists of 2,451 Spanish municipalities over the period 2003-2015. [4] The data sample is restricted to almost all municipalities above 1,000 inhabitants due to the lack of complete time-series data for those localities below this threshold. The Spanish municipal sector is characterized by a high degree of fragmentation, with an extremely large number of municipalities with very small populations. In particular, 60% of the approximately 8,100 existing municipalities have fewer than 1,000 inhabitants and represent just 3.6% of the total population. Thus, we believe the final sample to be reasonably representative of the whole population, at least for the municipalities with more than 1,000 residents.

In the Spanish institutional framework, the subnational sector comprises two levels of government: regions (so-called Autonomous Communities) and municipalities. According to the Spanish Constitution, the former are mainly responsible for the provision of edu-

[4] The use of political variables has forced us to restrict the panel data to the electoral years (i.e. 2003, 2007, 2011 and 2015). Therefore, our $T = 4$.

cation and heath services, whereas the later are mainly involved in the provision of refuse collection, water supply, sewer system and street lighting, among others.

In addition to their own sources of taxation, notably the property tax, municipalities rely heavily on unconditional transfers from the central government to meet their residents' demand for public goods and services. Contrary to conditional grants, which are determined on a project-by-project basis, unconditional grants are allocated according to population-based formulas that leave little room for electoral politics. In the case of Spain, intergovernmental grants are mainly unconditional and account for more than a third of municipal revenues on average.

3.2 The Model

As mentioned in the introduction, earlier studies on the FPE use a spatial cross-sectional approach (Acosta, 2010; Bastida *et al.*, 2013; Kakamua *et al.*, 2014; Yu *et al.*, 2016). The reason to adopt a spatial approach is that if local governments interact with each other, a change in the income of a particular municipality i may stimulate not only its own level of spending but also the spending level in neighbouring municipalities $j \neq i$ which, in turn, may generate additional effects going back to the municipality of origin i. Whether or not these cross-jurisdictional government interactions amplify or decrease the size of non-spatial FPE estimates is an empirical question and depends on the complementarity or substitutive relationships in the provision of public goods.

INSERT FIGURE (2) ABOUT HERE

Nevertheless, the nature of the dataset allows us to employ panel data techniques in this context, thus extending modelling possibilities as compared to the single equation cross-sectional setting employed so far. The empirical analysis begins with the following Spatial Durbin Model (SDM) including municipal fixed and time-period effects. The model is written in vector form for a cross-section of observations at time t:

$$E_t = \mu + \iota_N \alpha_t + \rho W E_t + X_t \beta + W X_t \theta + \epsilon_t \tag{7}$$

where E_t is a $N \times 1$ vector consisting of observations for the government municipal spending measured for every municipality $i = 1, \ldots, N$ at a particular point in time $t = 1, \ldots, T$,

$\mathbf{X}_t$, is an $N \times K$ matrix of exogenous aggregate socioeconomic and economic covariates with associated response parameters β contained in a $K \times 1$ vector that are assumed to influence local government spending. $\epsilon_t = (\epsilon_{1t}, \ldots, \epsilon_{Nt})^{'}$ is a $N \times 1$ vector that represents the corresponding disturbance term which is assumed to be i.i.d with zero mean and finite variance σ^2. W is a $N \times N$ matrix of known constants describing the spatial arrangement of the municipalities in the sample. The variable WE_t denotes contemporaneous endogenous interaction effects among the dependent variable, with ρ being the spatial auto-regressive coefficient. WX_t is the matrix of exogenous regressors of neighbouring municipalities with its corresponding $K \times 1$ vector of parameters θ. $\mu = (\mu_1, \ldots, \mu_N)^{'}$ is a vector of region fixed effects, $\alpha_t = (\alpha_1, ..., \alpha_T)^{'}$ denote time specific effects and ι_N is a $N \times 1$ vector of ones. Municipal fixed effects control for all municipal-specific time invariant variables whose omission could bias the estimates, while time-period fixed effects control for all time-specific, space invariant variables whose omission could bias the estimates in a typical time series (Elhorst, 2014).

Following the literature, we also add a set of conventional controls. These controls include several demographic and socio-economic variables (population, dependency rate -old and young population-, migrants, education, unemployment rate, capital transfers, asymmetry) and three political factors (ideology, regional and national alignment). A recent strand of the literature also investigates whether the response to changes in intergovernmental grants differs depending on whether grants are decreased or increased (Gamkhar and Oates 1996; Heyndels 2001; Stine 1994; Volden 2007; Kjaergaard, 2015). According to this asymmetrical response hypothesis, increases in public spending when grants are increased are expected to be larger than cuts in spending when grants are reduced with a similar amount (Gamkhar and Oates 1996). To investigate whether asymmetries are present in the case of changes in unconditional grants, we introduce a variable that captures whether a municipality experienced cutbacks or increases in grants, defined as $(G_{i,t} - G_{i,t-1})$. So, a significant value of its estimated parameter suggests asymmetrical reactions to changes in grants. Variables' labels, data sources, definitions and summary statistics are reported in Table A1 in the Appendix.

