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Exploring the causality between transparency and public finance indicators among Spanish local governments to improve competitiveness

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Abstract

Transparency of public finances plays a crucial role in making local governments more competitive and their management more efficient. In order to increase the competitiveness and development of local governments, this paper investigates the relationship between expenditure, revenues, and the transparency index in Spanish municipalities. The period analyzed includes all those years in which data on municipal transparency was collected by Transparency International (2008-2017). The findings from the panel data technique (Juodis, Karavias, and Sarafidis causality test; mean group and common correlated effects mean group estimators) and the ANOVA/linear dependent Dirichlet process mixture are useful for local policies. The results obtained show that there is interdependence in the actions of political managers and the characteristics of municipalities that have an impact on fiscal outcomes. The empirical results show that direct taxes and the transparency index are causally related in both directions. Transparency has a direct impact on direct taxes and an indirect impact on indirect taxes. Fiscal synchronization for direct taxes, indirect taxes and expenditure and spend-and-tax assumption for total revenues are supported. Transparency has a positive effect on deficit and debt, and political party exerts a causal effect on debt in municipalities governed by male mayors, while the unemployment rate is a cause for deficit in the case of mayors that are males. From the findings of this study, several important policy implications can be derived.

Keywords: *transparency, expenditure, revenues, causality, government.*

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1 INTRODUCTION

The significance of efficient management in local government has recently gained prominence (Otrusinova & Kulleova, 2019). Although boosting competitiveness and managing local governance effectively depend on public finance openness, the relationship between expenditure, revenues, and transparency in the literature is still not well understood. From a theoretical and empirical standpoint, policy makers have always been quite interested in this topic (Gurdal et al., 2021; Tashevska et al., 2020). The majority of research performed to date (Bolat, 2014; Mutascu, 2016; Yinusa, 2017; Sahed et al., 2020; Tashevska et al., 2020; Khan et al., 2021) has examined the causal relationship between expenses and revenues.

The theoretical framework outlines the following assumptions about the causal relationship between revenues and expenditures: that both variables can change simultaneously, leading to fiscal synchronization; that increasing taxes is a permanent fiscal policy to close the gap; and that the government can spend more due to its greater financial resources or taxpayers' fiscal illusions, which can stimulate spending due to lower taxes and encourage demand for public goods and services (Buchanan & Wagner, 1977; Narayan & Narayan, 1986). These theories run counter to the institutional separation hypothesis, which holds that taxes and public

spending are unrelated, as there is no intertemporal causal relationship between them (Hoover & Sheffrin, 1992; Baghestani & McNown, 1994).

From the perspective of policy decision making, examining the causal relationship between revenues and expenditures is even more crucial (Siničáková et al., 2017; Tkacova et al., 2023). Spending and revenue decisions would have to be made independently in the absence of fiscal synchronization due to the lack of causality, which could lead to significant budget deficits if spending exceeds revenue collection. If revenue-increasing policies, such as tax increases, are implemented, the budget deficit may decrease or disappear if revenues drive expenditures. Finally, if spending drives revenues, the government must raise taxes to meet the payments; however, this may generate a capital outflow, as additional taxes may need to be paid in the future.

Citizens want greater control over how financial resources are spent and are especially interested in knowing the practices of institutions and the public sector (Cuadrado-Ballesteros et al., 2017; Belas et al., 2019). Consequently, citizens demand transparency from governments. Making information available to all citizens, exposing public affairs to scrutiny, and improving political and administrative efficiency are made possible by public demands for transparency in public institutions (Piotrowski & Van Ryzin, 2007; Kim & Lee, 2012; Faura-Martínez & Cifuentes-Faura, 2020, Baldissera et al., 2023). Moreover, giving public managers more authority over decision making and redistribution of funds and revenues helps to bring public managers and citizens closer together and increases citizens' trust in government (Grimmelikhuijsen, 2012; Yang, 2022; Ahmad et al., 2022; Haustein & Lorson, 2023). This promotes the growth of good governance and decreases corruption (Bertot et al., 2010; Meijer, 2009; Charron, et al., 2019).

The body of knowledge on financial transparency is expanding. Most papers address the determinants of transparency, such as revenues and expenditures (Ribeiro et al., 2017; Tavares and da Cruz, 2014), or how transparency affects government efficiency in relation to the amount of money it spends and receives (Alt et al., 2010; Gerunov, 2016). However, to our knowledge, none has so far examined the causal connection between all of them.

Studies on transparency have been conducted in numerous countries over different time periods and using various methodologies to measure transparency. In public administration, the following have been used at the local and regional level (Ma & Wu, 2011; Albalate, 2013; Tavares & da Cruz, 2014; Muñoz & Bolívar, 2015; Tejedo-Romero & de Araujo, 2018; Tavares & da Cruz, 2020), as well as the national level (Alt & Lassen, 2006; ElBerry & Goeminne, 2021; Tashevska et al., 2020; Citro et al., 2021; Bisogno & Cuadrado-Ballesteros, 2021). In order to ensure greater transparency in management, it is important to perform greater audit controls (Fülöp & Szekely, 2017; Cifuentes-Faura et al., 2023a; Murphy et al., 2023). Most studies that measure transparency at the local level look at the amount of financial data that is released online or the Transparency International index.

