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French Local Government Borrowing’s Spatial Effects: A Spatial Panel Data Analysis of French Metropolitan Departments

Philipppe Frouté*

The aftermaths of the 2008 subprime crisis have modified financing channels of French local governments and led to regulation changes. Using a unique panel of the 96 French Metropolitan Departments covering 13 years between 2005 and 2017, this paper investigates the determinants of Departments’ borrowing using a spatial panel approach. Our estimates of a fixed-effects Spatial Durbin Model show that spatial determinants contribute to explain Departments’ financing decisions. The study exhibits the existence of a spatial multiplier effect that may influence the systemic risk of bankruptcy for French Department. In this context, the recent profound reshaping of the local financing sector should be considered with care paying attention to spatial interactions.

Regional Government Analysis – Local borrowing – Public investment – Spatial Panel Analysis

Les effets spatiaux des décisions d’emprunts des collectivités locales françaises : une analyse spatiale en données de panel des Départements métropolitains français

La crise des subprimes de 2008 a modifié les canaux de financement des collectivités territoriales françaises ainsi que la réglementation qui les encadre. A l’aide d’un panel unique portant sur les 96 Départements de France métropolitaine sur une période de 13 années comprises entre 2005 et 2017, cet article étudie les déterminants des emprunts des Départements à l’aide d’une analyse spatiale en panel. Les estimations conduisent à retenir un modèle spatial de Durbin à effets-fixes qui montre que des déterminants spatiaux contribuent à expliquer les décisions de financement des Départements. Les résultats montrent l’existence d’un effet multiplicateur spatial qui pourrait exercer une influence sur le risque systémique de défaut des Départements français. Dans ce contexte, les récentes modifications du secteur du financement local devraient être considérées en portant une attention particulière aux interactions spatiales.

Analyse des collectivités territoriales – Emprunt local – Investissement public – Analyse spatiale des données de panel

Classification JEL : R51, H74, R53, C33

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1. Introduction

The aftermaths of the 2008 subprime crisis have profoundly modified French local governments’ financing channels. The consequences have been twofold. First, some local governments have been close to bankruptcy, for instance Saint-Étienne municipality, or Seine-Saint-Denis Department. Second, the financial crisis has led to significant changes of regulation in order to better monitor local governments’ financing channels. The financial crisis has also led to the collapse of one major financer of French local governments: Dexia bank and its subsidy Dexia Crédit Local which has been bought out by two French state-owned banks: La Banque Postale (LBP) and the Caisse des Dépôts et Consignations (CDC). The balance between private financial institutions and state-owned financial institutions has shifted towards state-owned institutions which are currently financing more than 50% of local borrowing needs.

The issues are crucial. Indeed, on a yearly basis, French local governments borrow on average 15 billion euros according to S&P Global Ratings [2018]. Moreover, even if they are subject to a constraining regulation (Dafflon [2002]) with a balanced budget amendment rule known as the Golden Rule that restricts borrowing to the financing of public investment, fundamentally, French local borrowing regulation is market-based oriented (Ter-Minassian and Craig [1997]). It is then necessary to understand the determinants of their borrowing decisions, especially when considering the strategic nature of those decisions (Carlsen [1994], [1998]).

Dufrénot, Frouté, Schalck [2011] show that there exists a large heterogeneity of borrowing behaviors at the sub-national regional level. More precisely, running a quantile regression analysis on the 22 French regions over the period 1999-2007, the authors show that big borrowers tend to be more influenced by market variables such as interest rates and disposable income in comparison with smaller borrowers which tend to only consider previous borrowing levels and previously accumulated debt. This may be explained by the fact that bigger borrowers will generally have more qualified staff for integrating market variables into their borrowing decisions whereas smaller borrowers will lack resources for using this expertise. This also means that smaller borrowers will use other criteria to make their decisions.

In finance, the classical literature shows that information asymmetries between borrowers and lenders play a crucial role in borrowing decisions (see for instance seminal papers from Rothschild and Stiglitz [1976] and Stiglitz and Weiss [1981]). In order to reduce the gap and to avoid undesirable equilibriums, information sharing mechanisms play an important role. This implies the existence of networks that will enable to share information. Due to a lack of data, such networks have rarely been explored in the French context. Recently, cooperation between municipalities has been studied in the frame of fiscal cooperation (Charlot, Paty and Piguet [2015]) and public services delivery (see for instance, Frère, Leprince and Paty [2014]; Abidi et al. [2017] and Di Porto and Paty [2018]). It means that only two local government tiers have been studied: Regions and municipalities. One tier has
not been explored much: the Department level. Nevertheless, in comparison with the Regional and Municipal tiers, the Department level is the most fragile financially, notably because of the risks related to the social housing sector it guaranteed. In comparison with other European countries such as Spain (Balaguér-Coll, Narbó-Perpià and Tortosa-Ausina [2019]) or Italy (Perucca [2014]) where we can find lots of spatial empirical studies, there are relatively few economic studies addressing this issue in the French local governments context. A recent study by Maguain and Fréret [2013] explores the determinants of Departments’ welfare spending disparities between 1992 and 2008. Using spatial panel econometric techniques, they found large expenditure interactions with a reaction function that slopes positively: on average, when a department raises its expenditures by 5%, its neighbors increase theirs by 10%. Thus, not considering spatial factors leads to unduly attributing to income changes in expenditure stemming from local interactions such as yardstick competition. A recent study from Langer [2019] addresses this issue in the case of North Rhine-Westphalia in Germany.

