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Authors:

Emma Galli, Ilde Rizzo & Carla Scaglioni

SAPIENZA – UNIVERSITY OF ROME
P.le Aldo Moro n.5 – 00185 Roma T (+39) 06 49910563 F (+39) 06 49910231
CF 80209930587 - P.IVA 02133771002

Is transparency spatially determined?

An empirical test for the Italian Municipalities

Emma Galli [a*]

Sapienza University of Rome, Department of Social and Economic Sciences

IldeRizzo [b**]

University of Catania, Department of Economics and Business

Carla Scaglioni[c]

University of Reggio Calabria "Mediterranea", DiGiES

Abstract

In this paper, we aim at assessing whether transparency is spatially determined at local level. To this end we use a new composite indicator (CTI) built by Galli et al. (2017) for a large sample of Italian Municipalities and control for several factors (socio-economic, fiscal and politico-institutional), which according to the literature affect transparency. Our preliminary results suggest that there is a statistically significant transparency clustering across the Italian municipalities, which follows a dichotomic pattern, i.e. either very low or very high. The empirical analysis shows that spatial dependence matters and similarities in transparency behaviour mainly occur among small Municipalities where citizens' political participation is likely to be greater and the single ballot electoral system strengthens the incentives for government accountability.

Keywords: Transparency, local governments, spatial dimension, determinants

JEL Classification: K2, K4, H3, H7

[a*] (corresponding author) Department of Social and Economic Sciences Sapienza University of Rome,
Piazzale Aldo Moro -00100 Roma
Telephone number: +39.06.49910627
E-mail: emma.galli@uniroma1.it

[b] ** (Former President of the National Anticorruption Authority – ANAC, 2012 – April 2014) Department of Economics and Business, University of Catania,
Corso Italia 55-95129 Catania
Telephone number: +39.095.7537721; Fax: +39.095.7537710
E-mail: rizzor@unict.it

[c] DiGiES, Mediterranean University of Reggio Calabria, Via dei Bianchi 2-89127 Reggio Calabria
Telephone number: +39.0965.1695510; Fax: +39.0965.1695343
E-mail: carla.scaglioni@unirc.it

1 - Introduction

The increasing demand for transparency is a fundamental claim in democratic societies. Public administrations have been recently required to be more transparent in providing information about their activities with the aim of increasing their accountability, improving the use of public resources and enhancing citizens' trust in public institutions (OECD 2012; 2015).

Though there are many definitions of transparency, all of them consider the openness in the flow of economic, political and social information to the relevant stakeholders as the core of the phenomenon (Meijer 2009; 2013). Public administrations are required to engage in a more active disclosure of information (the so-called proactive transparency), while in the past they were passively providing it on request, and at their own discretion (the so-called reactive transparency) (see, among others, Piotrowski 2008; Meijer et al. 2012). There is a rich literature on the conceptual aspects of transparency and on its measurement and, consequently, the empirical analyses are growing[1].

Transparency can be measured in several ways. The "bottom up" approach develops measures of transparency based on the stakeholders' opinions through surveys. Along this line, there are few initiatives by international organizations, such as the *OECD Open Government Data* project and the *World Economic Forum Global Competitiveness Report*, and partial/single country indicators, provided by *Transparency International* for the Spanish Municipalities. Other contributions have developed specific transparency indexes based on a participatory method, like Ferreira da Cruz et al. (2016) for the Portuguese municipalities and Bertelli & Piotrowski (2010) for the New Jersey municipalities. There are also worldwide economic and politico-institutional transparency indexes based on several independent sources (Bellver & Kaufmann 2005).

The "top down" approach, instead, constructs legal/formal indicators moving from the existing transparency regulation. Some contributions have measured fiscal transparency indicators based on financial and non-financial information published on the website of public administrations

[1] For a recent and extensive review on transparency, see Cucciniello et al. (2016).

(for a survey, see Jorge et al. 2011). To our knowledge, apart from Galli et al. (2017)[2] there are not so many contributions in the literature, which have tried to estimate a broad transparency indicator based on existing regulation.

Using different measures of transparency, recently a branch of literature has empirically investigated the determinants of transparency in different countries. Alt et al. (2006), using a unique data set on transparent budget practices, which consists of survey responses to a questionnaire sent to the budget officials of the fifty states of the USA from 1972 to 2002, show that political competition and fiscal imbalances are associated with higher fiscal transparency, while political polarization is associated with lower transparency.

Esteller & Polo-Otero (2008) find that in the Catalan municipalities fiscal transparency is mostly determined by political competition, the number of inhabitants and the accumulation of debt. Using a measure of municipal transparency in New Jersey, Bertelli & Piotrowski (2010) find that, among several economic, social and institutional determinants, only the level of education, the percentage of elderly people and the size of the budget are significantly correlated with transparency. Caamaño et al. (2011) examine budget transparency for 33 municipalities in Galicia and find that unemployment is negatively correlated with fiscal transparency while the institutional variables are not. Bastida et al. (2011) show that municipalities collecting more taxes and receiving more transfers disclose more financial information. Moving from the analysis of fiscal transparency's website content of the Portuguese and Italian local governments, Jorge et al. (2011) find that the size of the municipalities and the rate of abstentionism in the last local elections are the only significant determinants of transparency. Albalate (2012), drawing on the 2010 transparency indexes constructed by Transparency International for Spanish Municipalities, finds that large municipalities and left-wing local government leaders are associated with better transparency. Using the same Transparency International indexes for Spanish municipalities, FerrazEsteves de Araújo & Tejedo-Romero (2016)

[2] For details, see below, par 3.1.

find that transparency level is associated with unemployment rate, investment, electoral turnout, political ideology, political competition and size of the population, but not with public debt and gender. Navarro et al. (2014) find that factors such as financial risk, demography and perception of stakeholders' demands have a significant impact on the sustainability-related transparency items (general, environmental, economic and social) of local governments in Nordic countries. Alcaraz-Quiles et al. (2015) provide evidence that socio-economic factors - such as education, population density and access to internet - as well as e-government factors - such as the provision of public information online, the percentage of procedures completed after online start and the level of online services provided and broadband availability - are all relevant to the disclosure of information by Spanish regional governments.