This paper uses panel data estimators and causality analysis to present new evidence on the impact of transparency on revenues and expenditures, as well as the effect of revenues and expenditures on the transparency index, taking into account the importance of this research topic from theoretical and political points of view. Moreover, by considering two groups of municipalities according to whether the mayor is male or female, the analysis of the impact of transparency and other indicators on debt and deficit provides additional information.

The study is conducted for Spanish municipalities between 2008 and 2017 (the time period is determined by the Transparency Index for Spanish municipalities, which was last updated in 2017 and first conducted in 2008). We focus on Spain in particular for several reasons. Transparency is a critical issue in any nation, but it is especially pertinent in Spain in light of the continuing cases of political corruption and the nation's declining level of institutional trust. Political managers can manage municipal resources more effectively and competitively at the local level due to the greater proximity of citizens and political leaders. In addition, citizens have more control over the actions of politicians, which prevents the misappropriation of public funds. On the other hand, regional issues have occupied and continue to occupy an important place in the concerns of Spanish society. Interest in these issues is increasing, and they are strongly related to political issues (Cuadrado-Roura, 2020).

Following this introduction, the paper explains the theoretical background. The next section focuses on the research objective, the methodology and the data. Finally, the paper presents the results and robustness analysis. The last section shows the main conclusions and offers valuable insights.

2 THEORETICAL BACKGROUND

According to Garrett and Vermeule (2008), the term "transparency" is often used to refer to a number of characteristics of an open system. Here, we will use it to refer to the information that is readily available about government agencies, enabling both citizens and outside parties to keep an eye on and assess the internal operations and overall effectiveness of public institutions (Meijer, 2013).

Accountability and good governance depend on transparency (Kosack & Fung, 2014; Grimmelikhuijsen & Welch, 2012; da Cruz et al., 2016; Cifuentes-Faura, 2023a,b). Given that local governments in Spain are in charge of making their own budgetary, financial, and economic decisions—all of which have an impact on transparency—it is especially important that they operate properly. To strengthen and encourage public activity transparency, as well as to control and direct the public sector, and make sure political decision-makers adhere to the principles of good governance, Law 19/2013 of December 9, 2013, on transparency, access to public information, and good governance, was passed (Cifuentes-Faura, 2021). This serves as evidence of the significance of transparency in Spain.

Given the importance that good governance and accountability issues have acquired in recent years in Spain, several studies have addressed municipal transparency with the aim of promoting greater and better exposure of municipal public financial information (Rodríguez-Bolívar et al., 2013; Laswad et al., 2005; Cifuentes-Faura et al., 2023b).

Caamaño-Alegre et al. (2013) distributed a questionnaire to measure the level of municipal transparency in 33 Galician municipalities in Spain. They found a negative correlation between political coalitions and transparency and a positive correlation between debt and transparency. Political elements such as political ideology, electoral participation and political rivalry have a great impact on the transparency index of Spanish municipalities, as shown by Araujo and Tejedo-Romero (2016a). Furthermore, those with lower unemployment rates exhibit greater transparency, which serves to validate the municipality's operations in the eyes of the public and demonstrate effective resource management. They discovered a negative, but not statistically significant, correlation between the amount of public debt, which is consistent with findings by Guillamón et al. (2011) and Albalate del Sol (2013). They could not find any proof that the mayor's gender affected transparency. On the other hand, Araujo & Tejedo-Romero

(2016b) demonstrated that, in Spanish municipalities, the presence of women in local political life lowers information asymmetry and increases information transparency.

Brusca et al. (2016), working with local municipalities in Spain and Italy, came to the conclusion that, although not all of it has yet been provided, institutional and legislative pressures as well as austerity measures have caused local governments to produce more information. More transparent are the organizations that transfer more money for capital expenditures. Cuadrado-Ballesteros et al. (2016) found, based on a sample of 110 Spanish municipalities from 2008 to 2010, that municipalities' financial situations improve when they are transparent about the actions of their local government. When people are informed about everything related to government, there is less doubt about how leaders are using funds and resources, which motivates them to run the government effectively.

Using a random effects panel data model, Tejedo-Romero & de Araujo (2018) discovered that political strength, gender, unemployment rate, and electoral participation have a significant impact on municipal transparency in Spain. A municipality's transparency increases with its unemployment rate; however, this effect is reversed if the mayor is a woman, suggesting that the influence of female mayors on transparency is greater in low-unemployment situations. Higher debt, tax, and transfer levels are positively correlated with greater fiscal transparency. Balaguer-Coll & Brun-Martos (2021) examined the factors that have influenced the development of financial and economic transparency in local governments in Spain. They concluded that opposition political parties are essential for increasing municipal transparency because their influence increases transparency. Similar to Guillamón et al. (2011), they find a notable and favorable impact on direct and indirect taxes, fees and other revenues. Local managers disseminate more economic and financial information in proportion to the level of tax revenues. According to the studies by Guillamón et al. (2011) and Caamaño-Alegre et al. (2013), there is a positive and significant correlation between the amount of debt and capital transfer revenues and the degree of transparency.

The causal relationship between revenues, expenditures and transparency is not examined in any of these studies. The revenue-expenditure relationship for Spain has been the subject of relatively few empirical studies (Kollias & Paleologou, 2006; Kollias & Makrydakis, 2000; Afonso & Rault, 2009), and practically none conducted at the regional level. The revenue-expenditure hypothesis, which postulates a unidirectional causal relationship between public revenues and expenditures, is supported by Jaén's (2012) analysis of this relationship for 15 Spanish ACs. Therefore, it is necessary to investigate the possible causal relationship between local government revenues and expenditures and government transparency in Spain.

