Urban sprawl and local expenditures on local public transport, roads and traffic management: the case of Italian Municipalities

Angela Stefania Bergantino[1], Giuseppe Di Liddo[1*], Francesco Porcelli[2]

[1]Universtity of Bari – Department of Economics, Management and Business Law
[2]SOSE s.p.a and University of Warwick (CAGE)

Abstract

Using a new measure of urban sprawl, we evaluate the impact of urban sprawl on municipal expenditures of Italian municipalities in local public transport, roads and traffic management, and municipal technical offices for the year 2013. Our results suggest that urban sprawl leads to an increase in standard expenditure needs of Italian municipalities for all expenditure categories considered.
The relationship between urban sprawl and expenditure is stronger for expenditures in road and traffic management.

Keywords: urban sprawl, transport expenditures, municipal budgets, Italian municipalities

1. Introduction

Urban sprawl has recently become a matter of concern throughout Europe since it can have a highly marked impact on municipal budgets. Local governments may see sprawl as a potential source of finance, in terms revenues associated to of buildings and dwellings, or increased transfers from upper tiers of government. At the same time, sprawl leads to increased levels of expenditure, as it may raise the provision costs of certain local public goods and requires greater investment in extending basic infrastructure for new urban development (Hortas- Rico 2014).

One of the main costs of this phenomenon is the impact of sprawl on local public finance. Sprawl increases the provision costs of local public services, as it tends to undermine scale economies and increase costs inefficiently (Carruthers 2002; Carruthers and Ulfarsson 2003, 2008), especially on roadways, other transportation (Carruthers and Ulfarsson, 2003).

Low-density and spatially expansive development patterns are also associated with higher costs because of the considerable levels of investment required to extend basic infrastructure over greater distances to reach relatively smaller numbers of residents

* Corresponding author: Giuseppe Di Liddo (giuseppe.diliddo@uniba.it)

(Carruthers 2002). Nevertheless, this new urban development pattern also seems to be a source of potential funds for local governments, in terms of increased grants from upper tiers of governments and revenues associated with building activity (development revenues hereinafter), including planning permissions, construction taxes, taxes on land value improvements, revenues from sales of public land and asset revenues (Hortas-Rico 2014).

The existing literature (Litman 2015) on the effect of urban sprawl on municipal expenditures shows that urban sprawl is associated with higher cost in infrastructures investments and management. However, there is still a lack of empirical investigations focused on transports and road management expenditures. The aim of this paper is to fill this gap evaluating the impact of urban sprawl on municipal expenditures of Italian municipalities in local public transport, municipal technical offices, and roads and traffic management for the year 2013.

Besides this introduction, the rest of the paper is organized as follows. Section 2 presents a brief literature review on the link between urban sprawl and municipal expenditures in public transport and traffic management. In section 3, we discuss some of the advantages and disadvantages of the existing sprawl measures commonly used for economic analyses and we present the measure adopted in our econometric models. The results of our analysis are presented in section 4 and section 5 concludes the discussion with some final remarks. Tables containing the results of our estimates are placed in the appendix.

2. Urban sprawl and municipal expenditures in public transport, road and traffic management

Urban sprawl is low-density, dispersed and leapfrog development (Litman 2015). It is the opposite of city compactness, one of the important characteristics of sustainable urban form, which include accessibility, design of street networks, diversity of land use, and density of intersections (Ewing and Cervero 2010). Urban sprawl may result in high energy costs, emission increase, less available green space and even worsening of community interaction (Talen 1999, Litman 2012, Jabareen 2006, Joffe and Smith 2016).

Arguments against sprawl include the agglomeration costs arising from lower employment density and the difficult exchange of ideas, information and services, leading to a less productive urban economy (Grimes 2010). Other arguments include the cost of public and active transport modes, meaning more cars on the road, longer commutes, increased energy consumption and carbon emissions, and unhealthier lifestyles (Chapman 2008).

One of the more important issue related to the sprawl phenomenon regards the link between municipal compactness and infrastructure. In principle, the consequence of dense development is that more people can be served by a given investment in networked infrastructure such as roads and water supply. Cities of higher density may have lower infrastructure management costs per capita, making them more economically efficient than lower-density development. It follows that higher city density would lead local councils more resources to allocate to other services. The empirical evidence on generic infrastructure savings from compactness rests largely on some key studies mainly from the United States (Carruthers and Ulfarsson 2003, 2008) and Spain (Hortas- Rico 2014, Prieto et al. 2015). These studies found that

infrastructure costs per capita fall as population increases, due to the presence of economies of scale and economies of density.

According to Litman (2015), sprawl increases the costs of providing and managing infrastructure by 10-40%. However, none of the studies cited above focus on public transport costs and roads and traffic management. The present study aims to fill this gap, examining the effect of urban sprawl on the expenditure in local public transport, municipal technical offices and traffic (and roads) management in the context of Italian municipalities. In order to conduct the empirical analyses we will use four "traditional" measures of urban fragmentation and density, and one new measure of "relative" urban sprawl recently introduced in the existing literature. The next section will present the above-mentioned measures, underlining the main advantages and limits of the use of such measures in economic analyses.

3. Urban sprawl measures for economic analyses

Most of the empirical research on urban sprawl focuses on the computation of a large number of indicators that can be classified into indicators of growth rates; density; accessibility; aesthetic; and spatial geometry. However, some of these aggregate measures of sprawl suffer from at least two problems: problems associated with measurements of the areal extent of an urban area, and the nonlinear variation of the aggregate population density of urban areas as a function of total population (Sutton 2003).

Trying to solve these issues associated with the computation of the aggregate measures listed above, starting from the late 90's, a number of studies made use of night-time satellite imagery. Data are usually provided by the US Defense Meteorological Satellite Program's Operational Linescan System (DMSP OLS), to measure the areal extent of the urban area in different ways (Imhoff et al. 1997, Small et al. 2005), in general making use of regressions of the light intensity vs. population relationship (Sutton 2003, Zhang and Seto 2011).

In fact, a number of studies (Chen and Nordhaus 2011, Doll et al. 2006, Elvidge et al. 2012) have confirmed the positive correlations between DMSP OLS night-time light data and socioeconomic variables at regional to global scales. It follows that the main difficult with the use of night-time light is to jointly evaluate the impact of demographic (population size) and economic (economic activity, income etc.) variables on the brightness of a given region, in order to estimate the degree of urban dispersion in a given area. However, one problem associated with the use of night-time satellite imagery as a proxy measure of urban extent is the question on what light intensity should be used to characterize an area as urban since light intensity is also correlated to other economic factors (Sutton 2003).

In order to obtain a sprawl measure based on light intensity and uncorrelated to economic factors, Bergantino et al. (2018) estimated, for Italian municipalities, a relative measure of urban sprawl (RMUS) obtained by means of panel regression analyses. In particular, they used as a dependent variable the light intensity associated with each municipality and many socio-economic variables in the set of regressors.

The evaluation of the urban sprawl of each municipality has been obtained by means of a Relative Measure of the Urban Sprawl (RMUS) that corresponds to the municipal fixed effect component of the error. Such measures is uncorrelated to economic

variables by construction and represents the degree of sprawl above the quantity due to the economic characteristics of each municipality.

In the following empirical analysis, we use the RMUS and a set of traditional indicators based on satellite images (table 1) provided by ISPRA (2018) as measures of urban sprawl. Furthermore, due to the great scale variability in the measures of urban sprawl, we will use the standardized values, producing variable with mean 0 and standard deviation 1.

Table 1: Sprawl measures provided by ISPRA.

	Description
LCPI	Largest Class Patch Index equals the area of the largest patch of the corresponding patch type divided by total landscape area, multiplied by 100 (to convert to a percentage); in other words, LCPI equals the percentage of the landscape comprised by the largest patch. It is an indicator of fragmentation trough the density of the borders of the urban areas.
RMSP	Residual Mean Patch Size equals the average area of all patches excluding the largest one. It is an indicator of fragmentation around the central patch.
ED	Edge Density is the ratio between the sum of the perimeters of all patches and their surfaces. It is an indicator of fragmentation around the borders.
IUD	Index of Urban Dispersion: Ratio between low and middle-density areas and the total area. It describes the urban dispersion.