Most of the existing literature on transparency refers to local governments. Apart from reasons related to data availability, the relevance of local governments on this matter can be explained recalling that decentralization fosters accountability, as widely recognized in the literature of yardstick competition related to local fiscal policies (Salmon 1987; Tommasi & Weinschelbaum 2007, Oates 2008; Martinez-Vazquez 2016) and in the official reports (OECD 2017). As Qian & Weingast (1997, p. 88) stress, "competition among jurisdictions forces governments to represent citizen interests and to preserve markets". Indeed, under given assumptions, resource allocation is claimed to be more efficient in a decentralized context, since local governments enjoy better information about citizens' preferences (and services costs) and are more incentivized to pursue innovative policies. However, if citizens/taxpayers lack information the claimed accountability would be weaker and, therefore, the potential benefits of a decentralized approach might be reduced. In this respect transparency can play a crucial role in producing information and favouring citizens access.

More in general, the satisfaction of the demand for transparency is one of the policies undertaken in many countries (Holzner & Holzner 2006). In Italy major reforms have been introduced since 2009 to favour transparency in public administrations and improve integrity and performance.

Rules have been issued to establish detailed transparency obligations for public administrations and to ensure the monitoring of their fulfilment[3].

Notwithstanding these significant legislative and administrative efforts carried out at any level of public administration, no much attention has been paid so far to transparency in the economic literature, except for a couple of contributions. Fadda et al. (2018), using the information derived by the 'Compass of Transparency'[4], show that there is an inverse correlation between levels of corruption and public administrations commitment towards transparency. Galli et al. (2017; 2018a, 2018b) build a completely new dataset for a large sample of Italian Municipalities, construct a composite indicator of transparency (CTI), which shows a satisfactory correlation with widely used measures of the quality of institutions as well as with the official data on municipalities' performance in public spending (Galli et al. 2018a) and Equitable and Sustainable Well-being (Galli et al. 2018b) indicators. Moreover, no empirical research so far has investigated the occurrence of strategic interactions in transparency.

Using the above-mentioned CTI for a sample of 524 Italian Municipalities, this paper addresses the spatial dimension of transparency. We perform the analysis in two steps. Firstly, we investigate the geographical characteristics of transparency, to check whether and where spatial dependence occurs. Our results suggest that there is a statistically significant clustering across the Italian Municipalities according to a dichotomic pattern, i.e. Municipalities seem to cluster where transparency is either very low or very high. Secondly, using a spatial analysis approach, we test for the occurrence of spatial interactions at local level controlling for several factors which affect transparency, such as socio-demographic, economic, fiscal and politico-institutional ones, in line with

[3] For details, see below, Section 2.

[4] The 'Compass of Trasparency' is a web-portal managed by the Italian government, which only assesses whether in the public administrations' websites the "Transparent Administration" section exists and if its structure formally complies with the standard legal requirements, without verifying the data and information content.

the above-mentioned literature. We find that a robust effect of spatial dependence holds in all the estimated models.

The paper develops as follows: Section 2 offers a short overview of the main features of the Italian regulation of public administration transparency and presents the CTI. Section 3 illustrates the data, the methodology, the variables and discusses the results. Section 4 provides some concluding remarks.

2 - Rules, actors and measurement of transparency

A detailed description of the Italian legislation on transparency is outside the scope of this paper. Here, it is worth noting that the 2009 reform[5] has established new rules and standards for transparency as well as for the performance of central government, emphasizing the connections with the aim of improving public sector accountability. An independent specialized Commission (*Commissione per la valutazione, l'integrità e la trasparenza delle pubbliche amministrazioni*– CiVIT) has been instituted to oversee the difficult implementation of such a reform (CiVIT, 2012).

Since the 2009 reform, the legislation on transparency has evolved through time enhancing the role of transparency to promote integrity and prevent corruption. A crucial step of this renewed effort is the Anticorruption Bill[6], which, among the other things[7], has put the basis for a new regulation[8] issued in 2013 on publication requirements, transparency and disclosure of information by public organizations. The new rules enlarge the number of very detailed obligations (about 270) to be published in a standardised format (*Amministrazione trasparente*[9]) and extend transparency

[5] Legislative Decree n. 150/2009 containing provisions on "*optimization of the productivity of public employees and efficiency and transparency of public administrations".*

[6] Law no. 190/2012, containing "*Provisions for the prevention and repression of corruption and illegality in Public Administration*".

[7] For details on the provisions of the Anticorruption Bill and on its implementation, see ANAC (2013), ANAC (2014) and ANAC (2015).

[8] Legislative decree n. 33/2013 containing "*Rules about publicity, transparency and information provision of public administrations."*

[9] Transparency obligations refer to both the integrity and the performance of public organizations, including, among the others, information about politico-administrative bodies and top public managers and officials, the private-public companies providing local public services, external consulting and collaborations, public procurement, management of the property and assets, timing of the payments and provision of public services.

obligations to all public offices at any level of government and Publicly owned companies (more than 10,000 subjects). Moreover, the access to information has been made easier (*civic access*) and, in the same direction, the generalized dissemination of information upon request has been also introduced in 2016[10].

The implementation of the transparency rules introduced in 2013 requires the interaction of several actors. In each public organization, on the one hand, a Responsible for Transparency is encharged of the implementation of transparency obligations; on the other hand, an Independent Evaluation Unit (*Organismo Indipendente di Valutazione* - OIV) is appointed by the political decision-maker to assess the fulfilment of transparency obligations and certifies it on the organization's website.

At central level, the National Anticorruption Authority (*Autorità Nazionale Anticorruzione* - ANAC)[11] performs regulatory and monitoring functions[12], with the power of issuing sanctions for non-compliance. However, in practice, monitoring refers only to very small samples, especially if compared with the huge number of public organizations, subjected to transparency regulation[13]. ANAC has carried out monitoring both indirectly, using OIVs statements, and directly, verifying public organizations websites. Though caution is needed because of the very small samples, looking at ANAC monitoring evidence (ANAC 2013; 2015; 2016) compliance appears rather disomogeneous across different types of public organizations, with small Municipalities exhibiting more difficulties of compliance than larger ones, and in relation to the type of information. While the publication of data is overall rather widespread, it seems that information which is more related to management and

[10] Legislative decree n. 97/2016, containing "*Revision and simplification of rules on the prevention of corruption, publicity and transparency*". It is part of a wider reform for the reorganization of public administrationsand and it follows the Freedom of Information (FOI) approach.

[11] The National Anticorruption Authority is identified in the former Commission for Evaluation, Transparency and Integrity (CIVIT). Law 114/2014 has redesigned its mission: among the others, its powers to prevent corruption and to foster transparency have been enlarged.

[12] The legislative decree n. 97/2016 has entitled ANAC to diversify obligations across administrations depending on the type and the size and has enlarged ANAC's sanction powers.

