Analysing financial risks of local governments to design sustainability policies for public services: An empirical study by the population size

Abstract

Academic researchers and international organisations have highlighted the need for a more extensive analysis of public finance in small and medium-sized local governments, in view of the high levels of borrowing observed, often aggravated by rural depopulation. The purpose of this paper is to identify financial risks by population size of local governments, to design sustainability policies for public services in small and medium municipalities. We consider the situation of 6,456 Spanish municipalities during the period 2009-2018 and find that certain demographic and socioeconomic factors influence the probability of loan default, in municipalities of all sizes. In smaller ones, the variables with most impact in this respect are socioeconomic, while among the demographic variables, female immigration and generational turnover are the most significant. In larger municipalities, the influence is more balanced between demographic and socioeconomic variables. Our results concludes that policies to reduce unemployment and the rate of generational turnover, as means of enhancing the financial viability of public services, should differ between small and large municipalities, especially as concerns employment promotion in the construction sector for persons aged 25-44 years. These employment promotion policies should pay special attention to female immigration, which is a risk factor for municipal default.

Key words

Financial sustainability, default risk, local government, population size effect, depopulation

1. Introduction

According to recent pronouncements by numerous international organisations, the current rapid increase in government debt is one of the major problems within the global economic crisis, aggravated by the COVID-19 pandemic (World Bank, 2021; IMF, 2021; OECD, 2021; 2020; EC, 2021; UN, 2021). Governmental indebtedness reflects the payment obligations of Public Sector entities originated by loan contracts. According with previous research on public financial management (Buendía-Carrillo et al., 2020; Navarro-Galera et al., 2020), these organisations propose that the risk of loan default is a key aspect of public debt and therefore should be analysed carefully in order to avoid another international bank debt crisis such as that of 2008. In this context, the risk of default for a public entity is the possibility of failing to comply with the payment obligations derived from loan contracts. This question is especially important because long-term loans produce high exposure to risk over many years, and any default would greatly limit the scope for the future public policies demanded by society. Accordingly, these international bodies have concluded that government borrowing is a key element of the financial sustainability of public services in local governments and, therefore, plays a key role in the survival of small municipalities (UN, 2021; OECD, 2021; World Bank, 2021; MF, 2021; 2020; EC, 2021). In this context, financial sustainability can be defined as the ability of government to deliver current services without compromising the ability to do so in the future. As a broader concept, it is composed of three inter-related dimensions: service, revenue and debt (IFAC, 2013).

In this same line, Lara-Rubio et al. (2017) and Navarro et al. (2017), among others, have observed that since 2008 many European countries (including Ireland, Greece, Spain, Italy and Portugal) have presented high levels of government debt, resulting in serious difficulties in maintaining the sustainability of public services and provoking budget deficits, resource deficiencies, tax increases and cuts in essential public services such as health, education and social welfare. If these previous experiences are repeated, future financial restrictions arising from high levels of government borrowing may severely constrain the management of the public sector. These considerations underline the timeliness of investigating the causes and effects of high levels of municipal debt and the risk of loan default, and how these dangers might be reduced, with special attention to local governments in Europe (Buendía-Carrillo et al., 2020; Ghulam and Derber, 2018).

The countries of the European Union have a total of 120,305 municipalities, of which 97.72% have fewer than 20,000 inhabitants (EU, 2011). To date, however, most research into financial management in this area has focused on large local

governments, studying the factors that influence the volume of bank debt (Lara-Rubio et al., 2017; Bailey et al., 2014) and, to a much lesser extent, loan default (Lara-Rubio et al., 2017; Greer, 2016). However, these prior analyses have not taken specific account of the effects of municipal population size as a factor relevant to these questions.

Nevertheless, Navarro-Galera et al. (2020) and Buendía-Carrillo et al. (2020), among others, have concluded that as debt is an important dimension of the financial sustainability of public services (IFAC, 2013), it would be very interesting to examine the determinants of loan default by small and medium-sized municipalities. In this respect, organisations such as the OECD (2019) and the European Commission (2019) and academics such as Miyauchi et al. (2021) and Merino and Prats (2020) have identified the financial viability of public services as a key element to address in efforts to avoid rural depopulation, since the public policies needed in municipalities at risk of depopulation might differ from those appropriate to large municipalities (Alamá-Sabater et al., 2021; Park and LaFrambois, 2020).