3.3 Inference, Interpretation and Bayesian Spatial Model Selection

Notice that the presence of spatial lags of the dependent and explanatory variables complicates the interpretation of the parameters in Equation (7). Therefore, some caution is required when interpreting the estimated coefficients in the SDM. As it is common in modern spatial econometrics analysis, inference is based on a partial derivative interpretation and the computation of *direct*, *indirect* and *total effects* (LeSage and Pace, 2009; LeSage, 2014). The matrix of partial derivatives with respect to a change in a regressor X_k is given by:

$$\frac{\partial E_t}{\partial X_t^k} = \left[(I - \rho W)^{-1}\right]\left[\beta^{(k)} + \theta^{(k)} W\right] \tag{8}$$

In this type of spatial models a change in a particular explanatory variable in municipality i has a *direct effect* on the dependent variable in that municipality, but also an *indirect effect* on the remaining municipalities. Thus, *direct effects* (diagonal terms in Equation (8)) capture the effect on local government spending in i caused by a unit change in an exogenous variable X_k in i. *Indirect effects* (off-diagonal terms) can be interpreted as the effect of a change in X_k in all other municipalities $j \neq i$ on the spending in i or, alternatively, as the impact of changing an explanatory variable in a particular municipality on spending in the remaining municipalities. Finally, the *total effect* is the sum of the direct and indirect effects.

The specification in Equation (7) is particularly useful in this context, because the SDM can be contrasted against alternative spatial panel data model specifications widely employed in the spatial econometrics literature such as the *Spatial Lag Model* (SLM), the *Spatial Error Model* (DSEM) and the *Spatial Durbin Error Model* (SDEM) in Equations (9), (10) and (11) respectively.

$$E_t = \mu + \iota_N \alpha_t + \rho W Y_t + X_t \beta + \epsilon_t \tag{9}$$

$$\begin{aligned} E_t &= \mu + \iota_N \alpha_t + X_t \beta + \upsilon_t \\ \upsilon_t &= \lambda W \upsilon_t + \epsilon_t \end{aligned} \tag{10}$$

$$\begin{aligned} E_t &= \mu + \iota_N \alpha_t + X_t \beta + W X_t \theta + \upsilon_t \\ \upsilon_t &= \lambda W \upsilon_t + \epsilon_t \end{aligned} \tag{11}$$

Another relevant source of model uncertainty in spatial econometrics is the spatial weights matrix. Given that this is a relevant issue in spatial econometric modelling, a broad range of alternative specifications of W are considered. The first spatial weights matrix is based on the concept of first order contiguity, according to which $w_{ij} = 1$ if jurisdictions i and j are physically adjacent and 0 otherwise. Secondly, several matrices based on inverse distance with cut-offs at different thresholds of distance in kilometers are introduced. In addition, power distance and exponential decay matrices with cut-offs at the first and second quartile are employed. Finally, k-nearest neighbours computed from the great circle distance between the centroids of the various jurisdictions are also considered. Furthermore, as is common practice in applied research, all the matrices are row-standardized, so that it is relative, and not absolute, distance that matters.

In order to choose between different potential specifications of the spatial weight matrix W, as well as to choose between SDM, SLM, SDEM and SEM specifications a Bayesian model comparison approach is applied following Rios *et al.* (2017). This approach determines the posterior model probabilities (PMP) of the alternative specifications given a particular W, as well as the PMP of different spatial weight matrices given a particular model specification. Proceeding in this way, we find the SDM appears to be the preferred spatial model specification, as its average probability over all W is 62.9% whereas the SDEM has a 37.1% and the SLM/SEM displays a 0% probability.[5] Conditional to the SDM specification, the spatial weight matrix displaying the highest probability is the exponential decay of the 5% with cut-off at the second quartile of distances. Thus, the investigation of the FPE presented in the next section relies on the SDM specification with an exponential decay matrix. The result of the functional form suggests that local government interactions are driven by global spillovers which is in line with previous theoretical and empirical contributions of Solé-Ollé (2006) or Rios *et al.* (2017) on local public finances in Spain.

4 Results

4.1 Baseline results

The first column of Table (1) presents the results obtained when a two-way fixed-effects model is estimated by OLS whereas Column (2) reports the own-municipality coefficient estimates and those of the neighbours of the SDM specification. As can be observed in Column (1), the coefficient of income per capita and the level of transfers per capita are

[5] The results are shown in the Table A2 in the Appendix.

positive and statistically significant at the 1% level. This seems to indicate the existence of a positive relationship between these variables and government spending in Spanish municipalities. Furthermore, the results show that the difference between these two coefficient estimates is 1.21 indicating the existence of a positive FPE in the sample municipalities. Likewise, for the remaining control variables included in matrix X, we find they are in general statistically significant and have the expected signs.