Source: ISPRA (2018)

4. Empirical analysis

Most of the empirical research on urban sprawl focuses on the computation of a large number of indicators that can be classified into indicators of growth rates; density; accessibility; aesthetic; and spatial geometry. However, some of these aggregate measures of sprawl suffer from at least two problems: problems associated with measurements of the areal extent of an urban area, and the nonlinear variation of the aggregate population density of urban areas as a function of total population (Sutton 2003). The empirical strategy consists in estimating separate expenditure functions for local public transport, traffic management, and municipal technical office. Generically, the representation of the expenditure function is:

$$E = f(B, P, A, S). \qquad (1)$$

In each equation, the dependent variable (E) represents the standard expenditure need (EN), computed by SOSE s.p.a.,[1] or the difference between current expenditure and the standard expenditure need in each category above mentioned, and the explanatory variables are related to local tax bases (B), demographic and geographical factors (P), and local preferences (A). The measures of urban sprawl (S) enter in turn in separate estimations, note that sprawl measures refer to year 2012, that is we are assuming that urban sprawl affects expenditures with a one-year lag. The corresponding econometric

[1] SOSE s.p.a. is owned by the Italian Ministry of Economy and Finance and Banca d'Italia. It is the methodology partner for the strategic analysis of data in Tax, Government and Corporate matters. Data on municipal standard expenditure needs are available at https://www.opencivitas.it/open-data.

specification results in equation (2) where ε_i represents the error term and revenues and incomes are expressed in logarithms.

$$E = \beta B_i + \gamma P_i + \delta A_i + \varphi S_i + \varepsilon_i \qquad (2)$$

Descriptive statistics are presented in table 2. Regarding variables related to local tax bases (B), i.e. total income and estate market value, the source of data is the Italian Ministry of Economy and Finance (MEF). Variables of category P, related to population, are taken from ISTAT, category E data source is the Italian Ministry of Interior and SOSE s.pa., sprawl indices, computed for year 2012, are taken from ISPRA (2018) and Bergantino et al. (2018).

Table 2: Regression sample, descriptive statistics, year 2013.

	N	Mean	SD	Min	Max
Total population (P)	6,330	7,895.27	44,661.85	0.00	2,645,236.00
Number of families (P)	6,330	3,164.06	22,391.26	0.00	1,369,811.00
Residential estate market value (Euro) (B)	6,224	1,110.06	557.59	204.44	10,395.83
Total income (Euro) (B)	6,330	104,091,663.24	781,328,521.21	415,555.00	47,550,956,167.00
Population 0-2 years (P)	6,330	209.09	1,181.48	0.00	71,721.00
Population 3-14 years (P)	6,330	870.25	4,721.60	0.00	284,137.00
Population over 65 years (P)	6,330	1,655.67	10,048.50	4.00	590,603.00
RMUS (2012) (S)	6,304	0.00	0.65	-7.68	31.32
LCPI (2012) (S)	6,330	66.48	24.55	0.00	100.00
ED (2012) (S)	6,330	592.71	250.80	39.98	1,952.38
RMPS (2012) (S)	6,330	4.08	4.14	0.00	57.08
IUD (2012) (S)	6,330	77.42	34.37	0.00	100.00
Administration: left (A)	6,301	0.10	0.30	0.00	1.00
Administration: right (A)	6,301	0.09	0.28	0.00	1.00
Administration: local (A)	6,301	0.30	0.46	0.00	1.00
Administration: centre (A)	6,301	0.00	0.06	0.00	1.00
Local public transport exp. (Euro) (E)	6,330	161,893.64	6,170,481.14	0.00	474,339,351.78
Local public transport EN (Euro) (E)	6,330	161,431.77	4,270,409.50	317.45	282,279,242.11
Municipal technical office exp. (Euro) (E)	6,330	166,623.29	1,293,689.59	0.00	96,388,549.15
Municipal technical office EN (Euro) (E)	6,330	166,879.42	877,474.71	3,371.30	54,598,590.26
Traffic management exp. (Euro) (E)	6,330	399,847.91	2,301,530.66	0.00	147,937,723.45
Traffic management EN (Euro) (E)	6,330	400,356.02	2,195,264.40	6,653.72	129,110,877.45
Altimetric scale, 1 = low (P)	6,330	2.92	1.54	1.00	5.00
Sismic risk, 1 = low (P)	6,330	2.73	1.24	1.00	5.00
Mountain degree, 1 = low (P)	6,330	1.89	0.95	1.00	3.00

We obtain coefficient point estimates of equation (2) by means of OLS estimator. Tables 3-5 in appendix report the results of our estimates using the log of local transport expenditures, local transport EN and the log of the difference between local transport expenditures and EN, respectively. Note that, regarding local public transport estimates, we include in the regression sample only those municipalities in which the service is currently active, according to SOSE s.p.a.. It follows that the regression sample, in this case, is constituted by observations on 1,282 municipalities instead of 6,127 municipalities.

Looking at the results presented in table 3, we can see that estimated coefficients associated with the residential estate market value and income capacity are statistically

significant and show positive sign, as one would expect, in all specifications of the model. That is, higher tax bases increase transport expenditures. Regarding the estimates of coefficients associated with urban sprawl measure we can see that coefficients associated with LCPI, ED and IUD are statistically significant and present the sign expected, positive for the fragmentation indicators LCPI and IUD, and negative for the density indicator ED. The fact that the estimated coefficient associated with RMUS variable, i.e. our main sprawl indicator "relative" to economic activity, is not statistically significant, suggests that there is weak evidence of the correlation between sprawl and local transport expenditure.

In table 4, we present the results of similar analyses using the official data, provided by SOSE s.p.a., on standard expenditure need in local transport as dependent variable. As we can see, all coefficients associated to the sprawl measures are not statistically significant, with the exception of RMUS, which shows a statistically significant, positive associated coefficient. Regarding the remaining control variables, we can observe positive and significant estimated coefficients associated with incomes and estate values, altimetric scale, and mountain degree Furthermore, estimated coefficients associated with voter turnout are significant and show positive sign, as one would expect, in all specifications of the model. Table 5 presents the results of similar estimates using the difference between observed expenditure and standard expenditure need in local public transport. Such variable would capture the amount of expenditure above (or below) the standard, that is, the amount of expenditure that is not directly linked to the provision of the standard quantity and quality of local public transport related services. In this case, only the variable RMUS is associated to a statistically significant coefficient with positive sign, the other sprawl measures have no significant impact on the dependent variable. Control variables present associated estimated coefficients in line with those obtained in the estimates presented in tables 3 and 4. We can conclude that, using the RMUS, there is strong empirical evidence on the impact of urban sprawl on expenditure and standard expenditure in local public transport. Using different indicators, the empirical results are more ambiguous.

Tables 6-8 report the results of our estimates using the log of municipal technical office expenditures, the corresponding EN and the log of the difference between expenditures and EN, respectively. As we can see from tables 6 and 8, the estimated coefficients associated with urban sprawl measures are not statistically significant, with the exception of the results presented in table 6, columns 4 and 5. However, in this case both coefficients have positive sign but are associated to measures of fragmentation (RMPS) and density (IUD), respectively. It follows that there is no empirical evidence on the effect of urban sprawl on municipal technical office expenditure, considered in absolute value or considering only the quota of expenditures that exceed the standard. Looking at the result presented in table 7, we can see that the estimated coefficients associated with sprawl measures are all statistically significant and all coefficients present the expected sign, i.e. negative for density indicators (LCPI and IUD) and positive for dispersion indicators (RMUS, ED and RMPS). Regarding the remaining control variables, we can observe positive and significant estimated coefficients associated with incomes and estate values, altimetric scale, sismic risk, and mountain degree in all the five specifications in table 7. As in the case of public transport expenditure, we can conclude that the degree of urban sprawl directly affect the standard expenditure in municipal technical offices while it does not explain variations of the amount of expenditure above the standard.