[13] Monitoring is undertaken both on single public organizations (mainly in response to complaints on non-compliance) and on samples of public organizations (*ex officio*). ANAC has monitored *ex officio* 165 different types public organizations in 2013-14; 98 different types of public organizations in 2015 and 42 different types of public organizations in March 2016. For more details, see ANAC (2013, 2015 & 2016).

performance is less transparent than on other public activities. A closer analysis of the degree of fulfilment of transparency obligations is offered by Galli et al. (2017), as indicated below.

3 - Data, variables and empirical strategy

In this section, we aim at empirically verifying whether transparency shows a spatial dependence across Italian Municipalities. To this end, we first look for possible clustering patterns caused by spatial spillovers; then, we use a spatial analysis controlling for the effects that socio-demographic, economic, fiscal and politico-institutional variables have on transparency compliance.

3.1 - Data and variables

We use the CTI constructed by Galli et al. (2017) for a sample of 524 Italian Municipalities[14] as dependent variable. The CTI is based on a completely new dataset containing transparency obligations validated by the OIV of each administration[15], according to ANAC resolution n.77/2013. The selected information is organized in two groups: one referring to *Integrity*, which includes items such as income and asset disclosure and conflicts of interest (on both politicians and top and senior public officials); the other, referring to *Performance*, which consists of information about the management of public property, the timeliness of public services provision, the quality of public services. The value of each of the selected items is based on the OIV evaluation (according to the criteria established by ANAC) in terms of information avaibility, completeness, updating and openness; each item is given equal weight, consistently with the ANAC methodology. Thus, the CTI is constructed as a simple average of two sub-indicators referring to *Integrity* (CTI *Integrity*) and *Performance* (CTI *Performanc*e). The indicator was calculated for 2013, the first year of the implementation of the new transparency regulation.

[14] The sample corresponds almost entirely to the one selected by ANAC for its monitoring activity.
[15] By law all the institutions are requested to publish the OIVs certifications and the relative filled-in format on their websites under the section *Amministrazione Trasparente*.

Our sample is quite diversified, encompassing both larger (above 150,000 inhabitants) and smaller (below 15,000 inhabitants) Municipalities, ranging from Rome (2,617,175 inhabitants) to Moncenisio (39)[16]. Although 78% of the Municipalities have less than 15,000 inhabitants, they account only for the 8% of the population of the overall sample. The largest Municipalities are in the North (representing the 43% of the overall sample), with the exception of Rome, Naples and Bari. Relatively large cities - below 250,000 to 45,000 inhabitants - count for t half of the population and are mostly located in the Centre. Specifically, 224 out of 524 Municipalities are in the Northern Regions (Piemonte, Valle d'Aosta, Liguria, Lombardia, Veneto, Friuli-Venezia Giulia, Trentino-Alto Adige, Emilia-Romagna), 95 in the Central ones (Lazio, Marche, Toscana ed Umbria) and 205 in the Southern areas (Abruzzo, Basilicata, Calabria, Campania, Molise, Puglia, Sardegna, Sicilia). Table 1 summarizes the descriptive statistics of the sample distribution by geographical area.

Table 1. Sample distribution by geographical area

Macro Area	**Municipalities in the sample by geographical area**						
	Number	**% Cumulate**	**Cohorts of Population (*inh. %*).**				
			250,000 and above	***249,999-90,000***	***89,999-45,000***	***44,999-15,000***	***Below 15,000***
North	**224**	***43%***	3%	10%	6%	4%	78%
Centre	**95**	***18%***	2%	12%	8%	4%	74%
South	**205**	***39%***	2%	6%	8%	3%	80%
All sample	**524**	***100%***	2%	9%	7%	4%	78%

Source: own elaborations on Istat (2013).

The control variables have been selected according to the above-mentioned literature on the determinants of transparency and grouped in socio-economic, fiscal and politico-institutional factors. The socio-economic variables are the following:

Education: Percentage of population with a secondary school diploma. Higher level of education is likely to be positively related to transparency.

[16] The mean and median population of all the Italian Municipalities in 2013 were about 7,500 and 2,500 inhabitants, respectively. Therefore, a Municipality with more than 15,000 people is considered a medium-large city.

Gender: Percentage of women in the total local population. As women generally show a higher pro-social attitude, a positive sign is expected.

Elderly: Percentage of citizens aged 65 years or older in the total local population. Being CTI based on website information, a negative relationship is expected.

Unemployment: Share of unemployed inhabitants in the Municipality. The expected sign is not univocal. Either people under economic pressure have a greater incentive to monitor the government action or they respond to the adverse economic conditions by withdrawing from the civic participation.

Digital Divide: Share of people who do not have access to information and communication technology (ICT). Being CTI based on website information, a positive relationship is expected.

The fiscal variables are the following:

Fiscal autonomy: The percentage of own taxes over the total revenues, as a proxy for accountability. A positive sign is expected.

Fiscal efficiency: The Municipality capability of disposal of residual liabilities. More efficiency in budgeting is expected to be associated with higher transparency.

The politico-institutional variables are the following:

Mayor age, gender and education: These variables refer to individual characteristics of the mayor. Younger, female and more educated mayors are likely to be positively related to transparency.

Political party: Dummy variable taking the value of 1 if the ruling local government leader belongs to a left-wing party, and 0 otherwise. There are no a-priori on the sign of the coefficient.

Turnout: Percentage of participation in the latest local elections in the Municipality. This variable serves as a proxy for citizens' interest in politics and, consequently, for the demand of accountability and transparency. A positive sign is expected.

Electoral system: Dummy variable taking the value of 1 for the single ballot electoral system applied in the Municipalities below 15,000 inhabitants and 0 otherwise[17]. With respect to the impact on transparency, we expect a positive coefficient as the single ballot favours the selection of more qualified politicians. This variable is also a proxy of the size of the population.

Second term: Dummy variable taking the value of 1 if the Municipal government is allowed to run a second term, 0 otherwise. The possibility of a second term, which strengthens the accountability concerns, is expected to be positively correlated with transparency.

Institutional Quality Index (IQI), developed by Nifo & Vecchione (2014). Higher quality of the institutions is expected to be positively correlated to transparency.

Table 2 shows the summary statistics of the variables employed in our study[18].

