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Urban sprawl and regional growth: empirical evidence from Italian Regions

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Abstract

Urban sprawl may affect economic growth through its negative effects on a number of relevant aspects of the economic activity. The negative effect may be due either by the increase in infrastructure's cost of provision within the national area and the reduction in productivity of farmland or by the increase in distortionary local taxes or subsidies. Furthermore, urbanization of remote rural area may also have important negative effects on public health, decreasing labour productivity.

Using Italian regional data, this paper provides empirical evidence of the negative impact of urban sprawl on regional economic growth in Italy. The results suggest that the containment of urban sprawl may lead to higher regional GDP growth rate.

Keywords: Urban Sprawl; regional growth; Italian Regions.

JEL Classification: R10; R14; H73; H77.

1. Introduction

Urban sprawl is characterized by compact growth around a number of smaller centres located at a distance from the main urban core (Clawson 1973).

Literature on the negative effect of urban sprawl is increasing over time. In fact, urban sprawl implies low density developments, large outward expansions, and leapfrog growth patterns that are likely to produce a number of negative effect on the economic activity. Many studies are focused on the negative impact of urban sprawl on the infrastructure's cost of provision within the national area.[1] The transport savings component of high urban density is a central topic to the new economic geography literature (Fujita, Krugman, and Venables 1999). Furthermore, at the local level, the higher the urban density, the lower the per-capita length of collector roads, water distribution lines, or sewer collection lines and, consequently, the lower the per capita public expenditure in infrastructures (Carruthers and Ulfarsson 2003).

At the regional or state level, the spatial pattern of urbanised areas is particularly important. In compact, contiguous patterns, infrastructure costs are significantly lower

[1] See Burchell et al. (2005) for an exhaustive literature review on urban sprawl and infrastructures' cost.

than in spread-out patterns (Speir and Stephenson 2002), while, in highly dispersed service areas, the length of inter-neighbourhood service components that connect separated service areas is higher than average (Burchell et al. 1998). Furthermore, urban systems with a higher concentration in central cities are more likely to benefit from efficiency gains offered by economies of scale. In fact, a larger number of people in larger cities carries fixed costs, so that the per-capita costs are lower than in small towns or spread-out subdivisions (Carruthers and Ulfarsson 2003).

Consequently, sometimes national governments choose not to invest sufficiently in internal transport and telecommunications, especially in less populated regions (Henderson and Kuncoro 1996). It follows that the negative impact of urban sprawl on economic growth is magnified in regions characterized by both high dispersion and low population.

Urban sprawl has important economic effects on the private sector too. Manufacturing and services' provision is much more efficient when concentrated in dense business-industrial districts in cities. In fact, spatial proximity promotes information spillovers amongst producers and more efficient labour markets and the existence of localized scale externalities has been tested through a number of empirical studies (Capello e Nijkamp 1996, Henderson 1988, Ciccone and Hall 1995, Glaeser et al. 1992).

Urban sprawl may also cause an increase in distortionary local taxes or subsidies. In fact, if people are more dispersed and do not reside in centralised cities, the consequent increase in costs of community infrastructure and public services tends to be financed by local taxes or user fees that are generally independent of location, causing remote development to be subsidised (Brueckner 2000, Heimlich and Anderson 2001, Wasserman 2000). Furthermore, high urban density can give some advantages on raising local tax more efficiently. In fact, tax compliance may be less expensive in the presence of high population density in urban areas, implying overall higher tax compliance. On the other hand, because people live close to their neighbours in urban setting, informal transaction become more feasible, which in turn will tend to reduce tax collection of both indirect and direct taxes (Kau and Rubin 1981). It follows that the overall effect of urban sprawl on local revenues is ambiguous.

Urban sprawl may also cause a number of environmental damages that result in high economic costs. In fact, sprawled development not only decreases the amount of forest area and woodland (Macie and Moll 1989; MacDonald and Rudel 2005, Hedblom and Soderstrom 2008) but also fragments farmland's ecosystems and habitats (McArthur and Wilson 1967, O'Connor et al. 1990, Lassila 1999) causing a reduction of the productivity in the primary sector of the economy (Harvey and Clark 1965).