Tables 9-11 report the results of our estimates using the log of traffic management expenditures, the corresponding EN and the log of the difference between expenditures and EN, respectively. As we can see from tables 9 and 10, the estimated coefficients associated with urban sprawl measures are mostly statistically significant, with the exception of the results presented in table 9, column 5, and table 10, column 1. Furthermore, in all specifications presented in tables 9 and 10 the estimated coefficients present the expected sign, negative for density indicators (LCPI and IUD) and positive for dispersion indicators (RMUS, ED and RMPS). It follows that, regarding traffic management, the empirical evidence suggest that urban sprawl affect both actual and standard expenditure. The robustness check presented in table 11 confirm the sign of the above-mentioned estimated coefficients. However, in this case the estimated coefficients are not statistically significant. Regarding the estimated coefficients associated with control variables, the statistical significance and the sign is in line with those observed in tables 3-8 and discussed above, with reference to municipal public transport and technical office.

5. Final remarks

The purpose of this empirical analysis was to examine the link between urban sprawl and the expenditures in local public transport, road and traffic management and municipal technical offices in the context of the Italian Municipalities. Our results suggest that a link exists between urban sprawl and the standard expenditure needs of Italian municipalities. That is the amount of resources necessary to provide standard quality and quantity of a due local public service. In particular, higher-density municipalities incur lower expenditure needs in all expenditure categories examined.

The relationship between urban sprawl and expenditure is stronger for expenditures in road and traffic management. In fact, in this case, we also have empirical evidence on the positive correlation between urban sprawl and the actual amount of expenditure.

Further research, based on panel data analyses, may help to confirm these findings and strengthen the evidence base. In interpreting these results, it is worth remembering that the relationships between sprawl and local transport, and between sprawl and road management should be also analyse at the higher government tiers. In fact some of these expenditure competencies, according to the Italian institutional settings, are shared between municipal and provincial governments or municipal and regional governments.

References

Bergantino, A.S., Di Liddo, G. and Porcelli, F. (2018) "A relative measure of urban sprawl for Italian municipalities using satellite Light Images", *SIET Working Papers 2018*, Società Italiana di Economia dei Trasporti e della Logistica.

Carruthers J.I. (2002) "The impacts of state growth management programmes: A comparative analysis", *Urban Studies* 39, pp. 1956-1982.

Carruthers J.I., Ulfarsson G.F. (2003) "Urban sprawl and the cost of public services", *Environment and Planning B: Planning and Design* 30, pp. 503–522.

Carruthers J.I., Ulfarsson G.F. (2008) "Does smart growth matter to public finance?" *Urban Studies* 45, pp. 1791–1823.

Chapman, R. (2008) "Transitioning to low-carbon urban form and transport in New Zealand", *Political Science* 60, pp. 89-98.

Chen, X. and Nordhaus, W.D. (2011) "Using luminosity data as a proxy for economic statistics." Proceedings of the National Academy of Sciences of the United States of America 108, pp. 8589-8594.

Doll, C.N.H., Muller, J.P. and Morley, J.G. (2006) "Mapping regional economic activity from night-time light satellite imagery", *Ecological Economics* 57, pp. 75–92.

Elvidge, C.D., Baugh, K.E., Anderson, S.J., Sutton, P.C., and Ghosh, T. (2012) "The Night Light Development Index (NLDI): A spatially explicit measure of human development from satellite", *Social Geography* 7, pp. 23–35.

Ewing, R., and R. Cervero. (2010) "Travel and the built environment: a meta-analysis", *Journal of the American Planning Association* 76 (3), pp. 265-94.

Grimes, A. (2010) "Infrastructure: new findings for New Zealand", *Policy Quarterly* 6 (4), pp. 3-8.

Hortas- Rico, M. (2014) "Urban sprawl and municipal budgets in Spain", *Papers in Regional Science* 93, pp. 843-864.

Imhoff, M.L., Lawrence, W.T., Stutzer, D.C., and Elvidge, C.D. (1997), "A technique for using composite DMSP/OLS ''city lights'' satellite data to map urban area", *Remote Sensing of Environment* 61, pp. 361 – 370.

ISPRA (2018) *Consumo di suolo, dinamiche territoriali e servizi ecosistemici. Rapporto ISPRA n.288/2018.* ISBN: 978-88-448-0902-7.

Jabareen, Y.R. (2006), "Sustainable urban forms their typologies, models, and concepts", *Journal of Planning Education and Research* 26 (1), pp.38-52.

Joffe, H. and Smith, N. (2016) "City dweller aspirations for cities of the future: how do environmental and personal wellbeing feature?", *Cities* 59, pp. 102-112.

Litman, T. (2012) "Understanding Smart Growth Savings: what we know about public infrastructure and service cost savings, and how they are misrepresented by critics", Victoria, BC: Working paper Victoria Transport Policy Institute.

Litman, T. (2015) "Analysis of Public Policies That Unintentionally Encourage and Subsidize Urban Sprawl", Victoria, BC: Victoria Transport Policy Institute for LSE Cities on behalf of the Global Commission on the Economy and Climate.

Prieto, A.M., Zofío, J.L. and Alvarez, I. (2015) "Cost economies, urban patterns and population density: the case of public infrastructure for basic utilities", *Papers in Regional Science* 94 (4), pp. 795-816.

Small, C., Pozzi, F. and Elvidge, C.D. (2005) "Spatial analysis of global urban extent from DMSP-OLS night lights", *Remote Sensing of Environment* 96, pp. 277-291.

Sutton, P. (2003) "A Scale-Adjusted Measure of 'Urban Sprawl' Using Night-time Satellite Imagery", *Remote Sensing of Environment* 86, pp. 353-369.

Talen, E. (1999) "Sense of community and neighbourhood form: an assessment of the social doctrine of new urbanism", *Urban Studies* 36 (8), pp. 1361-1379.