Nevertheless, the results of the non-spatial regression should be treated with caution. In particular it is important to recall that spatial effects play an important role in explaining government spending patterns in the Spanish setting, which may cause estimates in Column (1) to become biased, inconsistent and/or inefficient. Indeed, the positive and significant estimated spatial autorregresive parameter of government spending per capita in Column (2) indicates the existence of strong spatial dependence in municipal spending. In other words, expenditure in a given municipality is positively affected by spending in neighbouring municipalities. This result is in line with the information provided by Figure (2), and highlights the need to take into account spatial effects when modelling local spending patterns in Spain. The positive effect obtained here confirms previous findings of positive benefit spillovers and complementarity in local public goods provision in Spain (e.g. Bastida *et al.*, 2013; Rios *et al.*, 2017).

As regards the estimated coefficients of the SDM, both the per capita income and grants, are positive and statistically significant at the 5% level. Furthermore, the coefficient for grants is significantly larger than the coefficient of income. In particular, the results show that the difference between these two coefficient estimates is 1.16, indicating the existence of a positive FPE and, therefore, that the source of the municipal revenues matters. This finding confirms the results obtained in earlier empirical work on Spanish municipalities (Lago-Peñas, 2008; Bastida *et al.*, 2013), reflecting a large stickiness of grant revenues in the public budget.

However, as explained in Section (3.3), inference in spatial econometric models containing endogenous interactions should not be based on reduced form coefficients (LeSage and Pace, 2009). Thus, Columns (3) to (6) report the *direct*, *feedback*, *indirect* and *total effects*, respectively, calculated from the SDM with the full set of controls. Differences between *direct effects* and the SDM model own coefficient estimates reported in Column (2) are *feedback effects* passing through the entire system and ultimately reaching the municipality of origin. We find that the *direct effects* are significant for both private income and grants whereas *indirect effects* are only significant for income. Focusing on the main aim of the paper, the *total effects* reveal that the response of local governments to changes in private income is lower than to changes in grants, providing compelling evidence in favour of the FPE. The difference between the *total effects* is 1.37 (euros). The *direct effects* indicate that the 1 euro increase in private income and grants registered by a specific municipality leads to a FPE of 1.17 euros. In turn, the *indirect effect* shows that changes in private income and grants in the neighbouring municipalities contribute to amplify the FPE by an additional amount of 0.2 euros. Therefore, *indirect effects* account for approximately the 14.5% of the overall FPE, thus corroborating the empirical relevance of spatial spillovers in this context. In addition, it seems clear that the employment of a non-spatial spatial econometric approach would under-estimate the size of the flypaper by 13.2%.

INSERT TABLE 1 ABOUT HERE

With respect to the various control variables included in our baseline model, Table (1) shows that capital transfers are positively associated with local spending. This finding can be explained by the fact that capital grants are usually conditional transfers related to the provision of specific public goods and services. Both the share of dependent population and population size exert a negative effect on local spending. This seems to indicate that municipalities with a relatively important presence of young and old population spend less, which may be related to the lower revenues implied by a population with less active members. On the other hand, the negative effect of population size is consistent with the presence of scale economies in the provision of public goods as observed in Solé-Ollé (2006) and Rios *et al.* (2017). The effect of the share of migrants on spending is positive but weakly significant, and it is driven by positive spillover effects that reverse the sign of the direct impact. Turning to the asymmetry issue, clear evidence is found of asymmetrical reactions of spending depending on the direction of the change experienced in grants. This result is in line with previous empirical work (e.g., Gennari and Messina, 2014 or Heyndels, 2001). Our estimates reveal a clear fiscal replacement form of asymmetry: when grants grow, spending is stimulated strongly than when grants fall. Finally, the impact of unemployment, education, ideology and regional and national alignment is not statistically significant.

We perform a number of robustness checks to verify the quality of our estimates. First, we investigate if our results hold when employing an alternative measure of private income and per capita spending. Second, we perform an additional estimation using an alternative functional form based on logarithms in the dependent variable and the key independent variables. The results obtained in these checks are reported in Tables A3, A4 and A5 in the Appendix. As observed, these estimates are quite similar to those reported in Table (1), giving us confidence on the robustness of our main findings.

4.2 The role of moderators shaping the FPE

We now investigate how the political and institutional characteristics of the jurisdictions - proxied by the set of moderators described in Section (2.2) - affect the size of the FPE.