In addition, provincial tax and land-use policies related to urban sprawl create financial pressures that propel farmers to sell productive land to speculators, causing the loss of hundreds of hectares of productive agricultural land per year. (Berry and Plaut 1978, Fischel 1982, Nelson 1990, Burchell et al. 2005).

Urbanization of remote rural area may also have important negative effects on public health, reducing labour force's productivity. In fact, one of the main features of sprawl is increasing car dependency and more automobile travels that cause more health hazards, air pollution, motor vehicle crashes, and pedestrian injuries and fatalities (Frumkin 2002, Savitch 2003, Sturm and Cohen 2004, Yanos 2007).

Besides this introduction, the rest of the paper is organized as follows: section 2 introduce the urban sprawl problem in the Italian framework; section 3 shows the econometric strategy and the data, while section 4 discusses the results of the estimates. Finally, section 5 concludes. Tables and figures are placed in the appendix.

2. Urban Sprawl in Italy

The containment of sprawl is largely debated across European Countries and it is a central issue in urban planning policies. This is not the case in Italy. For some reason, sprawl in Italy is not perceived as a negative phenomenon (Gibelli and Salzano 2006).

However, the lack of interest on the Italian urban sprawl is unjustified. In fact, in Italy the territorial organisation of emerging urban systems is "outward oriented", whereas the spatial development of the existing urban system is "inward oriented". The result is a system of highly "dispersed cities" (Calafati 2003). A clear example of the peculiarity of the Italian urban sprawl is provided by the river Po' Valley (Turri 1990, 2004), in Northern Italy (figure 1 in appendix), characterized by a very complex network of small-medium urban centres not contiguous but strictly interconnected.[2]

Furthermore, the "Istituto Superiore per la Protezione e la Ricerca Ambientale" (ISPRA - The Italian national institute on environmental research) shows that in Italy, during the period 2000 - 2006, peripheral and sub-urban areas increased four times faster than city centres (ISPRA 2013). This trend is in contrast to what is happening in the rest of Europe (EEA 2010). In addition, the *Land Use and Cover Area frame Survey* of Eurostat (Eurostat 2013) shows that the percentage of soil covered by "artificial activities" (buildings, roads, housing, recreation and open pit mining) is about the 7.8% of the national territory, while the European average is the 4.6%. Italy is ranked at the fifth position after Malta (32.9%), Belgium (13.4%), Netherlands (12.2%) and Luxembourg (11.9%).

Urban sprawl in Italy is increasing over time, the percentage of land occupied by urban centres is increased by more than 10% in many Italian regions in the period 2001-2011 (Capozza 2015). Furthermore, Italian 'dispersed cities' score very highly in Europe for air pollution generated by cars, traffic congestion and demand for transport infrastructures and the empirical evidence being accumulated in Italy corroborates the hypothesis of the extremely high – unsustainable – 'running costs' of the Italian dispersed cities (Camagni et al. 2002).

Italy i salso characterized by a lack of coordination in planning policies in order to harmonize the urban expansion and the farmland use (Di Iacovo et al. 2010). Uncontrolled urban espansion and land use are causing serious damages to the specific public functions of the farmland, such as food production, land feritilty, water cycle etc. (Rovai et al. 2010).

The negative effects of the urban sprawl described above lead to consider a significant negative effect of urban sprawl on regional growth in Italy. The aim of this paper is to provide an empirical test for the existence of the inverted relationship between urban sprawl and economic growth at regional level.

To that end, we use a dataset based on a panel of Italian sub-national governments (regions) over the 1996-2009 period. Italian regions are supposed to be a good laboratory for applied analyses on urban sprawl, inasmuch as they share relevant

[2] The image in figure 1 is in the public domain because it is a detail of an image solely created by NASA. NASA copyright policy states "NASA material is not protected by copyright unless noted". See http://www.jsc.nasa.gov/policies.html#Guidelines for further details.

common institutional features but sensibly differ in the urban sprawl degree. In fact, looking at figure 1, it is apparent that the presence of urban sprawl on the Italian territory is heterogeneous, interesting the Po' Valley, the East coast and the regions close to the metropolitan areas of Rome and Naples in larger measure.