Table 2 -Summary Statistics

	Obs	Mean	Std. Dev.	Min	Max
Dependent variable					
CTI	524	.01778	1.146872	0	3.641768
Socio-economic variables					
Education	524	.3716366	.0869236	.0822	.6177
Gender	524	.512	.018	.379	.560
Elderly	524	.2298941	.0520482	.1091	.4769
Unemployment	524	.1079315	.061674	0	.4218182
Digital divide	524	.185687	.3127784	0	1
Fiscal variables					
Fiscal autonomy	524	.5589046	.2114132	0	.944
Fiscal efficiency	524	.384437	.1862201	0	.948
Political and Institutional variables					
Age Mayor	524	52.44656	9.707136	26	86
Gender Mayor	524	.110687	.314044	0	1
EducationMayor	524	.5076336	.5004195	0	1
Political Party	524	.7843511	.4386484	0	3
Turnout	524	.7097131	.112851	.331	.9684
Electoral System	524	.2270992	.4193576	0	1
Second term	524	.4484733	.4978132	0	1
IQI	524	.8301638	.1510528	0	1

[17] Specifically, in the less populated Municipalities citizens vote once, i.e. there is only a single round (single ballot) while in large Municipalities citizens vote twice, i.e. a dual ballot mechanism is used to select a winner. For the investigation of the effect of different electoral rules on the selection of politicians, see Nannicini & Galasso (2011) and Bordignon et al. (2016).

[18] In the Appendix, Table A1 reports variable descriptions and sources.

3.2 - Spatial dependence

The first line of empirical analysis aims at investigating the geographical dimension of transparency, to assess whether there is evidence of similarities in the transparency behaviour of Municipalities in relation to their geographical location. To analyze spatial dependence, the most known indicator is the Moran's I (*MI*) (Moran, 1950), which is mostly used to test whether socio-economic phenomena either cluster or are randomly spread in the space dimension[19].

In our case the *MI* is used to study if the attribute value of a specific unit (*i.e.* the degree of transparency of each Municipality) clusters with neighbours. Formally, this relation is expressed as follows:

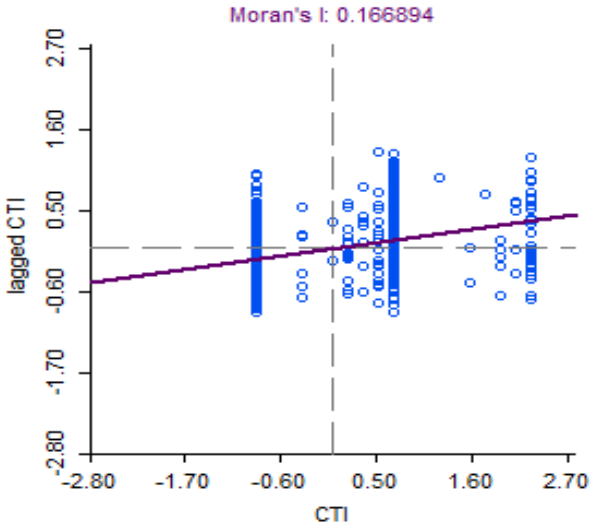
$$I = \frac{N}{W} \frac{\sum_i \sum_j w_{ij}(x_i - \overline{x})(x_j - \overline{x})}{\sum_i (x_i - \overline{x})^2} \qquad (1)$$

Where *N* is the number of Municipalities indexed by *i* and *j*, *x* is the variable of interest; $\overline{x}$ is its mean, and *wij* is an element of the spatial weights matrix W_{ij}, which is defined as distance-based spatial weights matrix, where the definition of neighbour is based on the distance between polygon centroids[20]. The matrix is standardized by row. If many neighboring features have high or low cross-products, then there is clustering. The test result varies between -1 and 1 and can be interpreted as a correlation. A positive coefficient means positive spatial autocorrelation, the opposite a negative one. In the first case, similar values cluster together, while in the latter dissimilar values cluster. A value close to zero identifies a random spatial pattern. Statistics can be represented both in a scatterplot, *i.e.*the Moran's scatterplot (as in Figure 1), or in a map (as in Figure 2.b). In the scatter plot, which is rescaled on the mean, the spatial lag is specified on the *y*-axis, while the *x*-axis is standardized and the units correspond to standard deviations[21]. Each quadrant corresponds to a different type of spatial autocorrelation: high-high (Quandrant II) and low-low (Quandrant IV) for positive spatial correlation

[19] For a discussion on alternative spatial autocorrelation indicators see among others Griffith (1987).
[20] We use a matrix determined applying an algorithm based on kclosestneighbours, since in our sample there are two islands (Sicilia and Sardegna). See Table A2 in the Appendix.
[21] Any observations beyond 2 standard deviations are typically categorized as outliers.

or spatial clusters; high-low (Quandrant I) and low-high (Quandrant III) for negative spatial correlation or spatial outliers. As for transparency, the *MI* provides a global statistic, which in our case is 0.167 (p = 0.001)[22], showing a moderate but significant spatial autocorrelation in our sample (see Figure 1).

Figure 1 –*Moran's I* scatter plot



To further investigate where the Municipalities are clustering relatively to their degree of transparency compliance, we estimate the Local Indicators of Spatial Association (LISA[23]) which not only test for local clustering, but also identify the presence of local significant spatial clusters (the high-high and low-low locations) or local spatial outliers (the high-low and low-high locations).

Figure 2 depicts, on the left side (a), the map of our sample; on the right side (b), the Local Moran's Map, which shows the clustering of the CTI. The Municipalities where high rates of transparency cluster with high rates are colored in red; those where low rates of transparency cluster with low rates are colored in blue. There is also a mix of high-low (light red) and low-high (light blue) outcomes. We are able to identify a moderate but significant clustering of transparency across