Let $\tilde{\delta}$, $\tilde{\gamma}$, $\tilde{\omega}$, $\tilde{\psi}$ and $\tilde{\zeta}$ denote the corresponding average total effects on government spending caused by an increase in Y_t, G_t, Z_t, $Y_t.Z_t$ and $G_t.Z_t$ using Equation (8). Then, the expected FPE conditional on Z_t can be obtained as: [6]

$$\frac{\partial E_t}{\partial G_t} - \frac{\partial E_t}{\partial Y_t} = \left(\tilde{\gamma} - \tilde{\delta}\right) + \left(\tilde{\zeta} - \tilde{\psi}\right) Z_t \tag{12}$$

In order to conduct inference on the FPE conditional to Z_t, we need to know if the estimated response given by Equation (12) is statistically distinguishable from zero. For that, we also need an estimate of the variance and the covariance of the total effects of the relevant terms implied in the calculation of the FPE. Thus, to simulate the distribution of the FPE conditional on Z_t we perform a Monte Carlo analysis of the distribution of the total effects by computing their covariances. Using the laws of the variance, the variance of the FPE conditional to Z_t is given by:

$$\begin{aligned} &Var\left[\frac{\partial E_t}{\partial G_t} - \frac{\partial E_t}{\partial Y_t}\right] = Var\left(\tilde{\gamma}\right) + Var\left(\tilde{\delta}\right) - 2Cov\left(\tilde{\delta}, \tilde{\gamma}\right) \\ &+ Z_t^2\left(Var\left(\tilde{\zeta}\right) + Var\left(\tilde{\psi}\right) - 2Cov\left(\tilde{\zeta}, \tilde{\psi}\right)\right) \\ &+ 2Z_t\left(Cov\left(\tilde{\gamma}, \tilde{\zeta}\right) + Cov\left(\tilde{\delta}, \tilde{\psi}\right) - Cov\left(\tilde{\gamma}, \tilde{\psi}\right) - Cov\left(\tilde{\delta}, \tilde{\zeta}\right)\right) \end{aligned} \tag{13}$$

In Figure (3) we report the estimated FPE conditional to each of the moderators discussed in Section (2.2) when they are introduced at a time in Z_t. Panels on the left display the mean effects and the 95% confidence intervals, while panels on the right present the t-statistic of the estimated impacts for the intervals in which the moderators Z_t are defined, information needed to make inference on the significance of the FPE.

[6] We use the tilde notation to make clear the distinction with respect the estimates of the parameters in Equations (5) and (7), given that to simulate the FPE conditional on Z_t we use the total effects implied by the Monte Carlo simulation of the partial derivative of the reduced form of the SDM in Equation (8).

Figure 3(a) depicts the evolution of the FPE as the index of tax-collection efficiency increases. As observed, municipalities where tax-collection is inefficient and incur in relatively higher costs to obtain a given level of revenue display higher values of the FPE. The negative slope of the mean effect of tax-collection efficiency supports previous results of Aragon (2013). Therefore, we confirm our expectation that central government's grants would have a smaller stimulatory effect in municipalities facing higher local tax-collection efficiency. It is important to note that the negative link between tax-collection efficiency and the FPE is significant at the 5% level up to a threshold of our composite index of 0.425, which covers approximately the 98% of our sample of municipalities.

Figure 3(b) shows the response of the FPE to changes in the margin of majority, which is the variable that captures political strength increases. As expected, there is a negative link between political strength and the size of the FPE. The effect is statistically significant at the 5% level for the range [-0.3, 0.25], thus covering the 97.5% of the municipalities. In our sample of study, the local council was a minority government in 55.1% of the cases, which always corresponds to a size of the FPE above 1. The finding of a negative link also supports previous analysis of Tovmo and Falch (2002) and Borge *et al.* (2008) who find that in weak governments the FPE is higher because of the lower bargaining power in the interaction with interest groups and the lower support that local politicians enjoy to implement higher taxes in such circumstances.

INSERT FIGURE 3 ABOUT HERE

5 Conclusions

This paper seeks to complement previous empirical findings on the FPE and contributes to our understanding of the factors that shape the asymmetric reaction of local public spending to private income and grants over space. To that aim, we employ spatial panel data econometric modelling tools to model the evolution of government spending in a sample of 2,541 Spanish municipalities for the period 2003-15. In particular, we estimate a SDM model by means of the BCML estimator and simulate the effects of per capita transfers and private mean income on per capita local public spending. Our estimates suggest that the size of the FPE is of 1.37 euros, which implies that an equivalent 1 euro increase in transfers and income generates a considerably asymmetrical response of local spending. We find that the omission of the spatial effects would under-estimate the FPE by 13.2%.

In a second step, we analyze how differences in political characteristics of the municipalities may affect the size of the FPE. We find that municipalities where political strength and tax-collection efficiency is high, the FPE is lower. In other words, municipalities where local incumbents either enjoy a greater margin of manouvre for budget decision-making or make a stronger monitoring and enforcement effort in tax collection are less responsive to additional grants, which in turn decreases the size of the FPE.

The findings of this paper pose some policy implications. The fact that government spending reacts more strongly to upper-tier levels of governments' transfers than to equivalent private income increases suggests that some degree of fiscal illusion exists in Spanish municipalities. If revenue sources are not completely transparent and are not fully perceived by taxpayers, then, the cost of local government spending is seen to be less expensive than it actually is, providing incentives to overspending. Although the share of local expenditure accounts for a small fraction in the overall national budget, this issue should not be overlooked. Thus, additional efforts on increasing transparency and accountability are needed to improve the functioning of local budgeting.