These results raise another issue related to the notion of systemic risk. Indeed, in the previous studies, nothing is said about the way to finance investment expenditures; while existing local interactions such as spatial multipliers or spillovers may have huge consequences on the financial viability of the local governmental level. The financial literature on systemic risk distinguishes two definitions of systemic risk (see De Bandt and Hartmann [2000]): a narrow view and a broad view.

The narrow view corresponds to the “domino effect” where an event occurring in one institution will spread to other neighbors through a contagion process. This first view can be associated to the spatial notion of spillover effect.

The second view of systemic risk corresponds to a situation where simultaneous adverse effects will affect many institutions or markets and will spread because of this severe and widespread shock. This view corresponds to the notion of spatial multiplier.

The current paper proposes to contribute to the literature by investigating if French Departments are sensitive to systemic risks when financing investment expenditures. More precisely, the paper proposes to address the issue of the vulnerability of the French Departments to systemic risks by testing if spatial interactions are governing French borrowing decision and to link each interaction with the relevant category of systemic risks. In order to do so, this paper investigates a unique database gathering data about the 96 French Metropolitan Departments covering 13 years. Using data on final budget from French Departments, a dataset gathering information about this local tier public investment has been collected over the period 2005-2017.

In this paper, we also computed an innovative statistic assessing local growth at the Department level. Indeed, data on Departments’ economic growth are not available. Following Arbia [2014], Elhorst [2014], Lesage [2014] and Belotti, Hughes and Piano Mortari [2016], the database is explored considering spatial interactions to explain French Departments’ borrowing decisions. Exploring alternative specifications, we found that the most relevant specification is a fixed-effects Spatial Durbin Model. We find a highly significant spatial parameter. This result is in line with Maguain and

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Fréret’s [2013] paper on investment expenditure. The significance of the spatial parameter shows that a spatial multiplier effect is at play. More precisely, the coefficient is positive which means that when neighbor Departments are borrowing, the considered Department will increase its own borrowing. The actual borrowing seems to have increased the average market risk.

Thus, these results show that spatial effects are an important factor for explaining local government decisions and should be carefully considered when designing policies aiming at avoiding financial risk or when reforming the regulations that govern local governments. Indeed, this study shows that Departments are sensitive to spatial effects that may influence the spread of shocks amongst local Departments.

The remainder of this paper proceeds as follows. The “Institutional background and Data” section presents the French Departments’ sub-national level organization and distribution of competencies with a specific attention to the consequences on the database construction and the choice of the best empirical strategy. The “Main findings” section presents the empirical results and the ‘Conclusion and discussion’ section discusses them and concludes.

2. Institutional background and Data

Both French Departments’ local governments and the regulation governing financing channels have experienced a lot of substantial modifications in recent years. Section 2.1 presents these modifications and their consequences for the analysis. Section 2.2 presents the database construction.

2.1. Institutional background

French Departments, as we currently know them, have been put into place in 1982 with the Decentralization Law of March 2nd. More precisely two layers of local administration have been introduced: Regions and Departments. Hence, the word “Departments” can be used to refer to the administrative division of the Central Administration at the local level1 or to refer to the local government with its Assembly of representatives. Since then, the organization of the French territory is divided between the State, the Regions, the Departments and the Cities. Each layer possesses its own government with an Assembly of representatives. In 2015, new layers have been introduced with the development of Metropoles and local administrations with a unique status (“collectivités à statut unique”) that can be viewed as

1. An administrative tier that has been introduced during the French Revolution in 1789 (December 22nd, 1789 Decree).
a kind of administrative merger between Regions and Departments or between two Departments (Law NOTRe on the new organization of the French territory, August 7th, 2015).