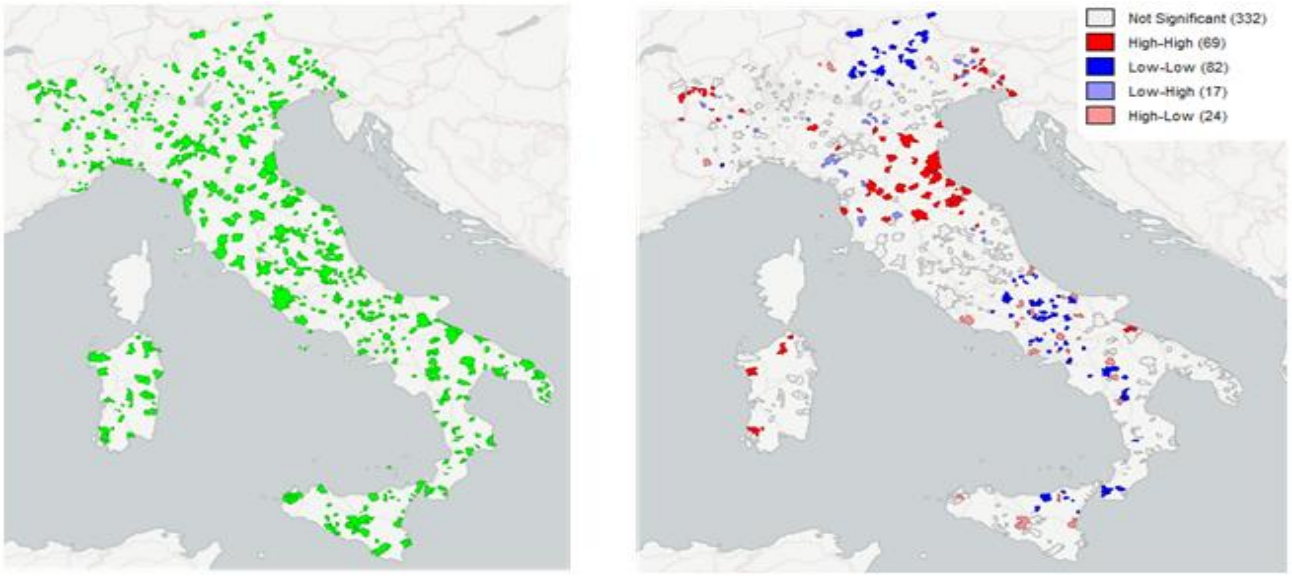
[22] Randomization was tested on 999 permutations.

[23] We recall here that the "so-called spatial clusters shown on the LISA cluster map only refer to the core of the cluster. The cluster is classified as such when the value at a location (either high or low) is more similar to its neighbours (as summarized by the weighted average of the neighboring values, the spatial lag) than would be the case under spatial randomness. Any location for which this is the case is labeled on the cluster map. However, the cluster itself likely extends to the neighbors of this location as well" (Anselin 2005). See also Ord & Getis (1995).

the Italian Municipalities according to a dichotomic pattern. While about 332 municipalities do not appear clustered, geographical agglomerations emerge in the two polar cases, where transparency is either very high or very low.

Figure 2– Sample Map and CTI Local Moran's Map

a. Sample Map b. CTI Local Moran's Map



Source: own elaborations.

As it emerges from the map (Figure 2.b), spatial clustering of high values ('red spots') occurs in different areas of the Northern Regions, especially in Emilia-Romagna. Some clustering of low values of transparency ('blue spot') are located in the South of the country. Specifically, the percentage of Municipalities characterized by significant *p-value* is higher in the low-low cluster (43%) than in the high-high cluster (36%). It seems that in the South there are less incentives to well perform in terms of transparency while in the North a virtuous transparency mimicking takes place (see on this point Section 3.5). This evidence can be the outcome of the existence of either a strong or weak institutional network among neighbouring Municipalities, as transparency turns out to be correlated with trust in institutions and social participation (Galli et al. 2018a). The percentage of the Municipalities that do not belong to the other two groups is about 21%.

3.3 - The transparency spatial interaction: an empirical model

As the aim of our paper is to check the existence of transparency interactions among Municipalities, we now consider spatial dependence in a cross-section framework. It is worth recalling that in the case of spatial autoregression the dependent variable or error term in each location is correlated with observations of the dependent variable or values of the error term in other locations (LeSage 1998, Anselin 1999). To test for spatial autocorrelation, we first estimate a spatially independent model assuming that $\rho = 0$. Our preliminary analysis (Section 3.2) suggests that spatial effects play an important role in explaining transparency patterns across Italian Municipalities which may cause OLS estimates to be biased, inconsistent and/or inefficient. To investigate the relevance of this potential problem in our sample, we use the residuals of the OLS estimation to calculate the Lagrange multiplier tests for the spatial lag model and the spatial error model, and their robust versions (Cliff & Ord 1973; Anselin & Rey2014). Following Anselin & Bera (1998) and Corrado & Fingleton (2012), we calculate the Moran's I statistics on the row-standardized weights matrix (WCTI) as in Section 3.2[24].

Table 3 reports the statistics for three different models which include the set of control variables presented above, i.e. the Socio-economic Model, the Fiscal Model and Politico-institutional Model. For all of them the hypothesis of no spatial autocorrelation is rejected because the *p*-values of the Lagrange multiplier test statistics *LM*ρ and *LM*ρ* are sufficiently small. This implies that the spatial lag term (ρ) needs to be taken into account. Furthermore, the test statistic *LM*λ* rejects null hypotheses when the autoregressive parameter is zero. This is confirmed by the SARMA test where both spatial coefficients are considered.

[24] We recall that W_{CTI} has been selected among different types of weight matrices based on the geographical distance across the Municipalities (see Table A2 in the Appendix).

Table 3 - Spatial correlation tests

Test/Model	Socio-economicModel		Fiscal Model		Politico-Institutional Model	
	Value	**p-value**	**Value**	**p-value**	**Value**	**p-value**
Moran's I	***0.1681***	***0.0000***	***0.1647***	***0.0000***	***0.1603***	***0.0000***
Lag Lagrange Multiplier (LMρ)	58.3180	0.0000	58.920	0.0000	60.806	0.0000
Error Lagrange Multiplier (LMλ)	78.4090	0.0000	75.240	0.0000	71.321	0.0000
RobustLag Lagrange Multiplier (LMρ*)	0.0217	0.88291	0.0863	0.7690	0.289	0.5908
RobustError Lagrange Multiplier (LMλ*)	20.1126	0.0000	16.4058	0.0000	10.805	0.0010
SARMA Lagrange Multiplier	78.4307	0.0000	75.326	0.0000	71.610	0.0000

Note: LMρ, Lagrange multiplier test for the lagged dependent variable; LMλ, Lagrange multiplier test for the spatial autocorrelation of residuals.

Based on the results of these tests, the General Spatial Model or Spatial Auto Correlation Model (SAC), which includes both the spatial lag term and a spatially correlated error structure, turns out to be the most appropriate. The model is expressed as it follows:

$$\mathrm{CTI_i} = \rho \mathrm{WCTI_i} + \mathrm{X}\beta_i + \mu_i; \qquad (2)$$

where

$WCTI_i$ is the spatially lagged dependent variable with associated autoregressive coefficient ρ;

X is the vector of a set of additional variables that control for socio-economic, fiscal and politico-institutional characteristics of the Municipality, whose description is provided above in Section 3.1;

$\mu = \lambda W \mu_i + \varepsilon_i$ where ε is distributed N(0, σ^2), and $\lambda W \mu_i$identifies the spatially correlated error structure[25].