The estimated positive spatial spending spillover suggests that local governments tend to increase by 0.335 euros their spending per capita in response to a rise of 1 euro in spending in neighbouring municipalities. This result implies that local governments in Spain could rapidly engage in races to the top or bottom, increasing fiscal policy instability. Furthermore, the existence of positive spatial spillovers suggests that some form of fiscal policy coordination should be placed in order to internalize decentralized actions and minimize inefficiencies.

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7 Figures and Tables

Figure 2: Local Spending in Spain (2003-2015): Do neighbouring jurisdictions matter?

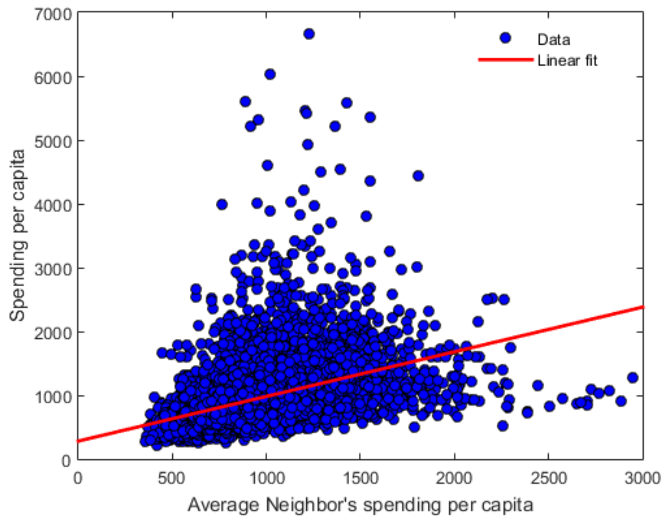
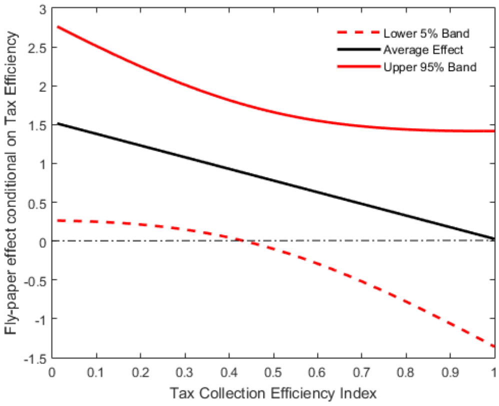
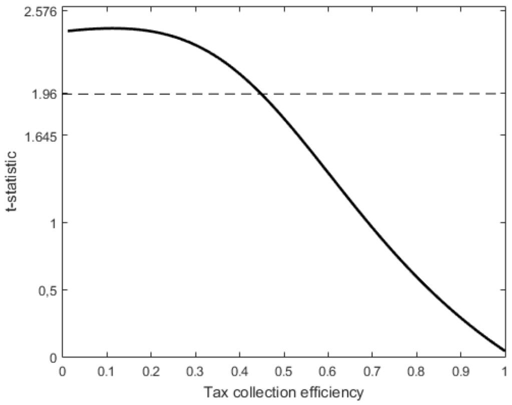


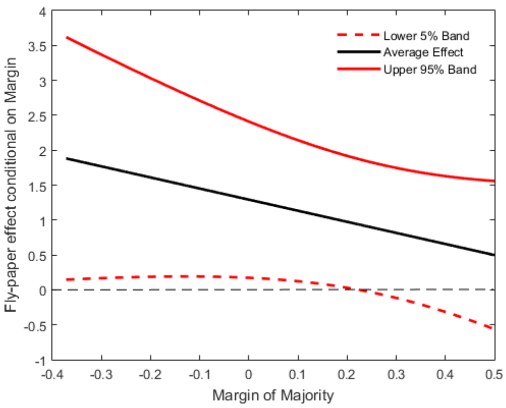
Figure 3: Heterogeneous Flypaper Effect Estimates



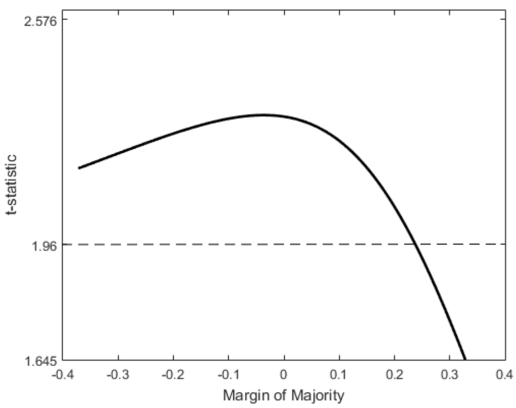
(a) Tax Collection Efficiency



(b) t-statistic Tax collection



(c) Margin of majority



(d) t-statistic Margin of majority

Table 1: Results and Effect Decomposition.

