Dynamics of Local Public Debt: the case of French municipalities

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Abstract

This article analyzes the behavior of debts and investment in a model of simultaneous equations in panel. The link between debts and investment is enriched by additional factors such as regional influence or electoral cycle. French municipalities are quite disciplined and local debt is a substitute to other means of fundings. Nevertheless, this behavior acts negatively for the development of low-income and small municipalities. Local investment is also positively infuenced by the end-of-term of policy-makers.

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1 Introduction

For more than twenty years, French local authorities have tended to favor self-financing resources to support their investments. However, in 2002, local authorities started to increase their outstanding amounts of loans (Guenguant, 2007). The decreasing trend in French public debt could have different impact on public investments. First, the development of public investment could have been unchanged if municipalities had developped autonomous capacities of financing, either by raising the level of taxes, or by mutualizing the supply of the long-lasting public goods (by developing the links between local authorities). Second, local authorities could have reduced the level of the realized investment. In this paper, we focus on the relationship between the development of local public debt and the development of public investment.

The dynamics of local public debt has received few attention in economic literature. Some theoretical works[1] and empirical studies suggest that local borrowing is explained by socio-economic and political factors (Bahl and Duncombe, 1993; Clingermayer and Wood, 1995; Sharp, 1986). Break (1980) argues that central State grants can act as substitutes or as complementary means to fund local public expenditures. Sanders (1995) shows that central State grants and differences in local incomes can impact on the behavior of local public borrowing.

Political structures play a significant role in the behavior of local authorities. Laws aiming at limiting increases in local taxes and local expenditures[2] or the adoption of new loans by referenda directly impact on the level of local public debts(Sanders, 1995).

Moreover, the Weak Government Hyptohesis (WGH) has received strong empirical support. Public deficits and debts are higher when ruling parties have to form into a coalition (Tovmo, 2001; Borge, 2003; Hagen and Vabo, 2005; Rattsø and Tovmo, 2002; Jochimsen and Nuscheler, 2004; Rumi, 2004; Schaltegger and Feld, 2004). Debts and deficits are also the outcome of a strategic behavior adopted by local decision-makers, who let the debt grow in order to compromise options for the future government (Persson, 1989; Alesina and Tabellini, 1990; Tabellini and Alesina, 1990). In these conditions, the ruling party that wants to be reelected tend to increase public spendings and debt before the elections (Baber and Sen, 1986; Clingermayer and Wood, 1995).

However, these papers do not take into account the influence of the investment as the explanatory factor of the behavior of borrowing. Following Know (2006), the behavior of debts of the municipalities is examined through its interaction with investment in a model that allows for capturing the impact of both regional influence (Peterson, 1995) and electoral cycle (Binet and Pentecote, 2006) on the local public debt 's development.

[1]See Adam, 1988; Fuchs, 1992; Sanders, 1992; Sbragia, 1983; 1986; Montkonen, 1984; Perry, 1995.

[2]Proposition 13(People's Initiative to Limit Property Taxation), enacted in 1978 is embodied in the Consitution of the State of California, limits the ability of the State to increase property taxes.

The paper is organised as follows. Section 2 presents the empirical econometric frame and specification. Section 3 analyzes the results. Finally, section 4 conclude

2 Model specification

By modelling the interactions between local public debts and local public investments, we pursue a twofold objective. On the one hand, we try to measure how choices of investment influence the development of public debts. On the other hand we examine the relative importance of several factors capable of reducing the appeal to debt when financing new investments ; such as the pre-existing debt burden, the cost of financing, the electoral cycle.