Municipalities are spatially dependent (ρ≠0) if the degree of transparency associated with one of them is hooked on those of others. If Municipalities show structural differences, spatial heterogeneity occurs (λ≠0).

Finally, to deal with both spatial autocorrelation and heteroskedasticity[26], the spatial regression models are estimated according to both the methods of maximum likelihood estimation (MLE) and the Generalized Spatial Two Stage Least Squares (GS2SLS).

Table 4 shows the estimated results of Equation [2] without the spatial dependence in columns (1), (4) and (7); and those with the spatial dependence in columns (2), (5) and (8). In columns (3), (6) and (9) the GS2LS estimations are presented.

[25] As explained in Schmidtner et al. (2012), the significance of ρ means that some explanatory variables correlated with the average of the dependent variable are relevant in the model specification (spatial lag; OLS estimates are biased and inference will be incorrect because of a problem of omitted variables). On the other hand, the significance of λ means that some spatially correlated explanatory variables are relevant in the error specification (spatial error/heterogeneity; OLS estimates are unbiased but no longer efficient because of the heteroskedasticity).

[26] To verify the presence of heteroskedasticity, the mainstream approach (Anselin& Rey 2014) suggests applying well-consolidated tests where the null hypothesis is always homoscedasticity: the Breusch-Pagan Lagrange Multiplier (LM) test, which is not suited in case of non-normal errors in small samples; the Koenker-Basset test, which is the best option when dealing with non-normal errors, and the White test, which is robust to any unspecified form of heteroskedasticity. For an extensive review see Lesage & Fischer (2008).

Table 4–Estimation results

Variable	Socio-economic Specification			Fiscal Specification			Politico-Institutional Specification		
	(1) OLS	(2) MLE	(3) GS2SLS	(4) OLS	(5) MLE	(6) GS2SLS	(7) OLS	(8) MLE	(9) GS2SLS
Education	0.982	1.223*	1.455**	1.127*	1.275*	1.532**	0.930	1.027	1.233*
	(0.657)	(0.660)	(0.638)	(0.665)	(0.662)	(0.642)	(0.689)	(0.685)	(0.654)
Gender	-4.222	-0.335	-2.165	-3.949	-0.305	-2.166	0.298	0.786	-1.027
	(2.818)	(2.673)	(2.234)	(2.822)	(2.666)	(2.248)	(1.010)	(2.704)	(2.291)
Elderly	2.310**	2.137**	2.637***	2.239**	2.128**	2.609***	-1.448	0.0386	0.844
	(0.982)	(0.961)	(0.821)	(0.982)	(0.959)	(0.815)	(2.826)	(1.003)	(0.821)
Population	0.331***	0.303***	0.293***	0.325***	0.299***	0.291***			
	(0.0339)	(0.0343)	(0.0336)	(0.0349)	(0.0342)	(0.0338)			
Unemployment	-2.411***	-1.682*	-1.248	-2.150***	-1.560	-1.188	-0.412	-0.767	-0.198
	(0.709)	(0.993)	(0.772)	(0.794)	(0.989)	(0.797)	(1.055)	(1.087)	(0.834)
Digital Divide	0.0613	0.0572	0.0534	0.0607	0.0503	0.0457	-0.153	-0.194	-0.168
	(0.169)	(0.159)	(0.135)	(0.169)	(0.159)	(0.133)	(0.166)	(0.156)	(0.126)
Fiscal Autonomy				-0.201	-0.00200	-0.267	0.0467	0.101	-0.0823
				(0.223)	(0.232)	(0.210)	(0.221)	(0.230)	(0.193)
Fiscal Efficiency				0.413	0.324	0.248	0.337	0.283	0.218
				(0.257)	(0.246)	(0.235)	(0.265)	(0.252)	(0.233)
Age Mayor							0.00214	0.00206	0.00223
							(0.00453)	(0.00417)	(0.00427)
Gender Mayor							0.00149	-0.00904	-0.0277
							(0.140)	(0.128)	(0.118)
Education Mayor							0.0967	0.109	0.106
							(0.0890)	(0.0818)	(0.0806)
PoliticalParty							0.179*	0.0635	0.0948
							(0.100)	(0.0960)	(0.0916)
Turnout							0.0290	-0.486	-0.350
							(0.454)	(0.444)	(0.423)
Electoral System							1.257***	1.101***	1.111***
							(0.148)	(0.144)	(0.152)
Second term							0.0452	0.0147	0.00851
							(0.0974)	(0.0898)	(0.0935)
IQI							0.698**	0.735*	0.316
							(0.286)	(0.397)	(0.237)
Constant	-0.299	-2.072*	-1.851*	-0.497	-2.209*	-1.829*	0.224	-0.255	-0.119
	(1.296)	(1.236)	(1.041)	(1.302)	(1.241)	(1.037)	(1.531)	(1.469)	(1.229)
P		-0.0978	0.452***		-0.0963	0.480***		-0.117	0.594***
		(0.189)	(0.115)		(0.183)	(0.114)		(0.194)	(0.104)
A		0.568***	0.0947		0.563***	0.0223		0.561***	-0.218
		(0.121)	(0.146)		(0.117)	(0.156)		(0.121)	(0.166)
Observations	524	524	524	524	524	524	524	524	524
Adj-R2/Peudo-R2	0.28	0.29	0.27	0.19	0.29	0.27	0.28	0.28	0.28
AIC	1462.286	1418.058		1463.315	1420.316		1471.178	1431.148	
Log likelihood	-724.143	-699.03		-722.66	-698.16		-719.589	-696.574	
Wald Test		75.77***	60.25***		73.82***	54.82***		71.36***	57.46***
Log likelihood Ratio		50.23			49			46.03	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

Overall, our results show that spatial dependence matters. Spatial Lag Coefficients (ρ_s) are generally significant and positively correlated with transparency. The diagnostic ML estimations (see

columns 2, 5 and 8) suggests that heteroskedasticity is still a serious problem. The values obtained for the Waldtest (W), the Log Likelihood Ratiotest (LR) and the LM-Lag test do not respect the expected ordering, i.e. W > LR > LM (Anselin 2005; Anselin & Rey 2014). The hypothesis that the spatial autoregressive error is absent ($\lambda = 0$) is rejected. Consequently, we re-run our estimation through the Generalized Spatial Two Stage Least Squares (columns 5, 6 and 7). The regression diagnostic suggests that these results are robust. The spatial lag term (ρ) is higly significant while the spatial autoregressive error (λ) is not (Kelejian & Prucha, 2010). Alternative specifications which either include new explanatory variables or incorporate different spatial weights (Anselin & Kelejian 1997; Anselin 2011) are not required.