3 RESEARCH OBJECTIVE, METHODOLOGY AND DATA

Panel data models are constructed to investigate the connection between public expenditures and revenues and transparency in Spanish municipalities from 2008 to 2017. The panel data approach uses the following indicators in addition to the political party leading each municipality and the gender of the mayor: debt, deficit, total revenues, direct taxes, total expenditures, indirect taxes, transfers, unemployment rate, and transparency index. The Ministry of Finance provides the financial variables, Transparency International Spain provides the transparency index, and the National Institute of Statistics provides the unemployment rate.

The economic classification of municipal revenues classifies own taxes as consisting of both direct and indirect taxes. While the latter is imposed on consumption, the former is imposed on personal wealth. Additionally, there are transfer revenues, which are non-tax funds that local

governments receive without asking for them directly and are used to fund both capital and ongoing operations. The total expenditure consists of a number of expenses, including financial, personnel, and current costs for goods and services.

The difference between non-financial income and non-financial expenditure is known as the deficit variable. The outstanding debt at December 31 of each year, expressed in thousands of euros, is the debt variable.

The term "government transparency index" refers to the minimal amount of freely available public data required to deter corruption and promote public accountability. The Transparency International Spain index provides data on the transparency of Spanish municipalities. The transparency index ranges from 0 to 100, where 0 represents the lowest transparency and 100 the highest. The 110 largest municipalities in Spain were assessed using a variety of metrics, categorized into six areas of transparency, for the 2008 and 2017 iterations of the Transparency Index: "Active transparency and information on the municipal corporation, website; Relations with citizens and society, and citizen participation; Economic-financial transparency; Transparency in contracting; Agreements, subsidies and costs of services; Transparency in matters of urban planning and public works and environment; and Right of access to information."

From a methodological perspective, the following preliminary tests must be performed before estimation: cointegration, unit root testing, slope heterogeneity, and cross-sectional dependence.

i) Cross-sectional dependence

Cross-sectional dependence among municipalities can be explained by their mutual social and economic ties, regular shocks at the national level, and model misspecification leading to biased and inconsistent estimators (Pesaran, 2015).

Let us begin with this regression model:

$$Y_{it} = \alpha_i + \beta_i X_{it} + u_{it}$$

with i-index for municipality, t-index for year, X_{it}- exogenous variables (k x 1 vector).

Given that the N-number of municipalities and the T-period length have relatively low values at the moment, the CD Pesaran test is advised, because these low values have no bearing on it. The null hypothesis states cross-sectional independence: $cov(u_{it}, u_{jt}) = 0$ and the LM statistic is:

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \widehat{\rho_{ij}}$$

with $\widehat{\rho_{ij}}$- estimated coefficient of pair-wise correlation.

Additionally, the CD statistic is computed to account for bias:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \frac{(T-k)\hat{\rho}_{ij}^2 - E\left[(T-k)\hat{\rho}_{ij}^2\right]}{var\left[(T-k)\hat{\rho}_{ij}^2\right]}$$

ii) Slope heterogeneity

Slope heterogeneity, which is caused by differences in population, economic development, and social progress levels amongst municipalities, may lead to estimations that are not reliable (Breitung, 2005):

$$\tilde{S} = \sum_{i=1}^{N} \left(\hat{\beta}_i - \tilde{\beta}_{WFE}\right)' \frac{X_i' I_t X_i}{\tilde{\sigma}_i^2} \left(\hat{\beta}_i - \tilde{\beta}_{WFE}\right)$$

$\tilde{\beta}_{WFE}$- weighted fixed effect pooled estimator; $\hat{\beta}_i$- ordinary least squares (OLS) estimator corresponding to municipality *i;* I_t- unit matrix, $\tilde{\sigma}_i^2$- estimated dispersion.

The biased-adjusted variance ($\bar{\Delta}_{adj}$) is as follows:

$$\bar{\Delta}_{adj} = \sqrt{N} \cdot \frac{N^{-1}\tilde{S} - E(\bar{z}_{it})}{\sqrt{var(\bar{z}_{it})}}$$

being $E(\bar{z}_{it}) = k$, $var(\bar{z}_{it}) = \frac{2k(T-k-1)}{T+1}$

iii) Panel data unit root test

Applying the second-generation panel unit root tests under cross-sectional dependence is recommended. The cross-sectionally augmented Dickey-Fuller test (CADF) is advised due to the panel's unbalance. For slope homogeneity, Pesaran and Yamagata's (2008) statistic is as follows:

$$\Delta Y_{i,t} = \alpha_i + \beta_i Y_{i,t-1} + \gamma_i \bar{Y}_{t-1} + \delta_i \Delta \bar{Y}_{i,t} + e_{it}$$

$$\bar{Y}_{t-1} = \frac{1}{N} \sum_{i=1}^{N} Y_{i,t-1}$$

$$\Delta \bar{Y}_{i,t} = \frac{1}{N} \sum_{i=1}^{N} \Delta Y_{i,t}$$

iv) Cointegration

The Westerlund test, which is resistant to cross-sectional dependence, is used to verify cointegration when there are non-stationary data in a level. The error-correction model used in this test begins with the null hypothesis that there is no cointegration:

$$\Delta Y_{i,t} = \delta_i' d_t + \rho_i \left(Y_{i,t-1} - \beta_i' X_{i,t-1}\right) + \sum_{j=1}^{K} \varphi_{ij} Y_{i,t-j} + \sum_{j=0}^{K} \varphi_{ij} X_{i,t-j} + u_{i,t}$$

ρ_i- speed of adjustment to equilibrium through OLS.