2.1 Explanatory variables

The basic specification of the ready-to-estimate system of simultaneous equation can be written as follows:

$$\begin{cases} I_{i,t} = \alpha_i + \alpha_0 I_{i,t-1} + \alpha_1 \Delta B_{i,t} + \alpha_2 X_{i,t} + \alpha_3 Z^I_{i,t} + \epsilon^I_{i,t} \\ \Delta B_{i,t} = \beta_i + \beta_0 \Delta B_{i,t-1} + \beta_1 I_{i,t} + \beta_2 X_{i,t} + \beta_3 Z^B_{i,t} + \epsilon^B_{i,t} \end{cases}$$

Vectors $I_{i,t}$ and $\Delta B_{i,t}$ contain respectively the series of investment and first differences of the debt of the municipalities (indicated $i = 1, ..., 660$) at every date (indicated $t = 1986, ..., 1997$). The dependent variable in the second equation, is the first difference of the public debt instead of the oustanding amount of local debt because we expect to explain the choice of financing investment by new debts.
A fixed individual effect (α_i and β_i) is introduced in every equation. Explanatory variables are broken down into three categories. In each of the equation of the system, an individual fixed effect is introduced , the other explanatory variables can be grouped together (included) in four categories.

First, every equation contains **a term of interaction** i.e. the dependent variable of each equation is introduced as an explanatory variable in the other one. In turn, the municipal investment is supposed to depend on the debt (coefficient α_1) and the investment influences the debt (coefficient β_1). We will discuss the expected sign of this coefficient in the next paragraph.

The second type of explanatory variables included in the matrix $X_{i,t}$ is composed of **common factors** that may influence both changes in debt levels and in amounts of investments. $X_{i,t}$ contains seven variables.

$$X_{i,t} = (T_t \ ; \ R_t \ ; \ R_{t-1} \ ; \ POP_{i,t} \ ; \ CENSUS_t \ ; \ SELF_{i,t} \ ; \ INCOME_{i,t})$$

- T_t represents a temporal trend.
- R_t and R_{t-1} represent the current and lagged interest rate of the bond market, respectively. These variables are proxies of the interest rate to which municipal debts are signed, and represent cost of debt financing that may influence the choice of investment and debt issuance.
- $POP_{i,t}$ stands for the population of the municipality. It captures the impact of the size of municipalities. The dummy variable $CENSUS_t$ takes the value 1 in 1989 and 0 otherwise. This year corresponds to the date of the census organized during the period of analysis and marks obviously a break in the series of population.
- $SELF_{i,t}$ symbolizes the margin of self-financing loosened by the municipalities. This variable is introduced to take into account the alternative fundings of investment.
- Finally, the municipal income ($INCOME_{i,t}$ is measured by the fiscal potential of every municipality and introduced in the model to get characteristics of the economic environment of the municipality.

Every equation also contains **specific variables**. $Z^B_{i,t}$ for the equation of debt and $Z^I_{i,t}$ for the equation of investment

- The vector $Z^B_{i,t} = B_{i,1986}$ contains only the initial level of debt in 1986. We assume the debt burden may reduce the appeal to debt for financing new investments but it has no direct impact on the level of investment.
- The matrix $Z^I_{i,t} = (CSE_{i,t}, CSF_{i,t}, REGION_i)$ collects three specific variables in the equation of investment. CSE and CSF represent Central Subsidies for Equipment and Central Subsidies for Functioning respectively. These subsidies are the main revenues received by municipalities from the central government. Finally, the model integrates a regional dummy variable $REGION$ which gets the membership of every municipality in the same region and takes into account the geographical nearness of municipalities and the multi-level decision and fundings of local investments.

The fourth type of variables in every equation is the **lagged dependent variable**. This specification may improve the quality of the realized adjustment by taking into account the inertia of investments and debt dynamics.
Except for interest rates and population, variables are expressed per capita in order to reduce the heterogeneity of the panel. The dabase includes observations of 660 municipalities of more than 10 000 inhabitants and covers the period 1986-1997.

2.2 Method of Estimation

The system of dynamic equations in panel data[3] is estimated by the generalized method of moments by using the procedure of Arellano and Bond (1991). At first variables are

[3]The appendix displays results of estimation with cross-section data

differentiated to cancel the fixed effect and instruments are built by using variables in level. For lagged endogenous variable, a different instrument is built at every date using all remaining possible lags.