3. The data and the empirical strategy

The econometric specification used in this paper is based on the literature on the effect of government size on GDP growth, following the studies of Barro (1990a, 1990b), Rahn and Fox (1996), Scully (1994, 1995, 2000, 2002, 2003) and Pevcin (2004, 2008). Similar analyses have been conducted by Di Liddo et al. (2015) basing on regional data, taking into account also the degree of decentralization in sub-national jurisdictions.

In the following empirical analysis, the dependent variable is the regional GDP growth in percentage and the independent variable of interest is a measure of urban sprawl suggested by Downs (1999), that is, the percentage of total population living outside the urbanized area. In this case, we consider as urbanized areas the chef-lieus of the 110 Italian provinces.

3.1 The data

The dataset covers on a panel of Italian regional jurisdictions over the 1996-2009 period. The analysis is focused on the fifteen Italian regions with ordinary statutes. In fact, Italian special status regions have a higher level of legislative autonomy from the central government by virtue of a special statute that allows them to make laws in more fields than the other fifteen regions do, including territorial planning. Following Fiorino and Ricciuti (2007), we exclude special status regions from our analysis.

Data on regional GDP are taken from the reconstruction of official Italian Regional Economic Accounts provided by the Italian National Statistical Institute (ISTAT). These provide a detailed time-homogeneous series for the years 1996-2009 (ISTAT, 2010). Census data are taken from DEMO ISTAT.[3]

The dataset also contains a set of control variables. Data on decomposition of expenditure and revenue among different tiers of Italian levels of governments are taken from the Regional Public Accounts (RPA) produced by ISTAT et al. (2012), a database created jointly by the Italian National Institute of Statistics (ISTAT), the State General Accounting Department (RGS), the Organization for Economic Co-operation and Development (OECD) and other central and local institutions.

The database provides annual data on public sector and it allows for the analysis of various sub-aggregates, covering different macro-areas and administrative regions. The public sector comprises, in addition to general government, a sector consisting of central and subnational entities that operate in public services segment, subjected to direct or indirect control over their management by public entities and/or receiving financing from such entities.

In the RPA database, data on expenditures are consolidated, i.e. each entity is represented as a final expenditure unit by eliminating flows between entities in the same

[3] The dataset is available at http://demo.istat.it/.

level of government. Therefore, it is possible to clearly distinguish between expenditures of central and subnational administrations, allowing to create decentralization measures as ratios of subnational expenditures to total public expenditures.

We measure the level of fiscal decentralization as the fraction of public spending under control of the subnational governments in the total public expenditure (central, regional and local government) allocated to each region as a geographic entity. Instead, the size of government is measured as the percentage of the total public expenditure (central and regional and local governments) registered in each region over the GDP of the regional economy. In order to capture the level of fiscal decentralization from the revenue side we computed the ratio between subnational own tax revenue and local current expenditure, which corresponds to an inverse measure of vertical fiscal imbalance (VFI), this terms should also capture the impact of different fiscal policies followed by local governments. Political variables are taken from the Italian Ministry of the Interior[4] while data on the degree of openness (Export and Import/GDP) of the regional economies are taken from Territorial Indicators of ISTAT.[5] Table 2 in appendix shows the main descriptive statistics.

3.2 Empirical model

Panel data methodology allows us to control for individual countries' heterogeneity as well as to obtain more information through increased variability, less collinearity among variables and greater degrees of freedom. Panel data are better able to study the dynamics of adjustment and to identify and measure some effects not detectable in pure cross-section and time-series data.