	Non Spatial Model	Spatial Durbin Model				
Variable	Coefficient (1)	Coefficient (2)	Direct Effects (3)	Feedback Effects (4)	Indirect Effects (5)	Total Effects (6)
Income	0.010***	0.004**	0.004***	0.095	0.059***	0.064***
Transfers	1.221***	1.165***	1.168***	0.003	0.269	1.436***
Implied FPE	1.21	1.16	1.16		0.21	1.37
Unemployment	-2.393**	1.320	1.246	ns	-0.762	0.484
Capital transfers	0.931***	0.923***	0.924***	0.000	0.117	1.041***
Education	-0.898*	-0.511	-0.500	ns	2.543	2.044
Dependency	-10.813***	-6.486***	-6.678***	0.030	-18.065***	-24.743***
Migrants	-3.005***	-5.744***	-5.766***	0.004	11.087***	5.321*
Population	-0.006***	-0.002**	-0.002**	0.071	-0.030***	-0.032***
Asymmetry	-0.313***	-0.274***	-0.276***	0.010	-0.329*	-0.606***
Ideology	0.846	0.016	0.051	ns	1.872	1.923
Regional Alignment	-11.406**	-8.881	-8.682	ns	-17.196	-25.878
National Alignment	-11.553*	-13.497*	-13.402*	-0.007	1.890	-11.511
Neighbour's Income		0.038***				
Neighbour's Transfers		-0.209				
Neighbour's Unemployment		-1.098				
Neighbour's Capital transfers		-0.236**				
Neighbour's Education		2.027				
Neighbour's Dependency		-10.030***				
Neighbour's Migrants		9.188***				
Neighbour's Population		-0.019***				
Neighbour's Asymmetry		-0.127				
Neighbour's Ideology		1.301				
Neighbour's Regional Alignment		-8.417				
Neighbour's National Alignment		5.892				
Neighbour's Government spending		0.335***				
R-squared	0.812	0.8203				
Log-Likelihood	-67,780.3	-67,593.04				

Notes: ns denotes not significant, * significant at 10% level, ** significant at 5% level, *** significant at 1% level. The non-spatial model is a two-way fixed and time-period fixed effects model specification. Inferences regarding the statistical significance of the spatial direct, indirect and total effects are based on the variation of 1000 simulated parameter combinations drawn from the variance-covariance matrix implied by the BCML estimates. The results are obtained using the 15 nearest neighbour's spatial weights matrix.

Online Appendix

Table A1. Descriptive Statistics and data sources of the variables.

Variable	Mean	Standard Deviation	Definition	Source
Dependent variable				
Expenditures	679.039	283.113	Per capita current spending (euros/inhab.). Corresponds to operating expenses as defined by Sections I to IV of the economic classification of local budgets	SMPF
Explanatory variables				
Income	15,093.81	5,072.68	Average income (euros)	STAO
Grants	294.265	127.374	Per capita current transfers from the central government (euros/inhab.)	SMPF
Asymmetry	38.019	93.241	Asymmetry in grants, defined as $Grants_t - Grants_t - 1$ (euros/inhab.)	SMPF
Population	15,619.82	80,888.56	Total resident population	INE
Unemployment rate	10.025	5.739	Share of active population unemployed (%)	INE
Education	53.499	12.831	Share of population with secondary and/or tertiary education (%)	INE
Migrants	7.926	8.431	Share of immigrants in the resident population (%)	INE
Capital transfers	123.921	158.646	Per capita capital spending (euros/inhab.). Corresponds to expenses as defined by Sections VI and VII of the economic classification of local budgets	SMPF
Ideology	5.713	1.957	Index that ranges between 0 (left) to 10 (right)	Deusto Polls
Regional Alignment	0.410	0.492	Dummy variable. 1 if regional and local governments are aligned, 0 otherwise	SMI and own calculations
National alignment	0.393	0.489	Dummy variable. 1 if national and local governments are aligned, 0 otherwise	SMI and own calculations
Moderators of the FPE				
Political strength	-0.010	0.116	Share of votes received by the leading local party - 50%	SMI and own calculations
Tax collection efficiency	0.157	0.846	Index that ranges between 0 (less efficient) to 1 (more efficient)	SPAO, and own calculations using GIS techniques and DEA

Notes: SMPF denotes the Spanish Ministry of Public Finance, SMI refers to the Spanish Ministry of Internal Affairs, INE is the National Statistics Institute, SPAO is the Spanish Propoerty Assessment Office, GIS is Geographical INformation Systems and DEA is Data Envelopment Analysis.

Table A2. Model Selection.