Appendix

Table 3: Coefficients point estimates. OLS. Dependent variable: log of local public transport expenditures.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Real total income Euro Log	1.464788***	1.470986***	1.509330***	1.470482***	1.571784***
	(0.383)	(0.380)	(0.379)	(0.382)	(0.381)
Residential estate value Euro/sqm. Log	0.771343***	0.802112***	0.792222***	0.774799***	0.759224***
	(0.143)	(0.144)	(0.143)	(0.143)	(0.143)
Voter turnout	-0.009899	-0.011122	-0.009821	-0.010457	-0.008944
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Mayor's party is left	0.102940	0.098417	0.099463	0.108107	0.068491
	(0.145)	(0.144)	(0.144)	(0.145)	(0.146)
Mayor's party is right	0.078932	0.065068	0.061909	0.067968	0.048628
	(0.181)	(0.181)	(0.181)	(0.181)	(0.181)
Mayor's party is local	0.044993	0.037395	0.031987	0.036754	0.040650
	(0.133)	(0.133)	(0.133)	(0.133)	(0.133)
Families/population	0.066031	0.068858	0.058137	0.074758	0.069953
	(0.277)	(0.276)	(0.276)	(0.277)	(0.276)
Population log	-0.394609	-0.379562	-0.370662	-0.402086	-0.494053
	(0.397)	(0.394)	(0.394)	(0.395)	(0.396)
Population under 14 %	-0.110683**	-0.108322**	-0.108523**	-0.111138**	-0.111097**
	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)
Population over 65 %	0.010802	0.013954	0.009256	0.011613	0.006577
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Region=Abruzzo	-1.120592***	-1.152666***	-1.064334***	-1.105003***	-1.079859***
	(0.398)	(0.398)	(0.397)	(0.398)	(0.398)
Region=Basilicata	1.052308***	1.045875***	1.110858***	1.051372***	1.110861***
	(0.382)	(0.381)	(0.382)	(0.382)	(0.383)
Region=Calabria	0.854074*	0.880387*	0.953006*	0.871012*	0.882075*
	(0.516)	(0.515)	(0.516)	(0.516)	(0.516)
Region=Campania	-0.513302	-0.465786	-0.543171	-0.483474	-0.513426
	(0.374)	(0.373)	(0.373)	(0.373)	(0.373)
Region=Emilia-Romagna	-0.678431***	-0.703277***	-0.718985***	-0.671581***	-0.667972***
	(0.247)	(0.247)	(0.247)	(0.247)	(0.247)
Region=Lazio	1.110828***	1.082827***	1.091081***	1.137327***	1.118686***
	(0.311)	(0.311)	(0.310)	(0.311)	(0.310)
Region=Liguria	0.440544	0.444882	0.574543*	0.447507	0.427595
	(0.301)	(0.301)	(0.306)	(0.302)	(0.301)
Region=Lombardia	0.142068	0.213240	0.314712	0.151174	0.058506
	(0.256)	(0.258)	(0.266)	(0.256)	(0.258)
Region=Marche	-0.230143	-0.263183	-0.126390	-0.228252	-0.199778
	(0.309)	(0.309)	(0.311)	(0.309)	(0.309)
Region=Molise	0.322935	0.349632	0.405564	0.336983	0.329922
	(0.587)	(0.586)	(0.586)	(0.587)	(0.586)
Region=Piemonte	0.406012	0.453891	0.449498	0.421124	0.345049
	(0.276)	(0.277)	(0.276)	(0.277)	(0.278)
Region=Puglia	-0.165755	-0.188103	-0.157582	-0.160376	-0.153767
	(0.341)	(0.341)	(0.341)	(0.341)	(0.341)
Region=Toscana	0.100869	0.046444	0.009122	0.107192	0.123356
	(0.264)	(0.264)	(0.266)	(0.264)	(0.264)
Region=Umbria	0.308049	0.266966	0.410795	0.294787	0.352137
	(0.366)	(0.366)	(0.368)	(0.367)	(0.367)
Altimetric scale, 1 = low	0.060735	0.057775	0.042686	0.063221	0.061469
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
Sismic risk, 1 = low	0.102636	0.110391	0.098393	0.104337	0.093848
	(0.068)	(0.068)	(0.067)	(0.068)	(0.068)
Mountain degree, 1 = low	0.189941**	0.194243**	0.174390**	0.200571**	0.209401**
	(0.085)	(0.084)	(0.085)	(0.084)	(0.084)
RMUS (relative fragmentation)	0.020819				
	(0.025)				
LCPI (density)		-0.114591**			
		(0.054)			
ED (fragmentation)			0.190755**		
			(0.079)		
RMPS (fragmentation)				0.048073	
				(0.050)	
IUD (density)					-0.105782*
					(0.061)
Constant	-17.588603***	-18.104929***	-18.668939***	-17.677820***	-18.537684***
	(3.517)	(3.484)	(3.494)	(3.501)	(3.501)
Observations	1,282	1,282	1,282	1,282	1,282
R-squared	0.518	0.520	0.520	0.518	0.519

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Coefficients point estimates. OLS. Dependent variable: log of local public transport expenditure need.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Real total income Euro Log	0.141122**	0.210160***	0.217481***	0.207020***	0.245800***
	(0.061)	(0.062)	(0.062)	(0.063)	(0.061)
Residential estate value Euro/sqm. Log	0.097973***	0.086703***	0.089248***	0.084888***	0.077736***
	(0.025)	(0.026)	(0.025)	(0.026)	(0.025)
Voter turnout	-0.002281**	-0.003268***	-0.002932**	-0.003231***	-0.002485**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mayor's party is left	0.134286***	0.139293***	0.141480***	0.139565***	0.116486***
	(0.025)	(0.026)	(0.026)	(0.026)	(0.026)
Mayor's party is right	0.102156***	0.097318***	0.097153***	0.096818***	0.081498***
	(0.030)	(0.031)	(0.031)	(0.031)	(0.031)
Mayor's party is local	-0.005112	-0.014515	-0.012945	-0.014896	-0.007861
	(0.021)	(0.022)	(0.022)	(0.022)	(0.022)
Families/population	0.027767	0.041854	0.044376	0.041765	0.035683
	(0.044)	(0.045)	(0.045)	(0.045)	(0.044)
Population log	0.999419***	0.943765***	0.952753***	0.944922***	0.905928***
	(0.063)	(0.065)	(0.065)	(0.065)	(0.064)
Population under 14 %	-0.038223***	-0.038658***	-0.037131***	-0.038922***	-0.036220***
	(0.007)	(0.008)	(0.007)	(0.008)	(0.007)
Population over 65 %	0.037144***	0.037235***	0.036871***	0.037122***	0.034817***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Region=Abruzzo	-0.098782	-0.078291	-0.056800	-0.077114	-0.065744
	(0.065)	(0.067)	(0.067)	(0.067)	(0.066)
Region=Basilicata	-0.075128	-0.078855	-0.056438	-0.080118	-0.045108
	(0.064)	(0.066)	(0.066)	(0.066)	(0.065)
Region=Calabria	-0.227890***	-0.202410***	-0.170378**	-0.206097***	-0.199213***
	(0.068)	(0.070)	(0.070)	(0.070)	(0.069)
Region=Campania	-0.262423***	-0.230330***	-0.245794***	-0.232970***	-0.255677***
	(0.058)	(0.060)	(0.059)	(0.059)	(0.058)
Region=Emilia-Romagna	-0.119040***	-0.126329***	-0.134436***	-0.124309***	-0.120639***
	(0.042)	(0.043)	(0.043)	(0.043)	(0.043)
Region=Lazio	-0.227188***	-0.217521***	-0.217543***	-0.213435***	-0.224437***
	(0.051)	(0.053)	(0.053)	(0.053)	(0.052)
Region=Liguria	-0.238034***	-0.246832***	-0.201760***	-0.246733***	-0.253264***
	(0.052)	(0.053)	(0.054)	(0.053)	(0.052)
Region=Lombardia	-0.025406	-0.037531	0.013201	-0.041985	-0.087653**
	(0.042)	(0.043)	(0.045)	(0.043)	(0.043)
Region=Marche	-0.112615**	-0.103867**	-0.076885	-0.102558*	-0.096989*
	(0.051)	(0.053)	(0.053)	(0.053)	(0.052)
Region=Molise	0.093887	0.100439	0.129736	0.096517	0.091124
	(0.095)	(0.098)	(0.098)	(0.098)	(0.096)
Region=Piemonte	0.064874	0.065656	0.076752	0.063932	0.012440
	(0.046)	(0.047)	(0.047)	(0.047)	(0.047)
Region=Puglia	-0.194054***	-0.197919***	-0.182499***	-0.198351***	-0.196327***
	(0.055)	(0.057)	(0.057)	(0.057)	(0.056)
Region=Toscana	-0.318129***	-0.330894***	-0.348187***	-0.326150***	-0.313618***
	(0.045)	(0.047)	(0.047)	(0.047)	(0.046)
Region=Umbria	-0.117767*	-0.113659*	-0.080057	-0.113200*	-0.087889
	(0.064)	(0.066)	(0.066)	(0.066)	(0.065)
Altimetric scale, 1 = low	0.063903***	0.061147***	0.057103***	0.061564***	0.066379***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Sismic risk, 1 = low	0.017160	0.015664	0.014774	0.015422	0.009813
	(0.011)	(0.012)	(0.012)	(0.012)	(0.011)
Mountain degree, 1 = low	0.048739***	0.064664***	0.057262***	0.064932***	0.064115***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
RMUS (relative fragmentation)	0.052195***				
	(0.005)				
LCPI (density)		-0.009472			
		(0.009)			
ED (fragmentation)			0.054392***		
			(0.013)		
RMPS (fragmentation)				0.005665	
				(0.009)	
IUD (density)					-0.078150***
					(0.010)
Constant	-1.894753***	-2.521658***	-2.767318***	-2.459653***	-2.784928***
	(0.560)	(0.576)	(0.576)	(0.577)	(0.567)
Observations	1,866	1,866	1,866	1,866	1,866
R-squared	0.956	0.953	0.953	0.953	0.954