In particular, our dynamic econometric model is an extension of the model used by Forte and Magazzino (2011) and Di Liddo et al. (2015). The econometric specification, in a semi-matrix notation, is:

1) $$g_{it} = \beta\, Urban_{sprawl_{it}} + \rho_1 govsize_{i(t-1)} + \rho_1 govsize^2_{1(t-1)} + \delta' D_{it} + \vartheta' V_{it} + \gamma_1' I^D_{it} + \gamma_2' I^V_{it} + \theta' C_{i(t-1)} + \omega' T + \sum_{j=1}^{j} \varphi_j g_{i(t-j)} + \alpha_i + \varepsilon_{it},$$

where *i* is the regional index and *t* is the year index. Variable *g* is the growth rate of regional GDP approximated by the first difference of the logarithm of GDP, *govsize* is the total expenditure-GDP ratio and *Urban_sprawl* is our measure of urban sprawl, given by the percentage of regional population living outside the main cities (Italian provincial Chef-lieus). *D* is a second order polynomial of our measure of expenditure decentralization, *V* is a second order polynomial of an inverse measure of the vertical fiscal imbalance (VFI), I^D represents the interaction term between the government size and the level of expenditure decentralization and I^V represents the interaction term between the government size and the local fiscal policy. *C* is a set of variables which includes census (population, percentage of population under 0-14, percentage of population over 65), political (centre-left regional government dummy and margin of victory), and economic controls (export and import extra-EU as a percentage of GDP

[4] Data are available at http://elezionistorico.interno.it/
[5] Data are available at http://sitis.istat.it/sitis/html/

and inflation rate). *T* is a quadratic trend, α_i captures the unobserved heterogeneity and ε_{it} is the idiosyncratic stochastic component.

Note that we use lagged values for the government size and not for the urban sprawl and decentralization index. We make the assumption that public expenditure effectuated at the period $t-1$ influences the growth rate in period *t*, while urban sprawl observed at period t regards commercial and transport decisions taken at period *t* and affects directly growth at time *t*. Furthermore, following the empirical literature, decentralization measure are not lagged.[6]

In order to test the negative impact of urban sprawl on growth, we do not expect to reject the H_0: $\beta < 0$ in order to test the negative effect of urban sprawl on the GDP growth.

Panel analyses[7] have been conducted through Generalised Methods of Moments (GMM) estimation for panel data. In particular, we used the Arellano and Bond (1991) estimator (GMM-DIFF), which consists in taking the equation to be estimated in first-differences in order to eliminate the specific-effect component. Then, lagged levels of the right-hand side variables are used as instruments.

The use of the dynamic estimations by difference GMM estimator is necessary because, when working with data on public expenditure and GDP, problems of endogeneity and autocorrelation are likely to arise. When such econometric problems exist, the traditional panel data estimators (Pooled OLS, Fixed Effects or Least Squares Dummy Variables (LSDV) and Random Effects) do not yield consistent estimates. Whilst the GMM dynamic panel data methods can simultaneously deal with the problem of persistence and endogeneity.

As regards the IV procedure, our set of instrumental variables is composed as follows. First of all we use the differences of the variables considered to be endogenous, such as GDP growth rate, urban sprawl, government size and the squared government size starting from lag 2 (GMM-style instruments). Subsequently, we use as additional instruments the remaining exogenous variables included in our specification (IV-style instruments).

4. Results

Table 1 reports the coefficient point estimates of the β coefficient and the p-value of the Sargan statistic obtained using different specifications. Table 3 in appendix reports the complete results for the relative six different specifications of the empirical model in equation (2), they differ in relation to the polynomial form of the government size and decentralization measures.

Table 1 shows negative and significant estimated coefficients associated to the urban sprawl measure in specifications (4-7). The negative sign is observed also in specifications (1-3), however, the estimates are not significant in these cases. The robustness of obtained coefficient estimates suggest a confirm of the existence of a negative relation between urban sprawl and economic growth.

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[6] For example, Eyraud and Lusinyan (2013). They use contemporary values of a VFI measure and lagged values of public debt.

[7] For a detailed analysis of panel modelling used see, among others: Wooldridge (2002), Baltagi (2005), and Roodman (2009).