	Posterior Probabilities For Spatial Models $P(SM\|W,X)$				Posterior Probabilities For W Matrices $(P(W\|SM,X))$			
Spatial Weight Matrix	SLM	SDM	SEM	SDEM	SLM	SDM	SEM	SDEM
First order contiguity	0.000	0.832	0.000	0.168	0.000	0.000	0.000	0.000
Cut-off 50 km	0.000	0.770	0.000	0.230	0.008	0.000	0.000	0.000
Cut-off 75 km	0.000	0.200	0.000	0.800	0.002	0.000	0.000	0.000
Cut-off 100 km	0.000	0.076	0.000	0.924	0.013	0.000	0.049	0.000
Cut-off 150 km	0.000	0.016	0.000	0.984	0.001	0.000	0.943	0.000
$1/d^{\alpha}$, $\alpha = 2.00$, cut-off at Q1	0.000	0.860	0.000	0.140	0.000	0.000	0.000	0.000
$1/d^{\alpha}$, $\alpha = 2.00$, cut-off at Q2	0.000	0.834	0.000	0.166	0.000	0.000	0.000	0.000
$1/d^{\alpha}$, $\alpha = 3.00$, cut-off at Q1	0.000	0.724	0.000	0.276	0.000	0.000	0.000	0.000
$1/d^{\alpha}$, $\alpha = 3.00$, cut-off at Q2	0.000	0.724	0.000	0.276	0.000	0.000	0.000	0.000
$exp - (\theta d)$, $\theta = 0.05$ cut-off at Q1	0.000	0.027	0.000	0.973	0.484	0.494	0.004	0.508
$exp - (\theta d)$, $\theta = 0.05$ cut-off at Q2	0.000	0.029	0.000	0.971	0.492	0.506	0.005	0.492
5-nearest neighbours	0.000	0.843	0.000	0.157	0.000	0.000	0.000	0.000
6-nearest neighbours	0.000	0.891	0.000	0.109	0.000	0.000	0.000	0.000
7-nearest neighbours	0.000	0.858	0.000	0.142	0.000	0.000	0.000	0.000
8-nearest neighbours	0.000	0.900	0.000	0.100	0.000	0.000	0.000	0.000
9-nearest neighbours	0.000	0.929	0.000	0.071	0.000	0.000	0.000	0.000
10-nearest neighbours	0.000	0.948	0.000	0.052	0.000	0.000	0.000	0.000
15-nearest neighbours	0.000	0.860	0.000	0.140	0.001	0.000	0.000	0.000

Notes: Columns (1) to (4) show the probability of each spatial model SM conditional on W and X $(P(SM|W,X))$, while Columns (5) to (8) show probability of the W conditional on the spatial model SM and X $(P(W|SM,X))$. To derive individual PMPs we employ a normal-gamma conjugate prior for $\delta = [\alpha, \beta]$ and σ and a beta prior for ρ (or λ in the SEM/SDEM case):

$$p(\beta) \sim N(c, \Sigma)$$

$$p\left(\frac{1}{\sigma^2}\right) \sim \Gamma(d, v)$$

$$p(\rho) \sim B(a_0, a_0)$$

To avoid situations where the conclusions depend heavily on subjective prior information we rely on diffuse or non-informative prior distributions. Parameter c is set to zero and Σ to a very large number $(1e + 12)$ which results in a diffuse prior for δ. The diffuse priors for σ and ρ, are obtained setting $d = 0$ and $v = 0$ and $a_0 = 1.01$.

Table A3. Robustness check (I): Alternative Definition of Private Income: median income.

Variable	Coefficient (1)	Direct Effects (2)	Feedback Effects (3)	Indirect Effects (4)	Total Effects (5)
Income	0.000	0.000	ns	0.000	0.000
Transfers	1.165***	1.168***	0.002	0.195	1.364***
Unemployment	1.528	1.413	ns	-12.167***	-10.754***
Capital transfers	0.924***	0.925***	0.001	0.164	1.089***
Education	-0.525	-0.516	ns	0.818	0.302
Dependency	-6.428***	-6.553***	0.019	-14.235***	-20.788***
Migrants	-6.148***	-5.991****	-0.026	17.757***	11.766***
Population	-0.002**	-0.002**	0.091	-0.030***	-0.033***
Asymmetry	-0.278***	-0.282****	0.015	-0.447**	-0.729***
Ideology	-0.136	-0.079	ns	7.577	7.497
Regional Alignment	-8.424	-8.496	ns	-27.771	-36.267
National Alignment	-12.962*	-12.707*	ns	22.659	9.952
Neighbour's Income	0.000				
Neighbour's Transfers	-0.392***				
Neighbour's Unemployment	-7.512***				
Neighbour's Capital transfers	-0.304***				
Neighbour's Education	0.652				
Neighbour's Dependency	-5.233*				
Neighbour's Migrants	12.705***				
Neighbour's Population	-0.016***				
Neighbour's Asymmetry	-0.136				
Neighbour's Ideology	4.338				
Neighbour's Regional Alignment	-11.074				
Neighbour'sNational Alignment	18.955				
Neighbour's Government spending	0.433***				
R-squared	0.819				
Log-Likelihood	-67633.00				

Notes: ns denotes not significant, * significant at 10% level, ** significant at 5% level, *** significant at 1% level. Inferences regarding the statistical significance of these effects are based on the variation of 1000 simulated parameter combinations drawn from the variance-covariance matrix implied by the BCML estimates. The results are obtained using the 15 nearest neighbour's spatial weights matrix

Table A4. Robustness check (II): Alternative definition of per capita spending: total spending.