Statistics on the group mean are provided by the following:

$$G_t = \frac{1}{N}\sum_{i=1}^{N}\frac{\rho_i}{se(\widehat{\rho_i})}$$

$$G_a = \frac{1}{N}\sum_{i=1}^{N}\frac{T\rho_i}{\rho_i'(1)}$$

G_t and G_a are used to confirm the alternative theory, according to which at least one cross-sectional unit exhibits cointegration.

The panel statistics are represented by:

$$P_t = \frac{\widehat{\rho_i}}{se(\widehat{\rho_i})}$$

$$P_a = T\hat{\rho}$$

P_t and P_a are employed to verify the alternative theory that the panel as a whole is cointegrated.

It is advised to use the MG (mean group) and CCEMG (common correlated effects mean group) under cross-sectional dependence and slope heterogeneity. In order to calculate the mean for slope coefficients—even though the coefficients and error variances may vary among municipalities—the MG estimator, which is based on OLS, assumes that time-series regressions have been constructed for each municipality. The heterogeneous factor loadings f_t of the CCEMG estimator are intended to capture the unobserved common effects:

$$Y_{it} = \alpha_i + \beta_i X_{it} + \gamma_i \bar{Y}_{it} + \delta_i \bar{X}_{it} + c_i f_t + \varepsilon_{it}$$

where Y_{it}- dependent variable; X_{it}- exogenous variables; γ_i, δ_i, c_i- parameters; α_i- constant; β_i- municipality-specific slope; f_t- unobserved common factor and ε_{it}- disturbance.

The Juodis, Karavias, and Sarafidis (2021) test, also known as the JKS test, is used to verify panel causality. Unlike the Dumitrescu and Hurlin test, the JKS test is appropriate for unbalanced panels. Using the half panel jackknife method eliminates the Nickell bias unique to the pooled estimator (Dhaene & Jochmans, 2015). The JKS test begins with a dynamic linear panel:

$$y_{i,t} = \phi_{0,i} + \sum_{p=1}^{P}\phi_{p,i}y_{i,t-p} + \sum_{p=1}^{P}\beta_{p,i}x_{i,t-p} + \varepsilon_{i,t}$$

$\phi_{0,i}$- individual-specific effects; $\phi_{p,i}$- heterogeneous autoregressive parameters; $\beta_{p,i}$- heterogeneous feedback coefficients and $\varepsilon_{i,t}$- disturbances, while i=1,2,…,N; t=1,2,…,T; p=1,2,..,P.

The null hypothesis establishes that $x_{i,t}$ does not Granger cause $y_{i,t}$:

H_0: $\beta_{p,i} = 0$, for any i and p

H_1: $\beta_{p,i} \neq 0$, for some i and p

Under the null hypothesis, the pooled estimator for $\{\beta_{p,i}\}_{i=1}^{N}$ could be computed.

To ensure robustness, the transparency of the deficit and debt is examined using an ANOVA/linear dependent Dirichlet process (DDP) mixture model. We consider $X = ((1, x_i^T))_{nx(p*+1)}$ and $y = (y_1, \dots, y_n)^T$ i=1,...,n acts like an index for observations at the municipality level. In the case of a constant (1) and p* covariates, $x = (1, x_1, \dots, x_{p*})^T$. The coefficients of the regression are given by $\beta = (\beta_0, \beta_1, \dots, \beta_{p*})^T$, β_0 is constant and $\beta_1, \dots, \beta_{p*}$ are the slopes for the p covariates. σ^2 is the dispersion of errors ε_i.

The normal distribution of parameters μ and σ^2 is $N(\mu, \sigma^2)$. Normal p.d.f. (bell-shaped) is $n(y|\mu, \sigma^2) = \frac{1}{\sigma\sqrt{2\pi}} \exp(-\frac{(y-\mu)^2}{2\sigma^2})$. The likelihood of *y* knowing *x* with parameters $\vartheta = (\beta, \sigma^2)$ is $f(y_i|x; \vartheta)$.

Let us consider a linear model:

$$y_i = x_i^T \beta + \varepsilon_i, \qquad \varepsilon_i \to N(0, \sigma^2), i = 1,2, \dots, n$$

$$f(y_i|x_i; \vartheta) = n(y_i|x_i^T \beta, \sigma^2), i = 1,2, \dots, n$$

OLS estimates are based on:

$$\hat{\beta} = (X^T X)^{-1} X^T y, \hat{\sigma}^2 = \frac{1}{n-p*-1} \sum_{i=1}^{n} (y_i - x_i^T \hat{\beta})^2,$$

where $y = (y_1, \dots, y_n)^T$ and $X = ((1, x_i^T))_{n\cdot(p*+1)}$

A general non-parametric model is represented as:

$$f(y|x;\ \vartheta) = \int f(y|x, \tau, \theta) dG_x(\theta) = \sum_{j=1}^{\infty} f(y|x, \tau, \theta_j(x) \omega_j(x)$$

$\{f(.|x, \tau, \theta)\}$: $(\theta, \tau)\} \in \Theta$ is kernel densities,

$\omega_j(x)$ represents mixing weights of unitary sum 1 for each $x \in \varkappa$,

$\delta_{\theta(x)}(.)$ probability measure that degenerates at $\theta(x)$,

τ- additional coefficients outside the mixture, and

$\{\omega_j(x)\}_j, \{\theta_j(x)\}_j$ infinite collections of processes that are indexed after $\varkappa$.