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Coefficients point estimates. OLS. Dependent variable: log of the difference between local public transport expenditure and expenditure need.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Real total income Euro Log	0.257804	0.345187	0.370364	0.295701	0.348875
	(0.414)	(0.414)	(0.413)	(0.418)	(0.414)
Residential estate value Euro/sqm. Log	0.833209***	0.827153***	0.841988***	0.829779***	0.817922***
	(0.155)	(0.158)	(0.157)	(0.156)	(0.156)
Voter turnout	-0.021639***	-0.023925***	-0.023592***	-0.023999***	-0.023811***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Mayor's party is left	0.291097*	0.272762	0.257091	0.284638	0.274034
	(0.175)	(0.176)	(0.176)	(0.176)	(0.176)
Mayor's party is right	0.337909	0.311901	0.300620	0.319165	0.316183
	(0.215)	(0.216)	(0.216)	(0.216)	(0.216)
Mayor's party is local	0.116521	0.096511	0.090759	0.101904	0.098502
	(0.156)	(0.156)	(0.156)	(0.156)	(0.157)
Families/population	0.060378	0.082008	0.071564	0.076250	0.084691
	(0.265)	(0.266)	(0.266)	(0.266)	(0.266)
Population log	0.563309	0.509340	0.521758	0.544266	0.503752
	(0.426)	(0.427)	(0.427)	(0.429)	(0.427)
Population under 14 %	-0.028677	-0.034919	-0.034772	-0.034919	-0.034730
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
Population over 65 %	0.027151	0.026306	0.026205	0.027093	0.026171
	(0.023)	(0.024)	(0.023)	(0.024)	(0.024)
Region=Abruzzo	0.845593	0.875588	0.887189	0.890050	0.882172
	(0.554)	(0.557)	(0.556)	(0.556)	(0.558)
Region=Basilicata	0.670160	0.666187	0.685360	0.684092	0.660759
	(0.442)	(0.444)	(0.444)	(0.445)	(0.446)
Region=Calabria	0.053213	0.084270	0.112260	0.106346	0.079208
	(0.561)	(0.563)	(0.563)	(0.563)	(0.563)
Region=Campania	-0.093447	-0.064747	-0.148819	-0.039535	-0.065047
	(0.439)	(0.441)	(0.445)	(0.441)	(0.441)
Region=Emilia-Romagna	-1.016624***	-0.997711***	-1.032980***	-0.961896***	-0.991756***
	(0.363)	(0.365)	(0.366)	(0.366)	(0.365)
Region=Lazio	-0.019230	0.033618	0.002029	0.069697	0.038343
	(0.361)	(0.362)	(0.362)	(0.363)	(0.361)
Region=Liguria	-1.328524***	-1.335421***	-1.297150***	-1.309355***	-1.337939***
	(0.354)	(0.356)	(0.357)	(0.357)	(0.356)
Region=Lombardia	-0.156029	-0.154748	-0.082401	-0.136418	-0.166580
	(0.313)	(0.317)	(0.321)	(0.316)	(0.317)
Region=Marche	0.464940	0.487862	0.526215	0.507336	0.497024
	(0.407)	(0.409)	(0.408)	(0.408)	(0.408)
Region=Molise	-0.360343	-0.348935	-0.335364	-0.334864	-0.354014
	(0.610)	(0.613)	(0.612)	(0.613)	(0.616)
Region=Piemonte	-0.456141	-0.417904	-0.442842	-0.390327	-0.428671
	(0.345)	(0.349)	(0.346)	(0.350)	(0.349)
Region=Puglia	0.694121	0.652527	0.628264	0.676730	0.656551
	(0.431)	(0.432)	(0.432)	(0.432)	(0.432)
Region=Toscana	-0.948163***	-0.940834***	-1.019978***	-0.902869***	-0.932844***
	(0.332)	(0.334)	(0.340)	(0.335)	(0.334)
Region=Umbria	-0.295511	-0.286509	-0.241402	-0.276213	-0.276435
	(0.422)	(0.425)	(0.424)	(0.424)	(0.425)
Altimetric scale, 1 = low	0.113946*	0.107067*	0.098395	0.111149*	0.107400*
	(0.063)	(0.063)	(0.063)	(0.063)	(0.063)
Sismic risk, 1 = low	-0.092165	-0.088195	-0.088994	-0.089338	-0.090292
	(0.079)	(0.079)	(0.079)	(0.079)	(0.079)
Mountain degree, 1 = low	0.104191	0.137841	0.127547	0.139399	0.138616
	(0.098)	(0.097)	(0.097)	(0.097)	(0.097)
RMUS (relative fragmentation)	0.058168**				
	(0.026)				
LCPI (density)		-0.020818			
		(0.062)			
ED (fragmentation)			0.116282		
			(0.094)		
RMPS (fragmentation)				0.056048	
				(0.065)	
IUD (density)					0.002313
					(0.069)
Constant	-3.855335	-4.720930	-5.339480	-4.209785	-4.675032
	(3.850)	(3.851)	(3.881)	(3.887)	(3.866)
Observations	611	611	611	611	611
R-squared	0.553	0.549	0.550	0.549	0.549

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Coefficients point estimates. OLS. Dependent variable: log of municipal technical office expenditures.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Real total income Euro Log	0.314018***	0.329665***	0.332609***	0.321074***	0.327058***
	(0.062)	(0.061)	(0.061)	(0.061)	(0.061)
Residential estate value Euro/sqm. Log	0.264158***	0.253429***	0.250765***	0.252206***	0.255310***
	(0.031)	(0.030)	(0.030)	(0.030)	(0.030)
Voter turnout	-0.002260**	-0.002318**	-0.002241**	-0.002269**	-0.002412**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mayor's party is left	0.037323	0.038790	0.037532	0.039689	0.045122
	(0.034)	(0.034)	(0.034)	(0.034)	(0.035)
Mayor's party is right	0.048139	0.049563	0.048137	0.048850	0.054690
	(0.033)	(0.033)	(0.033)	(0.033)	(0.034)
Mayor's party is local	-0.007309	-0.007637	-0.008139	-0.007773	-0.009043
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Families/population	0.010883	0.010701	0.011562	0.009940	0.011639
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
Population log	0.474676***	0.459127***	0.459497***	0.462462***	0.459771***
	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)
Population under 14 %	-0.013695**	-0.012670**	-0.012646**	-0.012973**	-0.012820**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Population over 65 %	0.006866**	0.007319**	0.007046**	0.007408**	0.007929***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Region=Abruzzo	-0.193317***	-0.170027***	-0.164581***	-0.171068***	-0.167580***
	(0.055)	(0.054)	(0.055)	(0.054)	(0.054)
Region=Basilicata	0.359591***	0.366004***	0.368152***	0.361701***	0.359477***
	(0.072)	(0.073)	(0.073)	(0.072)	(0.072)
Region=Calabria	0.098966*	0.110757*	0.113740*	0.105200*	0.104555*
	(0.059)	(0.059)	(0.060)	(0.059)	(0.059)
Region=Campania	0.078205	0.092716*	0.087087	0.091559*	0.090614*
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
Region=Emilia-Romagna	-0.161813***	-0.162241***	-0.162236***	-0.160197***	-0.162223***
	(0.050)	(0.051)	(0.051)	(0.051)	(0.051)
Region=Lazio	-0.020107	-0.015996	-0.014223	-0.011724	-0.007814
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
Region=Liguria	-0.063525	-0.059539	-0.050210	-0.059746	-0.061193
	(0.062)	(0.062)	(0.063)	(0.062)	(0.062)
Region=Lombardia	-0.313037***	-0.305829***	-0.301139***	-0.313710***	-0.308874***
	(0.037)	(0.038)	(0.040)	(0.037)	(0.037)
Region=Marche	-0.116905**	-0.114476**	-0.107995*	-0.116147**	-0.112126**
	(0.057)	(0.057)	(0.057)	(0.057)	(0.057)
Region=Molise	-0.129519*	-0.120034*	-0.116272	-0.124046*	-0.120099*
	(0.072)	(0.072)	(0.073)	(0.072)	(0.072)
Region=Piemonte	-0.239025***	-0.237909***	-0.238810***	-0.237180***	-0.233967***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Region=Puglia	-0.030804	-0.021664	-0.020666	-0.023144	-0.023173
	(0.058)	(0.058)	(0.059)	(0.058)	(0.058)
Region=Toscana	-0.103747*	-0.103820*	-0.101993*	-0.098032*	-0.102702*
	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)
Region=Umbria	0.041798	0.043043	0.049874	0.039363	0.039974
	(0.079)	(0.079)	(0.079)	(0.079)	(0.079)
Altimetric scale, 1 = low	0.034655***	0.035140***	0.034122***	0.035786***	0.033964***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Sismic risk, 1 = low	0.033398**	0.031769**	0.031527**	0.032279**	0.032363**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Mountain degree, 1 = low	0.044677***	0.044558***	0.044102***	0.045350***	0.046064***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
RMUS (relative fragmentation)	-0.004771				
	(0.008)				
LCPI (density)		-0.011854			
		(0.009)			
ED (fragmentation)			0.010565		
			(0.013)		
RMPS (fragmentation)				0.020974**	
				(0.009)	
IUD (density)					0.018041**
					(0.009)
Constant	0.155887	0.062194	0.030085	0.187866	0.081808
	(0.573)	(0.572)	(0.576)	(0.573)	(0.572)
Observations	6,127	6,138	6,138	6,138	6,138
R-squared	0.744	0.744	0.744	0.744	0.744