In order to avoid overlapping, the law NOTRe has reorganized the distribution of competencies between Cities, Departments and Regions. Cities are responsible for urban planning and city streets administration; social care for youth and elderly, daycare service, education for pre-primary and primary school children; culture, through libraries, museums and music school’s management; and sport and leisure, with stadiums and sport equipment administration. Regions have been granted a leading role towards other local administrations with respect to economic development issues and territorial planning (including economic development, innovation and internationalization). They oversee the administration of High schools, regional rail transportation and professional training. Departments are responsible for the administration of social aid (such as youth aid, grants for people with disabilities, for elderly, retirement houses), the administration of the minimum wage and aid to meet energetic insecurity. In other words, Departments are playing a major role in the implementation of French automatic stabilizers (Fatás, Mihov [2001]). Concerning public investments, Departments are mainly investing in education. They build and maintain lower secondary schools. They can invest in infrastructures such as ports and small airports, they can also manage some roads even if this competence is more and more transferred to Regions.

Public investment from local governments represents around 2% of French GDP. Departments are investing around 20% of this amount, almost the same proportion as Regions, knowing that the main competence of Department, social aid, represents around 85% of their budget and is composed of expenditures that Departments do not control. The main investors are Cities, but if we compare the ratio of expenditure with respect to the respective number of Cities (around 36000) and Departments (whose total number, Metropolitan and overseas, is equal to 101), investment from Department is almost 100 times higher than the investment from Cities. A last issue worth noticing, to understand the French institutional context, is the existence of a Golden Rule. Local governments must vote a budget that balances revenues and expenditures. Deficits are forbidden. This requirement of equilibrium is also required for each section of the budget individually: the operating section and the investment section of the budget have both to be balanced. The investment section equilibrium can be reached thanks to borrowing. But interest payment will be recorded as operating expenses. It means that investment revenues are generating operating expenses. This rule aims at preventing local government from borrowing too much. Nevertheless, due to the principle of administration freedom, each local government is free to decide, the kind of investment they want to implement, their amounts and the way to finance it. Hence, the categorization of market-based oriented regulation from Ter-Minassian and Craig [1997]. Furthermore, a study on the Regional level has shown that the Golden Rule must be a soft law rather than a hard law regulation Dufrénôt, Frouté, Schalck [2011], which means that the different local governments follow their own financing strategy.
When refunding conditions have deteriorated some local governments did not manage to cover new financial needs because they were not aware of the risks associated with some complex financial products. Lot of French local governments have then blamed financial institutions for having minimized the risks when proposing those products. This led first to the implementation of a good conduct charter, the Gissler’s charter, that has been signed between local governments and financial institutions in 2009. It has not been enough for dealing with the bankruptcy risk. To limit the risks, the legislator introduced in July 2013 an article in the general code of the territorial governments that restricts the characteristics of the products to which the local governments can subscribe. In the case of variable interest rates, the indexing formula must meet criteria of “simplicity” and “predictability”, these notions being defined in a decree of the Conseil d’État² (Decree 2014-984 of the 28th August 2014 framing the borrowing conditions for local government). In 2014, a supportive fund of 200 million euros per year for a maximum duration of 15 years has been created for local authorities having subscribed structured loans before 2014. The fund’s dotation has been increased up to 3 billion of euros. The concerned loans are the most sensitive loans and their related hedging contracts, often named as toxic financial products. According to the Cour des Comptes³ the sum of those toxic financial products amounts around 9 billion of euros. The supportive fund may contribute to provide local authorities with assistance from the State for the early repayment of these loans and instruments⁴. In 2017, the State financial aid has been estimated to 2.6 billion euros received by 578 local governments.

After the collapse of Dexia, the local government financing sector has been profoundly reshaped. The balance between private financial institutions and state-owned financial institutions has shifted towards state-owned institutions. Indeed, Dexia Crédit Local, the subsidy in charge of local governments financing has been transferred to La Banque Postale and La Caisse des Dépôts et Consignations. Together with the European Investment Bank, they concentrate almost 50% of local governments finances. There are also private financiers such as Savings Banks like BPCE, the Crédit Mutuel and public banks such as Crédit Agricole and Société Générale. A new player is also the Agence France Locale whose investors are directly local governments and which targets to reach one quarter of the market. If we consider the bond market, it means that French local governments borrowing is financed 54% by state-owned financiers, 14% by bonds, and 32% by private financiers (see table 1 below).