The previous distribution of the Bayesian density regression model's coefficients:

$$\vartheta = (\tau, \left(\omega_j(x), \theta_j(x)\right)_j), x \in \varkappa$$

Most of the Bayesian density regressions use the dependent Dirichlet process. DDP prior is $G_x \sim DDP(\alpha, G_{0x})$. The random distribution is given by: $G_x = \sum_{j=1}^{\infty} \omega_j(x)\, \delta_{\theta_{j(x)}}(.)$. As Sethuraman (1994) stated, the stick-breaking weights are given by:

$$\omega_j(x) = v_j(x) \prod_{l=1}^{j-1} \Big(1 - v_j(x)\Big), j = 1,2, \ldots$$

$$v_j \sim Q_j, v_j : \varkappa \to [0,1]$$

$$\theta_j(x) \sim ind\ G_{0x} \text{ (the atoms)}$$

A combination model with a mixing distribution is the ANOVA/linear DDP model:

$$G \sim Stick - Breaking\ \Big(\big(a_j, b_j\big)_j, G_0\Big) <=> G_X(\theta) \sim ANOVA - DDP\ \Big(\big(a_j, b_j\big)_j, G_0\Big)$$

$$G_x(\theta) = \sum_{j=1}^{\infty} \omega_j(x)\, \delta_{\theta_{j(x)}}(\theta)$$

$$\theta_j(x) = x^T \beta_j$$

$$\beta_j | \mu$$

$$T \sim iid\ G_0 = N(\mu, T)$$

Normal kernel $n(y|\theta, \sigma^2)$ (De Iorio et al., 2004).

The grouping variable in this instance is the mayor's gender, which has a value of 0 for women and 1 for men.

$$(y_{i(h)})_{i(h)}^{n_h} | X_h \sim f(y_h | X_h), h = 1, \ldots, N_h$$

$$f(y_h | X_h) = \sum_{j=1}^{\infty} \left\{ \prod_{i(h)=1}^{n_h} n(y_{i(h)} | x_{i(h)}^T \beta_j, \sigma^2) \right\} \omega_j$$

$$\omega_j = v_j \prod_{l=1}^{j-1} (1 - v_l)$$

$$v_j | \alpha \sim Be(1 - a, b + aj)$$

$$\sigma^2 \sim IG(\frac{a_o}{2}, \frac{a_o}{2})$$

$$\beta_j | \mu, T \sim N(\mu, T)$$

$$\mu, T \sim N\big(\mu \big| 0, r_0 I_{p*+1}\big) IW(T | p* + 3, s_0 I_{p*+1})$$

Every observation has a weight of one. Except for a selected burn-in of 2,000, the results take into account 3,600 Monte Carlo samples out of a total of 20,000 samples generated.

4 RESULTS AND DISCUSSION

The primary descriptive measures of the variables used in this investigation are compiled in Table 1. Transparency is at the other end of the spectrum, while both debt and deficit have greater relative dispersion.

Tab. 1 – Descriptive statistics

Variable	Mean	Standard Deviation	Coefficient of variation
Transparency index	71.36	42.02	0.59
Unemployment rate	12.73	13.25	1.04
Direct Taxes	8.51e+07	2.03e+08	2.39
Indirect Taxes	8,217,559	1.75e+07	2.13
Deficit	5.17e+07	2.57e+08	4.97
Debt	1.57e+07	8.45e+07	5.38
Transfers	8.98e+07	2.04e+08	2.27
Total Revenues	2.08e+08	5.28e+08	2.54
Total Expenditure	1.96e+08	4.86e+08	2.48

Source: own calculations

Initial experiments are carried out prior to choosing the best panel data models. Cross-sectional dependence and slope heterogeneity are present at the 1% significance level, according to Table 2's results of the tests for both variables. The presence of cross-sectional dependence and heterogeneity imposes the use of the second generation unit root tests to check for stationarity.

Tab. 2 – Slope heterogeneity and cross-sectional dependence tests.

Variable	Pesaran CD statistic	$\bar{\Delta}_{adj}$
Transparency index	28.39***	50.76***
Unemployment rate	108.82***	89.59***
Direct Taxes	138.35***	76.18***
Indirect Taxes	85.57***	82.27***
Deficit	182.31***	49.17***
Debt	189.66 ***	77.87***
Transfers	140.89***	48.26***
Total Expenditure	174.04 ***	75.48***
Total Revenues	167.62***	69.55***

Note: *** means significance at 1%
Source: own calculations

The CADF test is used to find the presence of a unit root in an unbalanced panel under conditions of slope heterogeneity and cross-sectional dependence. Because the number of lags affects the results of the CADF test, the equation is increased by one and two lags. At the 1% significance level, the data series for every variable are stationary in the first difference, according to Table 3's results. Here, cointegration is examined to ensure that the data are level.