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: Coefficients point estimates. OLS. Dependent variable: log of municipal technical office expenditure need.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Real total income Euro Log	0.033398***	0.056001***	0.058697***	0.051998***	0.060167***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Residential estate value Euro/sqm. Log	0.201307***	0.192579***	0.190265***	0.190624***	0.184841***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Voter turnout	-0.001501***	-0.001701***	-0.001638***	-0.001669***	-0.001576***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mayor's party is left	0.067861***	0.075060***	0.073939***	0.074762***	0.066314***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Mayor's party is right	0.044318***	0.045817***	0.044531***	0.045033***	0.039564***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Mayor's party is local	0.008451*	0.007088	0.006574	0.006629	0.006775
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Families/population	0.040564***	0.039997***	0.040862***	0.039781***	0.039873***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Population log	0.765370***	0.741853***	0.742116***	0.743275***	0.739850***
	(0.013)	(0.013)	(0.014)	(0.014)	(0.013)
Population under 14 %	-0.015778***	-0.015159***	-0.015130***	-0.015425***	-0.015454***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Population over 65 %	0.002854***	0.002874***	0.002629***	0.002836***	0.002039***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Region=Abruzzo	-0.049590***	-0.031503***	-0.026548**	-0.032460***	-0.035127***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Region=Basilicata	-0.058947***	-0.052474***	-0.050425***	-0.056810***	-0.056683***
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
Region=Calabria	0.017807	0.030816**	0.033548***	0.025674**	0.025593**
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Region=Campania	-0.075641***	-0.059720***	-0.064681***	-0.062064***	-0.066040***
	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)
Region=Emilia-Romagna	-0.049221***	-0.050528***	-0.050515***	-0.048947***	-0.048065***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Region=Lazio	0.026219**	0.033260***	0.034874***	0.035062***	0.025073**
	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)
Region=Liguria	-0.013682	-0.009262	-0.000892	-0.009727	-0.009469
	(0.013)	(0.013)	(0.014)	(0.013)	(0.013)
Region=Lombardia	-0.003118	0.002787	0.007099	-0.004395	-0.008937
	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
Region=Marche	-0.085088***	-0.082419***	-0.076566***	-0.082653***	-0.081689***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Region=Molise	-0.076639***	-0.066731***	-0.063255***	-0.071082***	-0.076511***
	(0.015)	(0.015)	(0.016)	(0.015)	(0.015)
Region=Piemonte	-0.001295	0.000182	-0.000607	-0.000978	-0.010163
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Region=Puglia	0.038349***	0.051060***	0.052081***	0.048463***	0.043773***
	(0.012)	(0.013)	(0.013)	(0.012)	(0.012)
Region=Toscana	-0.066302***	-0.067547***	-0.065961***	-0.062734***	-0.059848***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Region=Umbria	-0.058770***	-0.056744***	-0.050524***	-0.058225***	-0.052536***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Altimetric scale, 1 = low	0.018300***	0.018546***	0.017622***	0.018901***	0.019598***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Sismic risk, 1 = low	0.033506***	0.032576***	0.032344***	0.032800***	0.032098***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Mountain degree, 1 = low	0.021442***	0.021678***	0.021259***	0.022196***	0.020932***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
RMUS (relative fragmentation)	0.017577***				
	(0.002)				
LCPI (density)		-0.010522***			
		(0.002)			
ED (fragmentation)			0.009522***		
			(0.003)		
RMPS (fragmentation)				0.010685***	
				(0.002)	
IUD (density)					-0.015187***
					(0.002)
Constant	3.280685***	3.139996***	3.110596***	3.213167***	3.159019***
	(0.120)	(0.121)	(0.122)	(0.122)	(0.121)
Observations	6,181	6,192	6,192	6,192	6,192
R-squared	0.984	0.984	0.984	0.984	0.984