². The Conseil d’État is the supreme Court of Justice for cases dealing with administration.
³. The Cour des comptes is the supreme body for auditing the use of public funds in France. It is independent from the Government and Parliament.
⁴. The aid is calculated based on the early payments due; it cannot exceed 75% of the amount of these. In an initial phase and for a limited period of three years from the filing of the application, a portion of this assistance may nevertheless be paid to cover the financial costs relating to these loans and instruments. At the end of this phase, the local authorities may obtain, under conditions, and for a renewable period of three years, the continuation of the payment of the assistance until the end of borrowing.
Table 1. Market concentration of French local government financers

<table>
<thead>
<tr>
<th>Financial institutions</th>
<th>Market shares</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>State-owned</strong></td>
<td>53.4%</td>
</tr>
<tr>
<td>La Banque Postale</td>
<td>25%</td>
</tr>
<tr>
<td>European investment bank</td>
<td>=12.4%</td>
</tr>
<tr>
<td>La Caisse des Dépôts et Consignations</td>
<td>=12.5%</td>
</tr>
<tr>
<td>Agence France Locale</td>
<td>3.5%</td>
</tr>
<tr>
<td><strong>Private</strong></td>
<td>32.5%</td>
</tr>
<tr>
<td>BPCE</td>
<td>25%</td>
</tr>
<tr>
<td>Crédit Mutuel</td>
<td>2.5%</td>
</tr>
<tr>
<td>Crédit Agricole</td>
<td>2.5%</td>
</tr>
<tr>
<td>Société Générale</td>
<td>2.5%</td>
</tr>
<tr>
<td>Others</td>
<td>=0.1%</td>
</tr>
<tr>
<td><strong>Bond market</strong></td>
<td>14%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: S&P Global Ratings [2018].

In order to study French Departments’ borrowing, a dataset gathering annual administrative and economic data for 96 French Departments from 2005 to 2017 has been collected.

2.2. Data

Administrative data are drawn from the final budget of the French Departments. In order to use a cylindrical panel, we gathered data from 2005 to 2017 from the General Directorate for Local Governments. Final budgets are destined to finalize the budget situation of the local tier considering unexpected investment expenditures and business cycle fluctuations.

It is worth noticing that one major reform has impacted the sample during this period.

1. The 1st January of 2015, the Metropole of Lyon was created. The Metropole is a gathering of municipalities that will share a common budget and that will merge the administrative competencies of municipalities with the administrative competencies of the Department. The Metropole of Lyon does not cover the former area of the Rhône Department. Thus, since the 1st of January, there is a Department named Rhône that covers the former Department territory minus the territory of the new Metropole of Lyon. In order to preserve the structure of the database, the budget of the two entities have been merged for the three last years of study.

Following Dufrénot, Frouté and Schalck [2011] two different sets of data have been collected. The first one concerns budget variables. We collected...
data on investment expenditures and data on yearly interest payments. We also collected data on borrowing. The following table summarizes their descriptive statistics.

**Table 2. Local public finance variables descriptive statistics**

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final budgets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Borrowing</td>
<td>1248</td>
<td>41000</td>
<td>44100</td>
<td>0</td>
<td>357000</td>
</tr>
<tr>
<td>Investment expenditures</td>
<td>1248</td>
<td>139000</td>
<td>105000</td>
<td>13300</td>
<td>638000</td>
</tr>
<tr>
<td>Interest Payments</td>
<td>1248</td>
<td>18900</td>
<td>28400</td>
<td>0</td>
<td>371000</td>
</tr>
</tbody>
</table>

*Note: Variables are measured in millions of euros.*

*Source: General Directorate for local Governments, Budget of French local government.*

Final budgets provide also data on Departments’ population. As our dataset is in values, yearly data on inflation rates (consumer price index, CPI) have been collected from the French statistical national institute (Insee).

Data on Departments’ growth are not available. The Insee only provides growth per inhabitant at the regional level until 2015. After that year, the law NOTRe reduced the number of Regions from 22 to 13. Since then, regional statistics have not yet been made available. In this paper, a time series for Departments’ growth has been computed. We assume that Departments’ growth between 2005 and 2015 is based on the Departments’ population. Knowing Regional growth per inhabitant, Departments’ growth is computed as the product of Departments’ population and the regional growth per inhabitant of the Region they belong to. Departments’ growth for the years 2016 to 2017 has been computed thanks to a two-year moving average for each Department. Hence, the variability of growth between Department is preserved but conjuncture effects related for instance to foreign direct investment inflows are not considered. A correction has been made in order to ensure that the sum of Departments’ GDP is equal to French GDP. The difference between the two figures is positive. We have subtracted the corresponding percentage of this difference to each Department GDP and recomputed growth rates. Table 3 summarizes the socio-economic data.

5. There had been a lot of debates on the possibility to compute relevant growth indicator at the local level. For instance, André Larceneux criticizes Laurent Davezies geographical analysis of the French territory based on regional growth indicators (Larceneux [2018]) or Bouba-Olga and Grossetti who are criticizing concentration policies based on regional performance measured by regional GDP Bouba-Olga and Grossetti [2015]. In our case, the perspective is slightly different. We use the departmental growth in order to assess differences of wealth between Departments and not in order to detect where the origins of growth stand.