Table 1: Dynamic estimations (Dependent variable: regional real GDP growth rate, GMM- Diff estimator)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GDP Growth rate lag	-0.120196	-0.113309	-0.066952	-0.110343	-0.029646	-0.014074	-0.015339
	(0.110)	(0.107)	(0.126)	(0.159)	(0.128)	(0.135)	(0.137)
Urban Sprawl	-0.008503	-0.008606	-0.008411	-0.010610*	-0.011819**	-0.013208**	-0.013088**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
p-value of Sargan statistic	0.195	0.178	0.288	0.125	0.130	0.108	0.0942

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

In order to test the validity of our results we have performed several robustness checks.

As first step, we checked the robustness of the dynamic estimates conducting the Arellano-Bond autocorrelation test to verify that the error terms in the levels equation are not autocorrelated. If this condition holds, then the error terms in the first-difference equation presents negative first-order autocorrelation, and zero-second order autocorrelation. The Arellano-Bond test for autocorrelation - which is applied to the first differenced residuals - reports a p-value smaller than 0.05 for all estimations, confirming that residuals are AR(1), as expected in the first differences. The Arellano-Bond test applied to the second differenced residuals reports a p-value greater than 0.05 for all estimations. As a result, it is possible to reject the hypothesis of autocorrelation in second differences, concluding that the error term in the levels equation is not autocorrelated.

Afterwards, we used the Sargan test in order to check the validity of the included instruments. In our estimates we register p-values of the Sargan test greater than 0.05, so we can confirm the validity of the instruments (under the null hypothesis, the estimates are not weakened by many instruments).

We also check the results using a classical Fixed Effect model. Results are reported in table 4 in appendix. Notwithstanding, final results remain qualitatively the same with all alternative specifications of the baseline model.

Regarding the coefficient point estimates on the control variables, we can see from table 3 in appendix that the inverted U-shaped relation between government size and growth is confirmed. In fact, the point estimations associated to the governments size result in positive and significant coefficients associated to the government size and negative and significant coefficients associated to the squared government size in specifications (5-7) while in specifications (1-4) the coefficients are not statistically significant.

Furthermore, in table 3 all specifications the inflation rate shows negative and significant estimated coefficients, providing strong evidence in favour of a negative relation between inflation and growth.

Regarding the inverse measure of vertical fiscal imbalance, an inverted U-shaped relation with economic growth emerges only from specification (5). Instead, in specifications (3) and (6-7) estimates we observe positive and significant estimated coefficients associated to the inverse measure of vertical fiscal imbalance, suggesting a linear relation between vertical imbalance and growth. In particular, we found evidence that an alignment between spending and revenue-raising competencies between local governments stimulates regional economic growth.

The estimated point coefficients (table 3) associated to the decentralization index are positive and significant in specifications (3) and (5-7) suggesting the existence of a linear relation between expenditure decentralization and regional economic growth.

To conclude, we also observe significant coefficients associated to the interaction terms between government size and expenditure decentralization (and to the squared interaction term), suggesting the existence of a bell-shaped curve between these variables and the regional economic growth.

5. Conclusions

Italy is characterized by a large presence of urban sprawl, defined as urbanization of rural areas around the main city centres.

There are many factors that induce to think that urban sprawl can affect negatively economic growth through its negative effects on a number of relevant aspects of economic activity.

The negative effect may be due either by the infrastructure’s cost of provision within the national area (Burchell et al. 2005) and the reduction in productivity of farmland (Harvey and Clark 1965) or by the increase in distortionary local taxes or subsidies (Brueckner 2000, Heimlich and Anderson 2001, Wasserman 2000),

Furthermore, urbanization of remote rural area may also have important negative effects on public health (Frumkin 2002, Savitch 2003, Yanos 2007, Sturm and Cohen 2004).

Through empirical analyses on Italian regional data this paper provides evidence in support of the hypothesis that the institutional and urban structure of local jurisdictions has an effect on economic growth.