Our results seem to suggest that transparency is spatially determined across neighbour Municipalities. This phenomenon is in line with the predictions of the above-mentioned literature on yardstick competition related to local fiscal policies (Salmon 1987; Tommasi & Weinschelbaum 2007, Oates 2008) though in a different context. This literature emphasizes that at local level greater efficiency in the provision of public services is likely to occur, depending on the inter-jurisdictional competition which in turn enhances the control process by citizens and guarantees greater accountability of public officials (Qian & Weingast 1997). Moreover, the experimentation of innovative policies to improve the efficiency at local level is favoured by decentralization. In such a framework, transparency plays an important role and it is reasonable to assume that a mimicking behaviour occurs because citizens, looking for information about public activities, evaluate local administrators using as benchmark the degree of transparency of neighbour Municipalities. Mimicking in transparency is further strengthened by two factors: 1) from the perspective of citizens competition is costless because access to information, being provided on the website, is almost free; 2) from the perspective of local administrators, competition is challenging because citizens can report lack of compliance to ANAC and sanctions can be issued[27].

[27] See *supra* Section 2.

Our results also suggest that transparency spillovers mainly exist among small Municipalities where citizens' political participation is likely to be greater and the single ballot electoral system strengthens the incentives for government accountability. Moreover, both the level of education and the quality of institutions are the only factors which may be considered drivers of transparency, even though their significance is not confirmed in all the specifications.

3.4 - Robustness check

In order to capture high-high and low-low spatial interactions among neighboring Municipalities we include in the GMM estimations the macro-area and regional dummy variables as observed common factor for the Municipalities. Our previous findings are confirmed (see Table 5). The included dummies play a significant role, suggesting that in the Southern regions the socio-institutional environment generates less incentives to perform well in terms of transparency while in the North a virtuous transparency mimicking takes place. Moreover, the spatial error turns out to be significant only in the full specification where education loses significance signaling a problem of misspecification generated by the regional fixed effects.

Table 5 – GMM estimations with macro-area and regional dummies

	Socio-economic Specification			Fiscal Specification			Politico-Institutional Specification		
VARIABLES	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
edu	1.473**	1.653**	1.536**	1.559**	1.675**	1.607**	1.240*	0.907	1.239*
	(0.636)	(0.653)	(0.624)	(0.640)	(0.656)	(0.634)	(0.670)	(0.699)	(0.665)
gender	-2.023	-1.583	-2.431	-2.008	-1.468	-2.224	-0.985	-0.631	-0.987
	(2.248)	(2.143)	(2.215)	(2.264)	(2.175)	(2.230)	(2.322)	(2.321)	(2.302)
elder	2.632***	2.913***	2.894***	2.626***	2.943***	2.815***	0.848	0.449	0.847
	(0.823)	(0.834)	(0.812)	(0.816)	(0.846)	(0.817)	(0.847)	(0.918)	(0.848)
ltot_popu	0.292***	0.299***	0.293***	0.289***	0.295***	0.289***			
	(0.0335)	(0.0331)	(0.0337)	(0.0336)	(0.0332)	(0.0338)			
unemp	-1.076	-0.380	-1.177	-1.062	-0.393	-1.051	-0.558	-0.0650	-0.200
	(1.050)	(1.150)	(0.740)	(1.027)	(1.141)	(0.805)	(0.957)	(1.099)	(0.867)
digdiv	0.0576	0.0959	0.0688	0.0471	0.0803	0.0647	-0.181	-0.157	-0.169
	(0.138)	(0.139)	(0.134)	(0.136)	(0.139)	(0.136)	(0.129)	(0.136)	(0.128)
finance				-0.271	-0.131	-0.139	-0.0439	0.0306	-0.0885
				(0.210)	(0.249)	(0.247)	(0.202)	(0.248)	(0.248)
effic				0.233	0.192	0.238	0.249	0.237	0.215
				(0.245)	(0.248)	(0.236)	(0.245)	(0.245)	(0.236)
may_age							0.00249	0.00269	0.00224
							(0.00428)	(0.00398)	(0.00427)
may_gend							-0.0138	-0.124	-0.0280
							(0.118)	(0.122)	(0.118)
may_edu							0.106	0.155**	0.107
							(0.0813)	(0.0763)	(0.0810)
politi_party							0.0897	0.0580	0.0905
							(0.0926)	(0.0978)	(0.0954)
turnout							-0.382	-0.585	-0.367
							(0.439)	(0.433)	(0.439)
ele_sys							1.112***	1.167***	1.107***
							(0.151)	(0.150)	(0.149)
sec_mand							0.00520	0.00285	0.00714
							(0.0941)	(0.0955)	(0.0943)
iqi_prov							0.415	1.152**	0.307
							(0.305)	(0.536)	(0.254)
CTI	0.452***	0.434***	0.497***	0.503***	0.533***	0.496***	0.618***	0.644***	0.609***
	(0.122)	(0.119)	(0.105)	(0.117)	(0.114)	(0.108)	(0.0978)	(0.102)	(0.0973)
e.CTI	0.0911	-0.238	-0.0138	-0.00417	-0.334*	-0.0142	-0.212	-0.646***	-0.218
	(0.147)	(0.192)	(0.152)	(0.154)	(0.192)	(0.155)	(0.145)	(0.196)	(0.146)
Constant	-1.929*	-2.272**	-1.893*	-1.930*	-2.413**	-1.999*	-0.253	-0.708	-0.131
	(1.043)	(1.026)	(1.041)	(1.035)	(1.040)	(1.046)	(1.259)	(1.344)	(1.275)
Area dummy	Y	N	N	Y	N	N	Y	N	N
Regiondummy	N	Y	N	N	Y	N	N	Y	N
RSS dummy	N	N	Y	N	N	Y	N	N	Y
Observations	524	524	524	524	524	524	524	524	524

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.10

4 - Concluding remarks

Is transparency spatially determined across Municipalities in Italy? So far, no empirical research has addressed the spatial dimension of transparency. We do so by using a composite indicator of transparency (CTI) built by Galli et al. (2017) for a sample of 524 Italian Municipalities. We find a statistically significant clustering across them according to a dichotomic pattern, i.e. Municipalities seem to cluster where transparency is either very low or very high. Based on these results, we use a spatial analysis approach to test for the occurrence of spatial interactions at local level controlling for several factors which affect transparency, such as socio-demographic, economic, fiscal and politico-institutional ones. We find a robust effect of the spatial dependence in all the estimated models, while observing similar transparency behaviours mainly across small Municipalities. There citizens' political participation is likely to be greater and the single-ballot electoral system strengthens the incentives for government accountability.