Variable	Coefficient (1)	Direct Effects (2)	Feedback Effects (3)	Indirect Effects (4)	Total Effects (5)
Income	0.004**	0.004***	0.122	0.059***	0.064***
Transfers	1.165***	1.165***	0.000	0.280	1.445***
Unemployment	1.324	1.372	ns	-1.080	0.292
Capital transfers	0.923***	0.924***	0.001	0.105	1.029***
Education	-0.513	-0.505	ns	2.921	2.415
Dependency	-6.485***	-6.636***	0.023	-18.379***	-25.015***
Migrants	-5.747***	-5.721***	-0.005	10.820***	5.100
Population	-0.002**	-0.003**	0.114	-0.029***	-0.032***
Asymmetry	-0.274***	-0.274***	0.002	-0.327*	-0.601***
Ideology	0.015	0.055	ns	1.948	2.003
Regional Alignment	-8.878	-8.913	ns	-16.847	-25.760
National Alignment	-13.498*	-13.779*	0.021	0.344	-13.434
Neighbour's Income	0.038***				
Neighbour's Transfers	-0.221				
Neighbour's Unemployment	-1.096				
Neighbour's Capital transfers	-0.245**				
Neighbour's Education	2.026				
Neighbour's Dependency	-9.828***				
Neighbour's Migrants	9.191***				
Neighbour's Population	-0.019***				
Neighbour's Asymmetry	-0.123				
Neighbour's Ideology	1.281				
Neighbour's Regional Alignment	-8.170				
Neighbour's National Alignment	5.929				
Neighbour's Government spending	0.344***				
R-squared	0.820				
Log-Likelihood	-67,593.27				

Notes: ns denotes not significant, * significant at 10% level, ** significant at 5% level, *** significant at 1% level. Inferences regarding the statistical significance of these effects are based on the variation of 1000 simulated parameter combinations drawn from the variance-covariance matrix implied by the BCML estimates. The results are obtained using the 15 nearest neighbour's spatial weights matrix

Table A5. Robustness check (III): Alternative model specification: Logarithmic specification.

Variable	Coefficient (1)	Direct Effects (2)	Feedback Effects (3)	Indirect Effects (4)	Total Effects (5)
Income	0.064*	0.071**	0.115	0.777***	0.848***
Transfers	0.351***	0.352***	0.002	0.127*	0.478***
Implied FPE		1.123		0.357	1.480
Unemployment	0.001	0.001	ns	-0.005	-0.004
Capital transfers	0.001***	0.001***	0.003	0.000*	0.001***
Education	0.000	0.000	ns	0.002	0.002
Dependency	-0.005***	-0.005***	0.038	-0.020***	-0.025***
Migrants	-0.005***	-0.005***	-0.009	0.002	-0.003
Population	0.000***	0.000***	0.091	0.000***	0.000***
Asymmetry	0.000***	0.000***	0.032	0.000***	-0.001***
Ideology	0.001	0.001	ns	-0.003	-0.002
Regional Alignment	-0.008*	-0.008*	0.003	-0.001	-0.009
National Alignment	-0.009	-0.008	ns	0.060	0.051
Neighbour's Income	0.3934***				
Neighbour's Transfers	-0.0925**				
Neighbour's Unemployment	-0.0032				
Neighbour's Capital transfers	0.000**				
Neighbour's Education	0.001				
Neighbour's Dependency	-0.009***				
Neighbour's Migrants	0.003*				
Neighbour's Population	0.000***				
Neighbour's Asymmetry	0.000**				
Neighbour's Ideology	-0.002				
Neighbour's Regional Alignment	0.003				
Neighbour's National Alignment	0.037				
Neighbour's Government spending	0.459***				
R-squared	0.836				
Log-Likelihood	4848.72				

Notes: ns denotes not significant, * significant at 10% level, ** significant at 5% level, *** significant at 1% level. Inferences regarding the statistical significance of these effects are based on the variation of 1000 simulated parameter combinations drawn from the variance-covariance matrix implied by the BCML estimates. The results are obtained using the 15 nearest neighbour's spatial weights matrix. To make the results of the logarithmic specifications comparable to those of the level regressions, elasticities are transformed into marginal effects as: $\left(\frac{E_t}{G_t}\right) TE_G^{log-log} - \left(\frac{E_t}{Y_t}\right) TE_Y^{log-log}$ where $TE_G^{log-log}$ and $TE_Y^{log-log}$ denote the total effects obtained with the log-log specification and $\frac{E_t}{G_t}$ and $\frac{E_t}{Y_t}$ the ratio of spending to grants and income.