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Table 3. Socio-economic Data Description, Sample statistics, and sources

<table>
<thead>
<tr>
<th>Variable</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation</td>
<td>0%</td>
<td>2.8%</td>
<td>1.23%</td>
<td>0.83%</td>
<td>1248</td>
</tr>
<tr>
<td>Population</td>
<td>75700</td>
<td>2604481</td>
<td>663455.64</td>
<td>508582.62</td>
<td>1248</td>
</tr>
<tr>
<td>Growth indicator</td>
<td>-4.4%</td>
<td>8%</td>
<td>0.1%</td>
<td>0.5%</td>
<td>1248</td>
</tr>
</tbody>
</table>

Sources: CPI variations were obtained from the French national statistical institute (Insee). Population data were obtained from the French Departments Final Budgets (2005-2017), from the General Directorate for Local Governments. Growth indicator has been computed by the author based on Regional data from the Insee following the methodology described above.

3. Main findings

Following Dufrénot, Frouté and Schalck [2011], we will consider the following basic model where borrowings from individual $i$ at time $t$ ($Bor_{i,t}$) depends on investment needs ($Inv_{i,t}$), borrowing’s costs ($Int_{i,t}$) and socio-economics variables: Departments’ growth ($Growth_{i,t}$), Departments’ population ($Pop_{i,t}$) and inflation ($Inf_{t}$). This latter coefficient can be considered as a temporal effect because it is common to all Departments for a given year. We introduce a dummy variable to take into account the political orientation of the Department ($Poli_{i,t}$). This variable takes the value 1 if the President of the Department belongs to a right-wing party and 0 otherwise. The model also considers an error term $\varepsilon_{i,t}$:

$$Bor_{i,t} = a_{1i,t} Inv_{i,t} + a_{2i,t} + a_{3i,t} Growth_{i,t} +$$

$$a_{4i,t} Pop_{i,t} + a_{5i,t} Inf_{t} + a_{6i,t} Poli_{i,t} + \varepsilon_{i,t} \hspace{1cm} [1]$$

Introducing spatial components to this model yields two issues. First, the specification choice will reveal which spatial diffusion effects may be at play: for instance, while a spatial auto-regressive specification (SAR) will reveal the existence of a global spatial multiplier effect (the value of an observation $i$ at time $t$ depends on the fluctuations of $i$’s variables but also on neighbors’ variables fluctuations) and of spillover effects (what affects individual’s variables will be diffused to neighbors variables); a spatial error model (SEM) will reveal the existence of spillover effects only (section 3.1). Second, testing the significance of the model will reveal if the preceding effects are effectively at play and what their magnitude is, which can constitute an assessment of the systemic risk borne by the French Departments (section 3.2).
3.1. Model specification

First, we compute a connectivity matrix based on the first-order spatial contiguity of the French Metropolitan Departments. Table 4 below summarizes \( W \)'s properties.

### Table 4. Summary of spatial-weighting matrix \( W \)

<table>
<thead>
<tr>
<th>Matrix Description</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimension</td>
<td>96×96</td>
</tr>
<tr>
<td>Links</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>476</td>
</tr>
<tr>
<td>Min</td>
<td>1</td>
</tr>
<tr>
<td>Mean</td>
<td>4.958333</td>
</tr>
<tr>
<td>Max</td>
<td>10</td>
</tr>
</tbody>
</table>

\( W \) consists of 96 cross-sectional units with at least one neighbor (in Corsica), with about 5 contiguous units on average. The total number of common borders between the different Metropolitan Department is equal to 476. The maximum number of common borders is equal to 10 (in Seine-et-Marne). This matrix has then been row-normalized.

In order to choose the best specification, we follow the empirical strategy proposed by Lesage and Pace [2009], Elhorst [2010], and Belotti, Hughes and Piano Mortari [2016]. Their strategy enables to discriminate between five categories of spatial models, namely: spatial autoregressive model (SAR), spatial Durbin model (SDM), spatial autocorrelation model (SAC), spatial error model (SEM) and generalized spatial random-effects model (GSPRE).