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Appendix

Table A1–Variable descriptions and sources

Variables	Description	Source
DependentVariable		
Transparency Index (CTI)		Galli et al. (2017)
Socio-demographicvariables		
Education	Percentage of population with a diploma in secondary school	Istat
Gender	Percentage of women over the total local population	Istat
Elderly	Percentage of citizens aged 65 years or older over the total local population.	Istat
Population	Size of the city in terms of inhabitants (in thousands)	Istat
Economicvariables		
Unemployment	Share of unemployed inhabitants in the Municipality	Istat
Digital Divide	Share of people who do not have access to information and communication technology	Ministry of Economic Development
Fiscal variables		
Fiscal autonomy	Percentage of own taxes over the total revenues	Istat
Fiscal Efficiency	Capability of disposal of residual liabilities	Istat
Political and Insitutionalvariables		
Age_Mayor:	Age of Mayor for each Municipality when elected	Ministry of Home Affairs
Gender_Mayor	Dummy variable taking a value of 1 if the ruling municipal government leader is a woman and 0 otherwise	Ministry of Home Affairs
Education_Mayor	Dummy variable taking a value of 1 if the ruling municipal government leader has a Bachelor Degree and 0 otherwise	Ministry of Home Affairs
Political_Party	Dummy variable taking a value of 1 if the ruling local government leader belongs to a left-wing party, and 0 otherwise. This variable test for the role of ideology	Ministry of Home Affairs
Turnout	Percentage of participation in the last local elections in the Municipality	Ministry of Home Affairs
Electoral_system	Dummy variable taking a value of 1 for the electoral system of municipalities below 15,000 inhabitants and 0 otherwise	Ministry of Home Affairs
Second mandate	Dummy variable taking a value of 1 if the Municipal government is allowed to run second term and 0 otherwise	Ministry of Home Affairs
IQI	0<I<1	Nifo and Vecchione (2014)

Table A2–Spatial weight matrix selection

	Value	**p-value**	**Akaike information criterion**	**Log-likelihoodfunctionvalue**
1-nearest neighbour				
Moran's I	3.716	0.0002	1457.024	-712.512
5-nearest neighbours				
Moran's I	6.612	0.0000	1439.145	-703.572
10-nearest neighbours				
Moran's I	**9.208**	**0.0000**	**1431.15**	**-696.57**
15-nearest neighbours				
Moran's I	9.130	0.0000	1431.80	-699.402
1/d				
Moran's I	8.091	0.0000	1435.92	-701.96
$1/d^2$				
Moran's I	5.851	0.0000	1443.87	-705.935
$1/d^3$				
Moran's I	4.825	0.0000	1450.61	-709.307
$1/d^4$				
Moran's I	4.326	0.0000	1471.18	-719.589

*** p<0.01, ** p<0.05, * p<0.1

Note: In order to select the weighted matrix, we compare the method of maximizing the value of thelog-likelihood function and the Akaike information criterion (AIC) for the model presented in equation (7). Weponder several matrices based on the k-nearest neighbours (k = 1, 5, 10, 15) computed from the distance between the centroids of the various Municipalities (Le Gallo & Ertur 2003). Additionally, we construct various inverse distance matrices, whose off-diagonal elements are defined by $W_{ij} = 1/d_{ij}^{\alpha}$(α = 1, 2, 3, 4) (Anselin & Rey 2014; Keller & Shiue 2007; Elhorst, 2014; Elhorst et al. 2013, Ezcurra & Rios, 2015; Harris 2011). The weighting matrix showing the best results assumesk = 10, i.e. that each Municipality relates to its 10nearest Municipalities and therefore it is the one that we useinour analysis.

Table A3 –Correlation Matrix

	CTI	Education	Gender	Elderly	Population	Unemployment	Digital Divide	Fiscal Autonomy	Fiscal Efficiency	Age Mayor	Gender Mayor	Education Mayor	Political Party	Turnout	Electoral System	Second mandate	IQI
CTI	**1**																
Education	0.37	**1**															
Gender	0.18	0.34	**1**														
Elderly	-0.04	-0.23	0.15	**1**													
Population	0.51	0.66	0.41	-0.27	**1**												
Unemployment	-0.09	0.03	0.11	-0.18	0.13	**1**											
Digital Divide	-0.20	-0.34	-0.17	0.45	-0.49	-0.14	**1**										
Fiscal Autonomy	0.13	0.13	0.11	-0.03	0.21	-0.29	-0.12	**1**									
Fiscal Efficiency	0.15	-0.04	-0.01	0.06	0.09	-0.37	-0.02	0.32	**1**								
AgeMayor	0.04	0.11	0.02	0.00	0.07	0.04	-0.07	0.01	-0.03	**1**							
GenderMayor	-0.04	-0.09	-0.08	-0.01	-0.14	-0.15	0.02	0.06	0.13	-0.10	**1**						
EducationMayor	0.12	0.13	0.11	-0.09	0.24	0.11	-0.13	0.02	-0.01	-0.15	0.04	**1**					
PoliticalParty	0.02	-0.06	-0.06	0.06	-0.12	-0.02	0.05	0.05	0.10	0.06	0.02	-0.08	**1**				
Turnout	-0.14	-0.23	-0.32	-0.22	-0.27	-0.16	-0.04	0.04	0.12	-0.03	0.08	-0.11	0.01	**1**			
Electoral System	0.51	0.64	0.40	-0.06	0.81	0.10	-0.29	0.10	0.06	0.05	-0.15	0.19	-0.13	-0.36	**1**		
Second mandate	0.07	0.20	0.18	-0.06	0.25	0.29	-0.16	-0.07	-0.21	-0.08	0.00	0.11	-0.15	-0.33	0.21	**1**	
IQI	0.16	-0.02	-0.12	0.06	0.01	-0.71	0.00	0.27	0.41	-0.03	0.16	-0.11	0.07	0.24	-0.03	-0.26	**1**