Tab. 3 – The results of CADF test

Variable	**Data series in level (constant and trend)**		**Data series in the first difference (constant)**	
	Augmented by one lag	**Augmented by two lags**	**Augmented by one lag**	**Augmented by two lags**
Transparency index	-2.32 (0.56)	-0.910 (0.12)	3.229***	3.889***
Unemployment rate	-2.68 (0.152)	-0.882 (0.18)	3.167***	3.778***
Direct Taxes	-2.519 (0.210)	-0.787 (0.215)	4.886***	3.221***
Indirect Taxes	-2.250 (0.54)	-0.879 (0.17)	3.003***	2.887***
Deficit	-2.106 (0.718)	-0.367 (0.301)	4.118***	3.674***
Debt	-2.66 (0.16)	-0.402 (0.345)	3.655***	3.007***
Transfers	-2.255 (0.52)	-0.906 (0.11)	3.998***	3.667***
Total Expenditure	-2.571 (0.181)	-0.378 (0.377)	3.445***	3.556***
Total Revenues	-2.61 (0.15)	-0.351 (0.380)	4.112***	4.001***

Note: *** significance at 1%
Source: own calculations

The JKS test indicates that while transparency acts as a cause for debt, deficit, unemployment rate, and direct and indirect taxes, it also acts as a cause for total revenues, gender, and direct taxes. According to this perspective, direct taxes and the transparency index have a reciprocal relationship (see Table 4).

At the 5% significance level, bidirectional causalities are seen between indirect taxes and spending as well as between direct taxes and total spending. However, the relationship between total expenditure and total revenues is only unidirectional. These findings imply that fiscal synchronization is supported, with changes for direct taxes, indirect taxes, and expenditure occurring at the same time. However, for total revenues, the spend-and-tax assumption is supported (expenditure causes revenues). In times of economic crisis, municipalities may have to raise taxes to make up the difference between their revenue and expenses. Investors may withdraw money due to this tax policy because they fear having to pay more in taxes down the road.

Tab. 4 – Results of panel causality test

Null hypothesis	**Wald statistic**	**p-value**	**Half-Panel Jackknife estimator**
			Coefficient (p-value)
Δtransparency index↛ Δ direct taxes	4.8433642	0.0278	324538.5 (0.028)

Δtransparency index↛ Δindirect taxes	12.77969	0.0004	48638.35 (0.000)
Δtransparency index↛ Δdebt	4.0133391	0.0451	198447.1 (0.045)
Δtransparency index↛ political party	0.88459934	0.3892	134522.4 (0.390)
Δtransparency index↛ gender	1.62115698	0.2123	578844.2 (0.212)
Δtransparency index↛ Δunemployment rate	9.97047	0.0016	-0.0478491 (0.002)
Δtransparency index↛ deficit	3.4788221	0.0622	531033.7 (0.062)
Δtransparency index↛ Δtotal expenditure	1.5782278	0.2090	539413.9 (0.209)
Δtransparency index↛ Δtotal revenues	2.4120901	0.1204	727053.2 (0.120)
Δtransparency index↛ Δtransfers	0.77942482	0.3773	125208.7 (0.377)
Δtotal expenditure↛ Δtotal revenues	81.026734	0.0000	1.843079 (0.000)
Δtotal expenditure↛ Δindirect taxes	11.611451	0.0007	0.0065269 (0.001)
Δindirect taxes↛ Δtransparency index	1.3446325	0.2462	-1.59e-07 (0.246)
Δindirect taxes↛ Δtotal expenditure	429.13404	0.000	39.6974 (0.000)
Δdirect taxes↛ Δtransparency index	8.2792199	0.0040	-3.52e-08 (0.004)
Δdirect taxes↛ Δtotal expenditure	160.96377	0.000	2.237889 (0.000)
Δdeficit↛ Δtransparency index	0.28318339	0.5946	3.60e-09 (0.595)
Δtransfers↛ Δtransparency index	0.00342044	0.9534	-7.09e-10 (0.953)
Δunemployment rate↛ Δtransparency index	9.4585413	0.0021	-0.4198776 (0.002)
Δtotal revenues↛ Δtransparency index	4.2993852	0.0381	-8.77e-09 (0.038)
Δtotal expenditure↛ Δtransparency index	2.5158295	0.1127	-7.30e-09 (0.113)
Δdebt↛ Δtransparency index	2.2520039	0.1334	2.96e-08 (0.133)
Δtotal revenues ↛ Δtotal expenditure	0.3900463	0.5323	-0.112872 (0.532)
political party↛ Δtransparency index	0.23242919	0.6297	-2.113722 (0.630)
gender↛ Δtransparency index	4.8691005	0.0273	10.90822 (0.027)

Source: own calculations

Westerlund's test for cointegration is advised when there is cross-sectional dependence. Total revenues-transparency index- gender-political party - unemployment rate-direct taxes (R1) and total revenues -transparency index- gender-political party -unemployment rate (R2) are the two relationships assessed. Table 5 indicates the presence of cointegration, enabling the estimation of AMG and CCEMG.

Tab. 5 –Westerlund test

Statistics	**R1**	**R2**
	values (p-value)	**values (p-value)**
Pa	-7.799*** (0.005)	-7.629*** (0.005)
Pt	-8.167*** (0.004)	-8.989*** (0.003)
Ga	-7.611*** (0.005)	-6.115*** (0.009)
Gt	-2.433* (0.090)	-2.676* (0.078)

Note: ***, **, * denotes significance at 1%, 5% and 10%, respectively.
Source: own calculations

In contrast to Araujo and Tejedo-Romero (2016a), who discovered that lower unemployment is associated with higher transparency, Table 6 shows that unemployment rate and direct taxes had a positive impact on the transparency index. These findings are consistent with Tejedo-Romero and de Araujo's (2018) findings. However, the CCEMG approach showed that revenues had a positive impact on transparency, whereas the MG approach suggested that total revenues had a negative impact.