We begin to consider a fixed-effects SDM. The basic equation for this model can be written as:

\[
y_{i,t} = \rho \sum_{j=1}^{N} w_{ij}y_{jt} + X_{it} \beta + \sum_{j=1}^{N} w_{ij}X_{jt} \theta + \mu_j + \delta_t + \varepsilon_{it} \quad i, j = 1, ..., N
\]

with \( i \) referring to the Department and index \( t \) referring to the year. \( y_{i,t} \) indicates borrowing. \( \sum_{j=1}^{N} w_{ij}y_{jt} \) denotes the term that describes the impact on Department \( i \) of the borrowing of its neighbors \( (j = 1, ..., N) \). \( \omega \) is the contiguity matrix. \( \rho \) is the parameter that measures the response to neighboring Departments. \( X_{ij} \) is a vector gathering investment expenditures, interest expenditures, growth, population, inflation and a political dummy for

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6. Introducing time fixed effects led us to get rid of the inflation variable that was the same for all Departments and was corresponding thus to a temporal effect. Introducing inflation and time fixed effects would have led to introduce spuriously multicollinearity within the model.

7. The full description of these five models can be found in Belotti, Hughes and Piano Mortari [2016] page 3.

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Department $i$ at time $t$. $\beta$ is the vector of the estimated parameter. $\sum_{j=1}^{N} w_{ij} X_{ij}$ represents the characteristics of the neighboring Departments, while $\theta$ is the corresponding vector of the parameters estimated. $\mu_i$ and $\delta_i$ represent Departmental and time-fixed effects. $\epsilon_n$ is a normally, identically, and independently distributed error term. Following Elhorst [2014], Lesage [2014] and Belotti, Hughes and Piano Mortari [2016] we adopt a model selection strategy which consists first in testing if the SDM is preferred to a SAR or a SEM. The strategy consists in noticing that if $\theta = 0$ and $\rho = 0$, the SDM becomes a SAR. This corresponds to a Wald test assessed by a $\chi^2$ test. Second, we can notice that if $\rho = -\beta \rho$, then the SDM is a SEM. Once again, this assumption is assessed by a $\chi^2$ test. Third, if the best spatial model is not the SAR nor the SEM, it can be the SDM or the SAC. Here, Lesage and Pace [2009] and Elhorst [2010] suggest using the AIC criterion to discriminate between the two models and to select the model with the lowest AIC statistics. Finally, to discriminate between the SDM and the GSPRE we run a Hausman test in order to know if the fixed effects are better than the random effects (which means that the fixed-effects SDM is the best spatial model). If the answer is in favor of the random effects, we compare the random SDM with the GSPRE according to the AIC criterion. The table 5 below summarizes the results of the different tests.

**Table 5. Test for model selection**

<table>
<thead>
<tr>
<th>Final budget</th>
<th>$\chi^2$</th>
<th>p-value</th>
<th>AIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAR vs SDM</td>
<td>84.25</td>
<td>0.000</td>
<td>45337.65</td>
</tr>
<tr>
<td>SEM vs SDM</td>
<td>50.56</td>
<td>0.000</td>
<td>42018.53</td>
</tr>
<tr>
<td>SAC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDM</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hausman test</td>
<td>9.92</td>
<td>0.0070</td>
<td></td>
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</table>

First, the $\chi^2$ test strongly rejects the $\theta = 0$ assumption. It means that the SDM is preferred to the SAR. Second, we can see that the SEM assumption is also strongly rejected. The SDM is preferred to the SEM. Third, the AIC statistics is a bit lower for the fixed-effects SDM in comparison with the SAC model. The SDM is preferred to the SAC. Finally, the Hausman test is in favor of the fixed effect. In both cases, the best specification is thus a fixed-effects SDM.

### 3.2. Main results

According to Elhorst [2010], spatial dependence between observations may have an impact on the fixed effects. Langer [2019] shows that this issue...
may be considered by using a quasi-maximum likelihood (QML) estimator. Following Anselin [1988] and Fréret and Maguain [2017], the QML estimator also enables to deal with endogeneity issues coming from the fact in our case that own borrowing and neighbor borrowing are determined simultaneously and appear on the left- and the right-hand side of equation. We run the estimate using the xsmle package from Stata that is based on QML estimation technique. We both introduced individual fixed effects and time fixed effects. The main results are presented in table 6 below.

Table 6. QML estimates of French Departments’ borrowing

| Borrowing | Coef.       | Robust Std. Err. | Z    | P > |Z| |
|-----------|-------------|------------------|------|-----|---|
| Inv       | .5593035*** | .017834          | 31.36| 0.000|
| Int       | .2523156*** | .0318774         | 7.92 | 0.000|
| Growth    | –1.91e+07   | 2.45e+07         | –0.78| 0.434|
| Pop       | 67.86756*** | 16.60894         | 4.09 | 0.000|
| Pol       | 9640.120*** | 2360362          | 4.08 | 0.000|

| Spatial lag of X | Coef.       | Robust Std. Err. | Z    | P > |Z| |
|------------------|-------------|------------------|------|-----|---|
| Inv              | –.2131249***| .0326055         | –6.54| 0.000|
| Int              | –.0082604   | .068141          | –0.12| 0.904|
| Growth           | –1.56e+07   | 2.90e+07         | –0.54| 0.591|
| Pop              | 112.5242*** | 30.21359         | 3.72 | 0.000|
| Pol              | 2302.030    | 4506846          | 0.51 | 0.610|

| Spatial ρ       | .2230805*** | .0384455         | 5.80 | 0.000|
| Variance σ²     | 3.66e+14*** | 2.57e+14         | 5.12 | 0.000|