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Coefficients point estimates. OLS. Dependent variable: log of the difference between municipal technical office expenditure and expenditure need.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Real total income Euro Log	0.257075	0.330016*	0.339356*	0.335282*	0.335482*
	(0.184)	(0.181)	(0.181)	(0.182)	(0.181)
Residential estate value Euro/sqm. Log	0.514104***	0.485662***	0.479808***	0.476114***	0.473080***
	(0.087)	(0.085)	(0.085)	(0.085)	(0.085)
Voter turnout	-0.000958	-0.001693	-0.001500	-0.001592	-0.001450
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Mayor's party is left	0.123944	0.140102	0.137892	0.135626	0.127422
	(0.098)	(0.098)	(0.098)	(0.098)	(0.099)
Mayor's party is right	-0.004426	-0.003926	-0.007880	-0.004657	-0.012186
	(0.100)	(0.100)	(0.100)	(0.100)	(0.101)
Mayor's party is local	-0.079916	-0.085790	-0.087042	-0.087069	-0.086945
	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)
Families/population	-0.080995	-0.085858	-0.083915	-0.082650	-0.082404
	(0.159)	(0.158)	(0.158)	(0.158)	(0.158)
Population log	0.368317*	0.294946	0.297765	0.291588	0.293159
	(0.191)	(0.189)	(0.189)	(0.189)	(0.189)
Population under 14 %	-0.047701***	-0.045195**	-0.044490**	-0.045436**	-0.045618**
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Population over 65 %	0.005050	0.005764	0.005238	0.005415	0.004562
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Region=Abruzzo	-0.200807	-0.133055	-0.108401	-0.130863	-0.134102
	(0.165)	(0.161)	(0.163)	(0.161)	(0.161)
Region=Basilicata	0.435282**	0.450280**	0.464679**	0.437331**	0.440343**
	(0.181)	(0.181)	(0.183)	(0.181)	(0.181)
Region=Calabria	0.126110	0.162576	0.181467	0.148211	0.149557
	(0.170)	(0.171)	(0.174)	(0.170)	(0.170)
Region=Campania	0.150258	0.194823	0.179552	0.185148	0.186233
	(0.153)	(0.152)	(0.152)	(0.152)	(0.152)
Region=Emilia-Romagna	-0.135449	-0.143726	-0.149396	-0.139859	-0.138233
	(0.146)	(0.146)	(0.146)	(0.146)	(0.146)
Region=Lazio	-0.096368	-0.069623	-0.062589	-0.073247	-0.085987
	(0.155)	(0.155)	(0.155)	(0.155)	(0.156)
Region=Liguria	-0.112675	-0.109097	-0.074062	-0.106458	-0.099856
	(0.174)	(0.174)	(0.177)	(0.174)	(0.174)
Region=Lombardia	-0.358424***	-0.347568***	-0.319294***	-0.363879***	-0.368039***
	(0.110)	(0.112)	(0.119)	(0.110)	(0.110)
Region=Marche	-0.054733	-0.047726	-0.024005	-0.043923	-0.047939
	(0.167)	(0.167)	(0.168)	(0.167)	(0.167)
Region=Molise	-0.291190	-0.264606	-0.247079	-0.277846	-0.281946
	(0.219)	(0.219)	(0.221)	(0.219)	(0.219)
Region=Piemonte	-0.166197	-0.168492	-0.164738	-0.175141	-0.180539
	(0.124)	(0.124)	(0.124)	(0.124)	(0.124)
Region=Puglia	-0.186120	-0.143543	-0.133671	-0.158611	-0.159431
	(0.178)	(0.178)	(0.179)	(0.177)	(0.177)
Region=Toscana	0.016059	0.005908	0.004283	0.018960	0.021388
	(0.156)	(0.156)	(0.156)	(0.155)	(0.155)
Region=Umbria	-0.196737	-0.194109	-0.173934	-0.190162	-0.187887
	(0.200)	(0.200)	(0.201)	(0.200)	(0.200)
Altimetric scale, 1 = low	-0.009139	-0.009474	-0.012719	-0.009439	-0.007160
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
Sismic risk, 1 = low	0.028697	0.025209	0.024761	0.025435	0.025467
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
Mountain degree, 1 = low	0.101499**	0.105188**	0.102158**	0.105320**	0.103052**
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
RMUS (relative fragmentation)	0.031388				
	(0.020)				
LCPI (density)		-0.025253			
		(0.026)			
ED (fragmentation)			0.037668		
			(0.038)		
RMPS (fragmentation)				-0.005266	
				(0.027)	
IUD (density)					-0.022003
					(0.026)
Constant	-0.370988	-0.852060	-1.000252	-0.840302	-0.821618
	(1.692)	(1.684)	(1.694)	(1.690)	(1.683)
Observations	2,673	2,680	2,680	2,680	2,680
R-squared	0.324	0.322	0.322	0.322	0.322

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Coefficients point estimates. OLS. Dependent variable: log of traffic management expenditures.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Real total income Euro Log	0.156061***	0.169247***	0.181744***	0.158257***	0.171992***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Residential estate value Euro/sqm. Log	0.228432***	0.236454***	0.227087***	0.226562***	0.223868***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Voter turnout	-0.001066	-0.001346*	-0.001041	-0.001216*	-0.001262*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Mayor's party is left	-0.009995	0.003498	-0.000831	0.000414	-0.002792
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Mayor's party is right	0.031041	0.035198	0.029679	0.031746	0.032074
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Mayor's party is local	0.015049	0.016469	0.014568	0.014062	0.012906
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Families/population	0.083582***	0.081578***	0.085522***	0.081192***	0.082903***
	(0.031)	(0.030)	(0.030)	(0.031)	(0.031)
Population log	0.639115***	0.624216***	0.626245***	0.627772***	0.622098***
	(0.044)	(0.043)	(0.044)	(0.044)	(0.044)
Population under 14 %	-0.033513***	-0.032131***	-0.031837***	-0.033313***	-0.033250***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Population over 65 %	0.011871***	0.012684***	0.011583***	0.012304***	0.011949***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Region=Abruzzo	-0.032213	-0.022035	0.002660	-0.026382	-0.025672
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
Region=Basilicata	-0.197639***	-0.174693***	-0.161562***	-0.194399***	-0.196668***
	(0.050)	(0.050)	(0.051)	(0.050)	(0.050)
Region=Calabria	-0.083435**	-0.054340	-0.037527	-0.077083*	-0.078090*
	(0.041)	(0.041)	(0.042)	(0.041)	(0.041)
Region=Campania	-0.187662***	-0.161182***	-0.183680***	-0.174236***	-0.179547***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Region=Emilia-Romagna	0.049643	0.042561	0.041601	0.049021	0.048179
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Region=Lazio	-0.326206***	-0.317341***	-0.309101***	-0.313367***	-0.320098***
	(0.037)	(0.037)	(0.037)	(0.037)	(0.037)
Region=Liguria	-0.146947***	-0.143302***	-0.101055**	-0.145377***	-0.146119***
	(0.043)	(0.043)	(0.044)	(0.043)	(0.043)
Region=Lombardia	-0.118198***	-0.087116***	-0.060964**	-0.118442***	-0.118489***
	(0.026)	(0.026)	(0.028)	(0.026)	(0.026)
Region=Marche	0.057312	0.053233	0.081156**	0.054270	0.059207
	(0.040)	(0.039)	(0.040)	(0.040)	(0.040)
Region=Molise	-0.369471***	-0.343888***	-0.323563***	-0.364043***	-0.365976***
	(0.049)	(0.049)	(0.050)	(0.049)	(0.050)
Region=Piemonte	-0.037511	-0.023499	-0.025163	-0.031787	-0.038046
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
Region=Puglia	-0.076754*	-0.050903	-0.043223	-0.064701	-0.069734*
	(0.040)	(0.040)	(0.041)	(0.040)	(0.040)
Region=Toscana	-0.194108***	-0.213168***	-0.208253***	-0.192950***	-0.194628***
	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
Region=Umbria	-0.064397	-0.066451	-0.036376	-0.069901	-0.063447
	(0.055)	(0.054)	(0.055)	(0.054)	(0.055)
Altimetric scale, 1 = low	0.057687***	0.057444***	0.052810***	0.058529***	0.057530***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Sismic risk, 1 = low	0.013583	0.013445	0.012347	0.014111	0.013422
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Mountain degree, 1 = low	0.053354***	0.052332***	0.050104***	0.054312***	0.053709***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
RMUS (relative fragmentation)	0.022106***				
	(0.006)				
LCPI (density)		-0.045452***			
		(0.006)			
ED (fragmentation)			0.047368***		
			(0.009)		
RMPS (fragmentation)				0.031797***	
				(0.006)	
IUD (density)					0.002185
					(0.006)
Constant	2.774237***	2.579515***	2.422706***	2.827904***	2.674022***
	(0.393)	(0.390)	(0.394)	(0.392)	(0.392)
Observations	6,166	6,177	6,177	6,177	6,177
R-squared	0.838	0.839	0.839	0.839	0.838