From an institutional perspective, our results suggest that expenditure decentralization, accompanied by a balanced allocation of spending and revenue-raising competences between local governments may have an important role in stimulating regional economic growth. Furthermore, it may affect the inverted U-shaped relation between government’s size and economic growth (Di Liddo et al. 2015).

Regarding the urban geography of the Italian territory, our results provide a test on the negative impact of the urban sprawl on regional economic growth that may be due to the large number of factors illustrated above. Such factors includes increasing infrastructure and transport costs, health problems related to higher car dependency and negative effect on the local government fiscal structure.

The main policy implication that can be drown for Italy is that the lack of interest on the Italian urban sprawl is unjustified and that the design of urban patters in Italian regions is as important as the institutional design of the local public finance system.

The containment of sprawl is largely debated across European institutions and it is a central issue in urban planning policies of many European Countries. This is not the case in Italy, even if the Italian territory is particularly affected by the phenomenon. The results suggest that reducing urban sprawl may lead to an increase in economic growth and that planning policies aimed to reduce rural urbanization are strongly recommended for Italy.

The present study investigates the overall impact of urban sprawl, without giving information about the negative impact of the urban sprawl on the single aspects of the economic activity. In particular, further analysis will be necessary in order to investigate the possible different impact of urban sprawl on infrastructure public expenditure or local taxation.

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Appendix

Figure 1: The Night-time lights of Italy

Table 2: Descriptive statistics

Variable	N	Mean	SD	P5	P95	Min	Max
Real regional GDP growth rate	195	0.01	0.02	-0.04	0.04	-0.06	0.08
Urban Sprawl	210	71.05	10.7	38.4	84.82	35.18	85.54
Government size (Public expenditure/GDP)	210	0.52	0.09	0.37	0.66	0.34	0.74
Decentralization index (subnational/total expenditure)	210	0.28	0.04	0.19	0.34	0.14	0.36
Vertical fiscal imbalance (local own rev./local rev.)	210	0.44	0.15	0.23	0.73	0.11	1.01
Inflation rate	195	0.02	0.01	0.01	0.03	0.01	0.03
Export - Extra EU (% GDP)	135	17.97	9.69	1.13	32.13	0.91	34.39
Import - Extra EU (% GDP)	135	15.1	8.57	1.85	35.65	1.52	39.08
Centre-Left regional government (dummy)	210	0.62	0.49	0	1	0	1
Margin of victory (no. of seats in regional parliament)	210	12.3	4.69	6	20	6	25
Population (millions)	210	3.25	2.34	0.32	9.08	0.32	9.8
Population 0-14 (% total population)	195	14.05	2.28	10.7	18.6	10.2	19.38
Population over 65 (% total population)	195	19.18	2.91	13.89	24.57	13.3	25.72
Total expenditure CG (% GDP)	210	0.38	0.07	0.27	0.48	0.24	0.55
Total expenditure LG (% GDP)	210	0.06	0.01	0.04	0.09	0.04	0.1
Total expenditure RG (% GDP)	210	0.08	0.03	0.05	0.13	0.03	0.16
Own tax revenue CG (% total local expenditure)	210	0.1	0.02	0.07	0.14	0.05	0.17
Own tax revenue LG (% total local expenditure)	210	0.05	0.01	0.03	0.07	0.02	0.1
Own tax revenue RG (% total local expenditure)	210	0.04	0.02	0.02	0.09	0.01	0.12