Fixed-effects | Yes
Time-effects   | Yes
Mean of fixed-effects | –1.5e+08
Log-likelihood | 2.270e+04
R²            | Overall=0.5538

Signif. codes: 0.001 ‘***’ 0.01 ‘**’ 0.05 ‘*’ 0.1 ‘.’ 1
n = 96, T = 13, N = 1248.
The model is estimated using the bias correction procedure proposed by Lee and Yu [2010] with maximum likelihood.

The first main result is that significant spatial borrowing interactions exist between French Department. Indeed, the spatial coefficient ρ is statistically significant at the 1% level. Here a 1-euro increase in borrowing by the neighboring Departments will increase the considered Department’s borrowing by 22 cents. This result shows that the borrowing behaviour of Departments as measured by actual budget exhibits an increase of the systemic risk. Concerning the other variables, four of them are significant at the 1% level. Only the growth rate variable is not significant.

The comprehensive interpretation of the estimates would require computing the marginal effects. Yet, we can already notice that the coefficients of these four variables are positive, i.e. an increase in the considered variable generates an increase in borrowing. In the case of investment expenditures,
this result is the expected one and in line with other existing studies on French local public finance (see Dufrénot, Frouté, Schalck 2011) and with the Golden rule. Everything else being equal an increase in investment expenditures will increase the financial needs that are partly covered with borrowing. It corresponds to a quantity effect. The interest rate variable is also significant. It means that financing conditions are also influencing borrowing decisions. In other words, the price effect does also play a role in the context of French Departments. We can suspect that financiers may impose a higher price for financing unexpected investments. Departments may be captive when they must repair schools or roads for instance. This may explain why the coefficient is positive.

An increase in the population level will also positively influence borrowing. Here, the quantity effect and the price effect may be at play. Indeed, everything else being equal, an increase in population will lead to an increase in social needs that may necessitate more investment that will generate an increase in borrowing. In the meantime, everything else being equal, an increase of population will enable to finance borrowing more easily because of an increase in fiscal revenues. The fourth significant and positive coefficient is the right-wing political orientation of Departments. Everything else being equal it seems that right-wing Departments are using more borrowing to finance public investment. This result suggests that financial decisions are not only based on financial variables but that other factors may be at play. These factors are important components to be considered when considering issues such as financial risks. The last variable, the growth coefficient, is not significant. Two issues are worth commenting. First, this insignificance may be due to the fact that Department investments decision are not driven by production concerns. It may also be due to the fact that the Department’s scale is not the appropriate level for assessing the local generation of added value (see Bouba-Olga and Grossetti 2015 and Larceneux 2018 for discussion of such issues at the French Regional level).

We can also note that only two spatially lagged variables of $X_{jt}$ are significant: investment expenditures and population. The spatially lagged coefficient associated with the investment expenditures is negative. It means that if neighbor departments investment expenditures are increasing, the considered department will decrease its borrowing. This may be explained by cross-border effects. The positive and significant spatially lagged coefficient associated with the population can be linked to the same kind of argument. The demographic pressure of neighbor department may induce an increase of investment expenditures financed by borrowing.

As stressed by Lesage and Pace 2009, the interpretation of coefficient necessitates to distinguish direct from indirect effects. Direct effects describe how borrowing in Department $i$ changes in the case of a change in the $k_{th}$ regressor in this Department. The indirect effect describes how a change in the independent variable in Department $i$ changes the dependent variable in Department $j$. The sum of the direct and the indirect effects is the total effect.

9. We can note that similar results can be observed in the German context Langer 2019. Right-wing parties in North Rhine-Westphalia are investing more than other parties in average.
In our case, only direct and total effects are statistically significant. In other words, the indirect effects are not significant. This result is in line with the insignificance of the coefficient in equation 2 previously mentioned. It can be interpreted as the fact that French Departments are not sensible to the “domino” effect phenomenon. A hypothetical failure from one Department due to an idiosyncratic shock will not cause the failure of a neighboring Department because of a spillover effect. Nevertheless, the significance of the total effect means that French Departments are sensible to the consequence of severe and widespread “systematic” shocks. In other words, spatial multiplier is at play.