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10: Coefficients point estimates. OLS. Dependent variable: log of traffic management expenditure needs.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Real total income Euro Log	0.101072***	0.102505***	0.118407***	0.096093***	0.112652***
	(0.024)	(0.023)	(0.023)	(0.023)	(0.023)
Residential estate value Euro/sqm. Log	0.198348***	0.205227***	0.198614***	0.195647***	0.183539***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Voter turnout	-0.002898***	-0.002986***	-0.002623***	-0.002882***	-0.002683***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Mayor's party is left	0.087416***	0.093087***	0.090493***	0.089323***	0.071591***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Mayor's party is right	0.088797***	0.092245***	0.086327***	0.088959***	0.077351***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Mayor's party is local	0.020585***	0.022895***	0.021822***	0.020462***	0.020834***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Families/population	0.058709***	0.056869***	0.061679***	0.057087***	0.057186***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Population log	0.724844***	0.722793***	0.726109***	0.724572***	0.717623***
	(0.025)	(0.024)	(0.024)	(0.024)	(0.024)
Population under 14 %	-0.027903***	-0.026623***	-0.025702***	-0.027618***	-0.027682***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Population over 65 %	0.007752***	0.008522***	0.007425***	0.008096***	0.006427***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Region=Abruzzo	0.016200	0.028313	0.063992***	0.024866	0.019171
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Region=Basilicata	0.198894***	0.218293***	0.246684***	0.200352***	0.200748***
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Region=Calabria	-0.047503**	-0.025102	0.009055	-0.045384**	-0.045497**
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Region=Campania	-0.123209***	-0.104251***	-0.125310***	-0.116729***	-0.124864***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Region=Emilia-Romagna	0.032322*	0.027866	0.024028	0.033493*	0.035408*
	(0.020)	(0.019)	(0.019)	(0.020)	(0.019)
Region=Lazio	-0.064309***	-0.060295***	-0.047086**	-0.058312***	-0.079111***
	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)
Region=Liguria	-0.205356***	-0.201289***	-0.143191***	-0.203456***	-0.202871***
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Region=Lombardia	-0.154422***	-0.126523***	-0.076251***	-0.154364***	-0.163991***
	(0.014)	(0.014)	(0.016)	(0.014)	(0.014)
Region=Marche	0.031723	0.027792	0.063010***	0.029942	0.031711
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
Region=Molise	0.101777***	0.122934***	0.161331***	0.104682***	0.093283***
	(0.028)	(0.027)	(0.028)	(0.028)	(0.028)
Region=Piemonte	-0.027782*	-0.014863	-0.009800	-0.023821	-0.042945***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Region=Puglia	-0.049017**	-0.031138	-0.011498	-0.044485**	-0.054146**
	(0.023)	(0.022)	(0.022)	(0.023)	(0.022)
Region=Toscana	-0.033704	-0.048465**	-0.050510**	-0.030857	-0.024646
	(0.022)	(0.021)	(0.021)	(0.022)	(0.021)
Region=Umbria	0.104786***	0.102250***	0.141487***	0.100957***	0.112656***
	(0.031)	(0.030)	(0.030)	(0.031)	(0.030)
Altimetric scale, 1 = low	0.059597***	0.059626***	0.053246***	0.060436***	0.061969***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Sismic risk, 1 = low	0.013212**	0.012713**	0.011248**	0.013098**	0.011649**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Mountain degree, 1 = low	0.092234***	0.091365***	0.087789***	0.092871***	0.090227***
	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)
RMUS (relative fragmentation)	-0.003170				
	(0.003)				
LCPI (density)		-0.040202***			
		(0.003)			
ED (fragmentation)			0.063872***		
			(0.005)		
RMPS (fragmentation)				0.020892***	
				(0.004)	
IUD (density)					-0.032310***
					(0.003)
Constant	3.281931***	3.186927***	2.927170***	3.370417***	3.264089***
	(0.220)	(0.217)	(0.218)	(0.219)	(0.218)
Observations	6,181	6,192	6,192	6,192	6,192
R-squared	0.948	0.949	0.949	0.948	0.949

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11: Coefficients point estimates. OLS. Dependent variable: log of the difference between traffic management expenditure and expenditure need.

VARIABLES	(1)	(2)	(3)	(4)	(5)
Real total income Euro Log	0.044701	0.052061	0.053406	0.039654	0.046989
	(0.156)	(0.154)	(0.155)	(0.155)	(0.154)
Residential estate value Euro/sqm. Log	0.484198***	0.512127***	0.493602***	0.496723***	0.500462***
	(0.078)	(0.077)	(0.077)	(0.077)	(0.077)
Voter turnout	-0.000308	-0.000820	-0.000607	-0.000621	-0.000738
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Mayor's party is left	0.035330	0.070816	0.053891	0.058652	0.066270
	(0.099)	(0.098)	(0.098)	(0.098)	(0.099)
Mayor's party is right	-0.084859	-0.080035	-0.087956	-0.086777	-0.079524
	(0.087)	(0.087)	(0.087)	(0.087)	(0.087)
Mayor's party is local	0.026716	0.027998	0.022709	0.023885	0.022005
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
Families/population	-0.021848	-0.023589	-0.023211	-0.022308	-0.023962
	(0.126)	(0.126)	(0.126)	(0.126)	(0.126)
Population log	0.608428***	0.598238***	0.599421***	0.604388***	0.601266***
	(0.162)	(0.160)	(0.161)	(0.161)	(0.161)
Population under 14 %	-0.028030*	-0.025929*	-0.027398*	-0.027263*	-0.027081*
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Population over 65 %	0.029739***	0.030667***	0.030111***	0.030583***	0.031413***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Region=Abruzzo	-0.040208	-0.052592	-0.047928	-0.050492	-0.043415
	(0.144)	(0.142)	(0.144)	(0.143)	(0.143)
Region=Basilicata	-0.078136	-0.022839	-0.043342	-0.051193	-0.048799
	(0.301)	(0.300)	(0.302)	(0.300)	(0.300)
Region=Calabria	0.263417*	0.308613*	0.277736*	0.272226*	0.276662*
	(0.159)	(0.159)	(0.162)	(0.159)	(0.159)
Region=Campania	0.096546	0.132392	0.104826	0.108972	0.112785
	(0.144)	(0.144)	(0.144)	(0.143)	(0.144)
Region=Emilia-Romagna	0.038707	0.024697	0.033556	0.035067	0.033759
	(0.121)	(0.121)	(0.122)	(0.121)	(0.121)
Region=Lazio	-0.303019**	-0.274962*	-0.279374*	-0.273754*	-0.262998*
	(0.154)	(0.154)	(0.154)	(0.154)	(0.154)
Region=Liguria	-0.230896	-0.240764	-0.236410	-0.240471	-0.238932
	(0.150)	(0.150)	(0.153)	(0.150)	(0.150)
Region=Lombardia	-0.169631*	-0.134015	-0.163701	-0.168529*	-0.161198*
	(0.093)	(0.094)	(0.102)	(0.093)	(0.094)
Region=Marche	-0.008004	-0.014581	-0.006070	-0.013147	-0.003491
	(0.142)	(0.142)	(0.143)	(0.142)	(0.142)
Region=Molise	-0.203827	-0.158730	-0.191033	-0.192952	-0.181741
	(0.287)	(0.287)	(0.288)	(0.287)	(0.287)
Region=Piemonte	-0.152689	-0.132188	-0.150648	-0.146038	-0.137605
	(0.106)	(0.106)	(0.107)	(0.106)	(0.107)
Region=Puglia	0.040216	0.087851	0.063885	0.063909	0.068265
	(0.154)	(0.153)	(0.154)	(0.153)	(0.153)
Region=Toscana	-0.452281***	-0.464392***	-0.445356***	-0.443956***	-0.446002***
	(0.160)	(0.160)	(0.160)	(0.160)	(0.160)
Region=Umbria	-0.299058	-0.274935	-0.279242	-0.284547	-0.278860
	(0.232)	(0.232)	(0.233)	(0.232)	(0.232)
Altimetric scale, 1 = low	0.031868	0.029284	0.030646	0.032203	0.029014
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Sismic risk, 1 = low	0.004968	0.002054	0.004054	0.004399	0.004513
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
Mountain degree, 1 = low	0.068103*	0.067382*	0.066136*	0.066904*	0.068307*
	(0.037)	(0.036)	(0.037)	(0.037)	(0.037)
RMUS (relative fragmentation)	0.042092**				
	(0.021)				
LCPI (density)		-0.063448***			
		(0.022)			
ED (fragmentation)			0.003199		
			(0.035)		
RMPS (fragmentation)				0.028812	
				(0.024)	
IUD (density)					0.028679
					(0.023)
Constant	1.229281	0.973431	1.097390	1.253127	1.112641
	(1.454)	(1.450)	(1.460)	(1.455)	(1.450)
Observations	3,252	3,256	3,256	3,256	3,256
R-squared	0.333	0.335	0.333	0.334	0.334

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1