Tab. 6 – Explanations of the Transparency Index of Spanish Municipalities (2008-2017) using MG and CCEMG type estimates.

Variable	**Coefficients (MG)**		**Coefficients (CCEMG)**	
Unemployment rate	0.831***	-	-	-
Direct taxes	0.0029*	-	0.0155**	-
Total revenues	-	-0.0062**	-	0.0043**
Political party	-	-	-116.750	
Gender	-1.180	1.874	-	-
Group specific linear trend	-	3.217*	-	-
Cross-section averaged political party	-	-	249.204	-
Cross-section averaged direct taxes	-	-	0.00078	-
Cross-section averaged total revenues	-	-	-	-0.002
Cross-section averaged transparency index	-	-	0.660***	1.319*
Constant	-31.199	62.292*	-605.104**	-20.253
Nº of significant trends	-	16	-	

Note: Note: ***, **, * denotes significance at 1%, 5% and 10%, respectively.
Source: own calculations

Transparency impacted direct taxes positively and indirect taxes negatively, as shown by the results in Table 7. According to Ramos et al. (2018), local governments that exhibit greater transparency are prone to understate their tax revenues. A right-wing political party that wins power reduces the national debt and deficit. The impact of unemployment was favorable for direct taxes, debt, and deficit. Conversely, an increase in unemployment lowers overall revenues, total expenditures, and indirect taxes. Additionally, Velaj and Prendi (2014) discovered that tax receipts will drop in the event of rising unemployment.

Tab. 7 – MG estimators

Variable	**Total revenues**	**Total expenditure**	**Direct taxes**	**Indirect taxes**	**Deficit**	**Debt**
Transparency index	-127320.2	-857421.9	131313.7***	-23532*	664791.8	155939.6
Unemployment	-1570000**	-1560000*	680054.2***	-305850.6***	7871672**	4682429**
Political party	9310000	1710000	-160000	750270.3	-805000***	-533000***
Gender	-929000	-838000	-	-	-	301000
Constant	3730000*	36100000*	8110000***	126000***	-4520000	-3010000

Note: ***, **, * denotes significance at 1%, 5% and 10%, respectively.
Source: own calculations

ROBUSTNESS ANALYSIS

When a more thorough causal analysis is done for mayors who are male and female, the ANOVA/linear dependent Dirichlet process (DDP) mixture model is used, and the robustness analysis is carried out using CCEMG in a panel framework to evaluate the impact of different variables on deficit and debt.

Table 8 indicates that both gender and the transparency index positively impacted deficit and debt. These findings are in line with those of previous studies by Tejedo-Romero and de Araujo (2018) and Caamaño-Alegre et al. (2013), which also found a positive relationship between transparency and debt. When men rather than women serve as mayors, the deficit and debt appear to be greater.

Tab. 8 – CCEMG estimators

Variable	**Deficit**	**Debt**
Transparency index	164089*	473.9903**
Unemployment rate	-406870.7	1908.47
Political party	556574.8	-434.7798
Gender	259981.6*	290.7008*
Cross-section averaged political party	-1778449	-878.2499
Cross-section averaged debt	-	0.9999***
Cross-section averaged deficit	1.0045***	-
Cross-section averaged transparency	-405990.5	116.328
Cross-section averaged unemployment rate	942375.5	-4253.681
Constant	8923461	-24899.5

Source: own calculations

Prior to building the Dirichlet process mixture model, the priors are defined as per Karabatsos (2017).

Gender is the grouping variable. The scaled variables have a null mean of one and a standard deviation of one. The marginal posterior distribution of the intraclass correlation coefficient (ICC) is presented in Table 9. This coefficient quantifies the percentage of debt/deficit variation brought about by heterogeneity between groups. Heterogeneity between males and females accounts for an average of 49.4% of variation in deficit and 55.2% of variation in debt. Table 9 additionally displays the marginal posterior distributions of the reliabilities of the estimations of the random slope parameters and random intercepts over groups.