3 Results

Table 1 summarizes the results of our estimation. Column (a) displays results of the basic specification. Changes in local public debts are significantly explained by the initial level of debt in 1986. The issue of new debts is negatively related to the pre-existing level of debts. French municipalities tend to adopt a quite disciplined behavior. Moreover, the negative coefficient of the lagged variation of debt captures the decreasing trend of local debts along the period. The appeal to debt is also negatively related to the local income and to the self-financing margin of the municipalities. In turn, debt issuance and self-financing are considered as sustitute ways of funding investments. Consequently, lowest income municipalities (which could also have little self financing margins) tend to more indebted.

Surprisingly interest rates do not impact significantly on the appeal to debt. This result can be due to the fact that we used a macro proxy for the interest rates of local public debts. Moreover, at the time, local public debt was mainly labelled at constant rate.

Local investment leads to a small increase in the local public debt. One euro of investment generates less than 0.5 euro of new debt.

Results of estimation for the second equation of the system show that local investment follows a strong decreasing trend along the period. The local investiment negatively depends on interest rates but it is positively related to the size of the municipality, the margin of self financing, the central subsidy for equipment and the increase of local debt.

Columns (b) and (c) in table 1 display results of estimation when introducing dummy variables for electoral cycles. ELECT1 takes the value 1 each year of local election (1997 and 1993 in most of the cities) and 0 otherwise. ELECT2 takes the value 1 each previous year of the election. We find a significant and positive impact of the electoral cycle on the level of investments. Local government tends to provide more public good equipment before their term.

Table 1. Simultaneous equations system in panel data

	(a)		(b)		(c)	
Dep. Variable	$\Delta B_{i,t}$	$I_{i,t}$	$\Delta B_{i,t}$	$I_{i,t}$	$\Delta B_{i,t}$	$I_{i,t}$
$I_{i,t}$	0,49		0,45		0,49	
	(0,10)***		(0,10)***		(0,10)***	
$I_{i,t-1}$	-	0,1		0,1		0,09
		(0,02)***		(0,02)***		(0,02)***
$\Delta B_{i,t}$	-	0,18		0,18		0,19
		(0,02)***		(12,18)***		(0,01)***
$\Delta B_{i,t-1}$	-0,02		-0,02		-0,02	
	(0,007)***		(0,007)***		(0,007)***	
T_t	1,23	-29,52	-4,63	-29,56	-9,83	-30,92
	(9,22)	(2,86)***	(10,94)	(2,94)***	(14,87)	(2,89)***
R_t	14,53	-42,16	-4,13	-41,65	9,33	-52,26
	(19,70)	(8,88)***	(28,18)	(9,74)***	(21,40)	(9,78)***
R_{t-1}	26,63	8,06	32,9	7,46	4,67	17,31
	(17,87)	(9,64)	(18,99)*	(11,16)	(24,57)	(10,74)*
$POP_{i,t}$	-0,00	2,30E-04	-8,20E-06	2,30E-04	-1,20E-05	2,30E-04
	(0,00)	(5,9E-05)***	(8,98E-5)	(5,9E-5)***	(8,88E-5)	(5,9E-5)***
$CENSUS_t$	-332,02	505,29	-174,63	506,11	6,08	511,38
	(201,6)*	(56,89)***	(267,18)	(58,76)***	(395,66)	(57,11)***
$SELF_{i,t}$	-0,25	0,92	-0,21	0,92	-0,26	0,93
	(0,13)*	(0,04)***	(0,13)*	(0,04)***	(0,13)**	(0,04)***
$INCOME_{i,t}$	-9,6E-5	5,60E-06	-9,90E-05	6,50E-06	-9,40E-05	1,10E-05
	(5,2E-5)*	-3,40E-05	(5,3E-5)*	(3,4E-5)	(5,3E-5)*	(3,4E-5)
$B_{i,1986}$	-11,18		-11,8		-11,32	
	(2,26)***		(2,29)***		(2,28)***	
$CSF_{i,t}$		0,05		0,05		0,04
		(0,14)		(0,14)		(0,14)
$CSE_{i,t}$		2,39		2,4		2,44
		(0,90)***		(0,90)***		(0,88)***
$REGION_i$		-2,69		-2,69		-3,06
		(0,70)***		(0,72)***		(-4,45)***
ELECT1$_t$			-36,62	1,4		
			(-52,55)	(25,4)		
ELECT2$_t$					-58,01	51,98
					(60,96)	(19,56)***
J-Hansen	52,63 [0,05]	49,64 [0,06]	52,73 [0,05]	49,71 [0,06]	52,09 [0,05]	52,89 [0,03]
R bar 2	0,14	0,12	0,14	0,12	0,14	0,12