Table 3: Dynamic estimations (Dependent variable: regional real GDP growth rate, GMM-Diff estimator)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GDP Growth rate lag	-0.120196	-0.113309	-0.066952	-0.110343	-0.029646	-0.014074	-0.015339
	(0.110)	(0.107)	(0.126)	(0.159)	(0.128)	(0.135)	(0.137)
Urban Sprawl	-0.008503	-0.008606	-0.008411	-0.010610*	-0.011819**	-0.013208**	-0.013088**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.006)
Gov. Size lag	0.207871	1.000216	0.638037	1.345712	11.457533***	13.275617***	13.313956***
	(0.129)	(0.662)	(0.646)	(1.017)	(3.836)	(3.653)	(3.705)
Squared Gov. Size lag		-0.690302	-0.360205	-1.135953	-10.732333***	-2.716329***	-2.769748***
		(0.563)	(0.543)	(0.954)	(3.470)	(3.439)	(3.496)
Gov. Size*VFI lag				-2.047294		-3.478488	-3.515956
				(1.898)		(1.989)	(2.010)
Squared Gov. Size*VFI lag				2.078718		3.591092*	3.679813*
				(1.860)		(2.002)	(2.040)
Gov. Size*Dec. lag					-36.233921**	-7.177588***	-37.179057***
					(12.959)	(12.369)	(12.509)
Sq. Gov. Size*Dec. lag					34.829346**	36.278145***	36.352909***
					(11.581)	(11.171)	(11.338)
Gov. Size*VFI*Dec. lag							-0.219765
							(0.586)
Population log	0.171083	0.163005	0.228276	0.260331	0.014288	0.049995	0.054528
	(0.186)	(0.197)	(0.175)	(0.170)	(0.196)	(0.166)	(0.168)
CL reg. government	0.001855	0.001924	-0.000148	-0.000024	0.000770	0.001256	0.001089
	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Margin of victory lag	0.000200	0.000125	0.000243	0.000042	0.000177	-0.000038	-0.000020
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Inflation rate lag	-2.128706***	-2.066645***	-2.445682***	-2.204887***	-2.471081***	-2.418318***	-2.449254***
	(0.471)	(0.455)	(0.489)	(0.689)	(0.669)	(0.590)	(0.573)
Economic openness lag	0.067713	0.091503	0.130650	0.126330	0.165203	0.160093	0.163138
	(0.079)	(0.080)	(0.092)	(0.111)	(0.104)	(0.102)	(0.101)
Dec. Index			0.342384**	0.891589	11.047830***	11.050220***	11.208919***
			(0.138)	(0.998)	(3.612)	(3.560)	(3.646)
VFI Measure			0.059676**	0.648503	0.191465**	0.988933*	1.024121*
			(0.020)	(0.487)	(0.073)	(0.494)	(0.502)
Squared VFI measure				-0.097850	-0.125825*	-0.113473	-0.122180
				(0.082)	(0.067)	(0.082)	(0.075)
Squared Dec. Index				-0.992125	-2.681842	-2.563023	-2.777901
				(1.712)	(1.576)	(1.736)	(1.585)
Population +65 years %				0.254751	0.007647	0.068311	0.075972
				(0.560)	(0.514)	(0.554)	(0.559)
Population 0-14 years %				0.268628	0.696471	0.719113	0.697364
				(0.642)	(0.692)	(0.650)	(0.627)
Year	3.316629***	3.070605**	3.559719**	2.721774	2.033821	2.163175	2.206731
	(1.058)	(1.197)	(1.257)	(1.663)	(1.947)	(1.764)	(1.771)
Squared Year	-0.000828***	-0.000767**	-0.000889**	-0.000680	-0.000508	-0.000540	-0.000551
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	120	120	120	120	120	120	120
Number of regions	15	15	15	15	15	15	15
AR(1) test statistic	-3.219	-3.263	-3.008	-2.975	-3.016	-2.970	-2.946
p-value of AR(1) statistic	0.00129	0.00110	0.00263	0.00293	0.00256	0.00297	0.00322
AR(2) test statistic	-1.992	-1.775	-1.365	-1.735	-1.773	-1.598	-1.622
p-value of AR(2) statistic	0.0464	0.0759	0.172	0.0828	0.0763	0.110	0.105
Sargan statistic	106.6	106.5	99.12	101.2	100.9	100.3	100.4
Degrees of fr. for Sargan	95	94	92	86	86	84	83
p-value of Sargan statistic	0.195	0.178	0.288	0.125	0.130	0.108	0.0942