Tab. 9 – Posterior Summary Estimates

Parameter	**Deficit**				**Debt**			
	Mean	Standard Deviation	25%	75%	Mean	Standard Deviation	25%	75%
β_0 (sample)	0.334	0.367	0.09	0.785	0.497	0.202	0.08	0.98
$\beta_{transparency}$(sample)	0.107	0.667	0.075	0.803	0.229	0.778	0.072	0.089
$\beta_{unemployment}$(sample)	0.232	0.998	0.045	0.037	0.344	0.684	0.011	0.288
$\beta_{political\ party}$(sample)	0.078	0.554	0.056	0.823	0.115	0.667	0.09	0.112
β_{gender}(sample)	0.502	0.993	0.28	0.692	0.433	0.778	0.06	0.094
σ^2	0.85	0.188	0.88	0.933	0.794	0.805	0.113	0.206
β_{gender}(group of females)	0.43	0.219	0.09	0.17	0.334	0.745	0.143	0.208
β_{gender}(group of males)	0.21	0.277	0.055	0.12	0.192	0.445	0.127	0.329
$\beta_{transparency}$(group of females)	0.06	0.903	0.01	0.09	0.073	0.775	0.056	0.063
$\beta_{transparency}$(group of males)	0.03	0.889	0.02	0.07	0.06	0.893	0.033	0.076
$\beta_{unemployment}$(group of females)	0.113	0.445	0.202	0.305	0.056	0.769	-0.02	0.095
$\beta_{unemployment}$(group of males)	0.223	0.377	0.118	0.126	0.034	0.802	0.06	0.185
$\beta_{political\ party}$(group of females)	0.023	0.788	-0.293	0.456	0.094	0.764	0.089	0.102
$\beta_{political\ party}$(group of males)	0.302	0.588	0.21	0.387	0.335	0.667	0.07	0.096
ICC	0.552	0.106	0.509	0.745	0.494	0.120	0.663	0.789
Reliability $\beta_0 R$	0.566	0.038	0.789	0.822	0.663	0.044	0.611	0.783
Reliability $\beta_{transparency} R$	0.79	0.045	0.766	0.845	0.69	0.056	0.589	0.659
Reliability $\beta_{unemployment}$R	0.678	0.048	0.698	0.703	0.648	0.069	0.667	0.733
Reliability $\beta_{political\ party}$R	0.783	0.055	0.663	0.785	0.722	0.089	0.704	0.755
Reliability β_{gender}R	0.82	0.06	0.792	0.853	0.786	0.075	0.466	0.651

Note: St. D= Standard deviation

Source: own calculations

The significance of each predictor (gender, political party, unemployment rate, transparency index) for debt and deficit is shown by the 75% posterior intervals for the total sample. Given that zero is excluded from the 75% posterior intervals for every covariate, these variables have significant causal effects. Group-level analysis indicates that gender, the unemployment rate, and the transparency index are important factors that contribute to debt for both men and women. However, only in the case of male mayors does political party have a causal effect on debt. While the unemployment rate only affects male mayors, gender, political party, and transparency all contribute to deficits for both male and female mayors.

Our results are consistent with those of previous research. For example, a study by Brisca et al. (2016) found a significant correlation between the financial situation of Spanish municipalities and unemployment, as well as between the political party of the mayor and the level of debt per capita. When it comes to Spain's debt, political party matters when it comes to male mayors. This indicates that progressive governments led by men have higher debt levels, which is consistent with the results of the studies by Vicente et al. (2013) and Guillamón et al. (2011),

although these studies did not take gender differences into account. According to the research by Vicente et al. (2013), unemployment has a notable and favorable impact on debt. More unemployed people suggest less taxes to pay the debt. In male-dominated municipalities, the deficit increases along with unemployment. To effectively manage debt and deficit problems, transparency is crucial.

5. CONCLUSION

To improve competitiveness and achieve effective management, transparency is a critical component of good governance, which enables all citizens to have access to information and prevent covert corrupt practices. Due to the significance of this research topic, this work uses panel data estimators and causality analysis to examine how transparency affects municipal revenues and expenditures as well as how those factors affect the transparency index for Spanish municipalities between 2008 and 2017.

The Juodis, Karavias and Sarafidis test finds that while transparency is a cause of debt, deficit, unemployment rate, and direct and indirect taxes, it is also a cause of total income, gender and direct taxes. Direct taxes and the transparency index are correlated in both directions. Both direct taxes and total spending and indirect taxes and spending have reciprocal causal relationships. The relationship between total spending and total revenue is only unidirectional. These results lend credence to the idea of fiscal synchronization, with simultaneous adjustments of spending, direct taxes and indirect taxes.

Revenues are also found to be driven by spending. This encourages municipalities to spend more because, in the event of an economic downturn, they may have to raise taxes to make up the difference between what they take in and what they spend. Due to the unpredictability of this fiscal policy and investors' fear of future tax increases, there may also be capital outflows. For direct taxes, transparency is beneficial; for indirect taxes, it is detrimental. Municipalities governed by right-wing politicians contribute to debt and deficit reduction. In addition, the unemployment rate benefits direct taxes, debt and deficit. Higher unemployment, however, reduces overall revenues, total spending and indirect taxes.

The findings of this study demonstrate the interdependence between municipal characteristics and the performance of political managers in determining fiscal outcomes. It is imperative that local governments take steps to improve transparency, as greater transparency has a positive impact on taxes, for example. The battle against debt and deficit in Spanish municipalities requires maintaining low unemployment rates and ensuring transparency. As suggested by Heras et al. (2016), transparency could be improved by increasing the educational level of the residents of these municipalities. Transparency is greatly affected by political competition (Araujo and Tejedo-Romero, 2016a), implying that improved governance can lead to increased transparency in Spanish municipalities. These localities should take advantage of fiscal illusion to ensure greater transparency and improve governance (Guillamón et al., 2011).

One of the limitations of our work is the time period analyzed, due to the availability of the data. Moreover, the Dirichlet process mixture model employed certain priors, when other values could also be possible. The paper is limited only to Spanish municipalities. Therefore, more places could be considered in a next study, which allow us to make comparisons between results. For future research, in order to carry out a similar study, it would be useful to have a more recent indicator of municipal transparency. However, this methodology is sufficient and transferable to any other nation. Future work could replicate this study and compare the levels of transparency in other countries, thus establishing a ranking at the municipal level.

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