*$p < 0.1$; **$p < 0.5$: ***$p < 0.01$. Standard errors in brackets.
Estimation by GMM. J-Hansen: Over-identification test of instrumental variables. P-value in brackets.

4 Conclusion

From the mid 1980s to the 1990s French municipalicities tended to restrict their investments and to reduce their level of debts. During that time, relationship between municipalities (inter-municipal institutions like "métropole" or "cities community") were not developped and intra-regional transfers were not possible. We then used this specific period to analyze the interations beween local debt and local investment. Using a system of dynamic simultaneous equations with panel data, we show that:

1. French municipalities maintain highly sustainable level of public debts.
2. The appeal to debt is a substitute to other means of fundings.
3. Local investment per inhabitant is increasing with both the size of municipalities and the end of term of mayors.

This globlal behavior could have negative impact for small and low-income municipalities that do not use the debt for funding their needed investment. Largest cities benefit from more various means of fundings and provide more local public investments to their inhabitants.

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Appendix: Estimation in cross section

In a first stage the model is estimated by exploiting only the intermunicipal differences. We consider the model in cross section by taking the average series over the 12 year period:

$$\begin{cases} \overline{I}_{i,.} = & \alpha_0 + \alpha_1 \overline{B}_{i,.} + \alpha_2 \overline{INCOME}_{i,.} + \alpha_3 \overline{POP}_{i,.} + \alpha_4 \overline{CSF}_{i,.} + \alpha_5 \overline{CSE}_{i,.} + \epsilon^I_{i,.} \\ \overline{B}_{i,.} = & \beta_0 + \beta_1 \overline{I}_{i,.} + \beta_2 \overline{INCOME}_{i,.} + \beta_3 \overline{POP}_{i,.} + \beta_4 \overline{REG}_{i,.} + \beta_5 \overline{GEO}_{i,.} + \epsilon^B_{i,.} \end{cases}$$

The dummy variable GEO, distinguishes the municipalities by their geographical place. This variable measures the effect of a municipality to be situated in the North or in the South.

The results are displayed in table 1. In this specification, the level of the municipal debt increases the investment but less than proportionally ($\alpha_1 = 0,06$). On the other hand, the increase in investment grows up the local debt ($\beta_1 = 4.70$). In this paper on American data Kwon (2006) obtains coefficients of 0.57 and 9.22. Local income positively influences the level of the municipal investment, which confirms the interpretation of this variable as a proxy of the municipal income getting demand for better equipments. The financial receipts, the central subsidies of equipment and functioning also positively influence the level of investment.

The explanation of the variable of debts is less clear, the economic variables (POP and $INCOME$) do not seem significant. It is only the level of investment and the dummy of location that influence the level of the debt.

At this stage we were not able to introduce the variable of interest rate (which is the same for all the municipalities) in the equations, the equations of the system being then colinear.

Table 1: Simultaneous equations in cross section

	(1)		(2)	
var. dep.	I		B	
Constante	0,09	(0,07)	1,87***	(0,31)
B	0,06***	(0,00)		
I			4,70***	(0,25)
$INCOME$	0,97***	(0,14)	-0,89	(1,12)
POP	0,00***	(0,00)	0,00	(0,00)
CSF	0,09**	(0,05)		
CSE	6,54***	(0,71)		
REG			0,00	(0,02)
GEO			1,13***	(0,23)
N	660		660	
R^2	0,50		0,41	
DW	1,86		1,91	

*$p < 0.1$; **$p < 0.5$: ***$p < 0.01$. Standard errors in brackets.

Estimation by GLS.