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 4: Static estimations (Dependent variable: regional GDP growth rate, Fixed Effect estimator)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
GDP Growth rate lag	-0.119890	-0.114570	-0.068272	-0.102436	-0.043636	-0.028616	-0.029851
	(0.110)	(0.108)	(0.125)	(0.142)	(0.120)	(0.130)	(0.132)
Urban Sprawl	-0.005935	-0.005740	-0.005996	-0.006474	-0.008954*	-0.009219*	-0.009095*
	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Gov. Size lag	0.123950	0.805032	0.584386	0.044159	10.824048***	12.223845***	12.263207***
	(0.105)	(0.603)	(0.547)	(0.961)	(3.345)	(3.723)	(3.725)
Squared Gov. Size lag		-0.594997	-0.395585	0.015607	-10.311322***	-11.863938***	-11.914654***
		(0.517)	(0.466)	(0.900)	(2.990)	(3.482)	(3.482)
Gov. Size*VFI lag				0.500153		-1.972379	-2.026279
				(1.666)		(2.098)	(2.133)
Squared Gov. Size*VFI lag				-0.427546		2.105292	2.211527
				(1.650)		(2.147)	(2.216)
Gov. Size*Dec. lag					-34.791014***	-36.646006***	-36.632962***
					(10.825)	(10.959)	(11.027)
Sq. Gov. Size*Dec. lag					33.740109***	35.944258***	35.992307***
					(9.680)	(10.056)	(10.099)
Gov. Size*VFI*Dec. lag							-0.224749
							(0.681)
Population log	0.157294	0.158459	0.203062	0.220351	-0.027617	-0.003897	0.001196
	(0.169)	(0.177)	(0.169)	(0.147)	(0.173)	(0.137)	(0.137)
CL reg. government	0.001547	0.001399	0.000550	-0.000065	0.000212	0.000750	0.000593
	(0.007)	(0.007)	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)
Margin of victory lag	0.000325	0.000252	0.000180	0.000199	0.000217	0.000169	0.000185
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Inflation rate lag	-2.210901***	-2.147875***	-2.394716***	-2.311169***	-2.458366***	-2.470758***	-2.498412***
	(0.423)	(0.414)	(0.431)	(0.599)	(0.578)	(0.505)	(0.476)
Economic openness lag	0.066702	0.083346	0.112674	0.109430	0.138509*	0.133342*	0.135799*
	(0.053)	(0.056)	(0.066)	(0.082)	(0.068)	(0.067)	(0.066)
Dec. Index			0.266469*	0.995183	10.634826***	10.957546***	11.112197***
			(0.133)	(0.714)	(2.947)	(2.948)	(2.927)
VFI measure			0.048643***	0.019691	0.193913**	0.622537	0.662862
			(0.016)	(0.413)	(0.074)	(0.496)	(0.515)
Squared VFI measure				-0.097453	-0.134135*	-0.118940	-0.128302
				(0.076)	(0.064)	(0.078)	(0.074)
Squared Dec. Index				-1.229629	-2.762231**	-2.723334**	-2.930114**
				(1.269)	(0.969)	(1.049)	(0.986)
Population +65 years %				0.037850	-0.141315	-0.123327	-0.115350
				(0.456)	(0.442)	(0.463)	(0.469)
Population 0-14 years %				0.334002	0.616343	0.671346	0.652089
				(0.640)	(0.665)	(0.643)	(0.638)
Year	3.719194***	3.476909***	3.909419***	3.289137**	2.316576	2.480136*	2.518863*
	(0.795)	(0.912)	(0.991)	(1.377)	(1.526)	(1.340)	(1.329)
Squared Year	-0.000929***	-0.000868***	-0.000976***	-0.000821**	-0.000579	-0.000619*	-0.000629*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-3725.797005***	-3483.502476***	-3916.633550***	-3295.381714**	-2320.774018	-2485.173107*	-2524.076444*
	(795.803)	(912.998)	(991.524)	(1,379.767)	(1,528.811)	(1,341.795)	(1,331.090)
Observations	135	135	135	135	135	135	135
R^2	0.220	0.226	0.307	0.333	0.385	0.390	0.390
Number of regions	15	15	15	15	15	15	15

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1