4. Conclusion and discussion

Using a unique and innovative database on French Departments gathering data on 96 Departments over the period 2005-2017, this paper examines the spatial determinants of French Departments’ borrowing decisions. To our knowledge, this has never been done before while it is a crucial issue because the aftermaths of the financial crisis have weakened some Departments financial stability and because they have profoundly reshaped the French local financing system with the collapse of Dexia and the birth of new actors such as the Agence France Locale which claims to be willing to gain up to 25% of the market shares.

To deal with this issue, the database was built thanks to final budgets from French Departments. Following an empirical strategy suggested by Elhorst, [2014], Lesage [2014] and Belotti, Hughes and Piano Mortari [2016] for dealing with spatial panel data we performed different specification tests that led to assess a fixed effects spatial Durbin model.

Following Elhorst [2010] as well as Anselin [1988], Fréret and Maguain [2017] and Langer [2019] we estimate the model with a quasi-maximum likelihood estimator in order to consider spatial dependence between observations and endogeneity issues.

This specification enables to test for two kinds of spatial effects. First, a spatial multiplier, which means that an individual variable will be influenced by its own determinants and by what affects its neighbors. Second, spillover or contagion effects, the influence of an individual behavior on its neighbors. In terms of public policy, the first effect means that the effects of a systemic shock will be worsened by the whole influence of neighbors and by contagion adverse effects. The second effect means that in the case of an adverse shock, the consequences will be spread through a contagion process driven by neighboring spatial interactions. This must be considered when reforming the regulatory framework governing local government financing, especially in the case of French Departments that is the most financially fragile tier of local government because 85% of their budget is destined to finance...
social expenditures that they do not control. Estimates show that the spatial multiplier effect is significant. When neighboring Departments are increasing borrowing by 1 euro, the considered Department will increase its borrowing by 22 cents. Actual borrowing decisions have led to spread the adverse consequence of systemic shock. However, estimates show that spillover effects are not statistically significant in the case of French Metropolitan Departments.

The main issue is to assess if this result will last. Indeed, the observed and anticipated concentration process in the financial industry providing loans to Departments may change this result. If financers possess a larger financing capacity, they may provide more loans which may lead to increase the systemic risk because financers will be less constrained in their capacity to grant new loans.

Hence, this paper suggests to carefully consider spatial determinants of financing decisions when considering regulatory reforms, especially when local networks exist and may increase the diffusion of economic processes. In the case of French Departments, one may think about the ‘Association des Départements de France’ on the demand side or about the geographical organization of the banking industry on the supply side.

The obtained results argue for further researches. First, we need to collect more data at the local level in order to refine the analysis. Second, we could extend the analysis to a dynamic framework such as dynamic spatial Durbin model following seminal paper from Debarsy, Ertur and Lesage [2012] or addressing the issue of heterogeneity in a spatial context with quantile regressions (McMillen [2013]).

References


ANSELIN L. [1988], *Spatial econometrics: Methods and models*, Springer.

ARBIA G. [2014], *A Primer for Spatial Econometrics, With Applications in R*, Palgrave Macmillan.


BELOTTI F., HUGHES G., PIANO MORTARI A. [2016], Spatial panel data models using Stata, *The Stata Journal*, 17(1), 139-180.

BOUBA-OLGA O., GROSETTI M. [2015], La métropolisation, horizon indépassable de la croissance économique ?, *Revue de l’OFCE*, 143(7), 117-144.


CHARLOT S., PATY S., PIGUET V. [2015], Does fiscal cooperation increase local tax rates in urban areas?, Regional Studies, Taylor & Francis (Routledge), 49(10), 1706-1721.


DEBARSY N., ERTUR C. and LESAGE J. [2012], Interpreting dynamic space-time panel data models, Statistical Methodology, 9(1-2), 158-171.

DI PORTO E., PATY S. [2018], Cooperation among local governments to deliver public services, Politics and Policy, 46(5), 790-820.


FRÉRET S., FRÈRE Q., LEPRINCE M., PATY S. [2014], The impact of inter-municipal cooperation on local public spending, Urban Studies, 51(8), 1741-1760.


LESAGE J. P. [2014], What regional scientists need to know about spatial econometrics, Review of Regional Studies, 44, 13-32.


MCMILLEN D. [2013], Quantile Regression for Spatial Data, Springer Briefs in Regional Science.

PERUCCA G. [2014], The Role of Territorial Capital in Local Economic Growth; Evidence from Italy, European Planning Studies, 22(3), 537-562.

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STANDARD & POOR’S GLOBAL RATINGS [2018], French Local Anal Regional Governments’ New Borrowings Are Likely To Remain At Rock Bottom, February 22nd.