Moreover, although studies have considered the impact of some demographic and socioeconomic factors on local government loan default, their conclusions have emphasised the need for a deeper understanding of the causes of this default, especially in smaller municipalities, regarding the influence of factors such as generational turnover, gender (of the dependent population and of the immigrant population) and unemployment (by age and activity sector) (Buendía-Carrillo et al., 2020; Navarro-Galera et al., 2017).

Within the framework of the European Union, the European Observation Network for Territorial Development and Cohesion has reported that demographic change in Europe currently presents a major political challenge (ESPON, 2020). According to this body, although countries with a majority of rural areas account for 28% of the European population, the decline in population size in small municipalities has accelerated with the restructuring of the agricultural sector and the concentration of employment in large towns and cities. Eurostat, the statistical office of the European Union, forecasts that by 2050 the population of urban regions will have risen by 24.1 million, while that of rural areas will have fallen by 7.9 million (EU, 2016). Furthermore, the OECD (2019) has recommended that studies should be undertaken to determine the influence of factors such as demographic change, population aging and migration, in order to design and implement policies to prevent the disappearance of small municipalities.

The aim of this paper is to identify financial risks by population size of local governments, thus contributing to the design of sustainability policies for public services in small and medium-sized municipalities.

This purpose is very interesting because the conclusions and recommendations presented by researchers and international organisations (World Bank Group, International Monetary Fund, OECD, United Nations, European Union), together with the high volumes of bank debt that governments will have to manage in the coming years, underline the usefulness of the present study of how financial management by small and medium-sized municipalities can be improved. This question is of vital importance, as it is one of the factors determining the sustainability of public services and the ability of smaller municipalities to prevent their depopulation and even disappearance. In this respect, too, an appropriate analysis of the feasibility of arranging loans for local governments can help smaller municipalities meet Sustainable Development Objectives 5, 8, 9, 10 and 11, since debt is a key element of the financial sustainability of public services (UN, 2019). The Sustainable Development Goals are the master plan to achieve a sustainable future for all societies, specifying 17 goals aimed to balanced and sustainable economic growth in the year 2030.Thus, a good understanding of the factors influencing the feasibility of contracting debt to finance public investment can contribute to sustainable economic growth and to the inclusive creation of employment, thereby helping maintain the sustainability of rural areas and favouring equal opportunities between large and small territories.

From this motivation, to achieve our aim we analyse municipalities of different population sizes in order to identify demographic and socioeconomic factors that may affect the risk of loan default by small, medium-sized and large local governments. This approach provides useful findings that may make it possible to prevent or eliminate this financial risk in smaller municipalities, and provide valuable information for politicians, managers, tax authorities, audit bodies, finance providers, creditors, investors, taxpayers, users of public services and stakeholders in general. The results we present are novel and complement those obtained in previous studies of government default, such as Navarro et al. (2017a, 2017b), who only studied highly aggregated political variables and demographic variables and did not include the size effect. The present analysis is based on a much larger sample (in terms of the length of the study period, the number of entities considered and the number of variables included). Moreover, we study socioeconomic and demographic variables that are disaggregated by size.

This empirical study was conducted to analyse the financial behaviour of 6,456 Spanish local governments (of which 5,209 were small, 1,105 medium-sized and 142

large) during the period 2009-2018, together with potentially relevant variables. This analysis revealed the differences in financial behaviour that are attributable to the size effect, thus facilitating the design of public policies appropriate to each population segment. In Spain, many local governments present high levels of bank debt, many have fewer than 5,000 inhabitants and there is a wide diversity of population sizes. This combination of factors makes it a suitable location for our study.

2. The Basel III standards: a model for measuring the credit risk of local governments

In line with the pronouncements of international organisations (World Bank, 2021; IMF, 2021; OECD, 2021; 2020; EC, 2021; UN, 2021), the Basel Committee on Banking Supervision has formulated a generally accepted methodology for measuring credit risk in public institutions and private companies (BCBS, 2017; 2011).

In the latest version of these standards, Basel III (BCBS, 2017), credit risk is quantified by two measures: expected loss (EL), or the average value of the expected credit loss, and economic capital (EC), the amount of capital necessary to cover unexpected losses.

In obtaining EL and EC, three essential risk parameters are considered: the probability of default (PD), its impact, or loss given default (LGD), and the entity's exposure at the time of default (EAD). These values are usually estimated from the historical information available and are assigned to operations and clients according to their characteristics.

The present study focuses on the PD of local governments as an indicator of their credit risk. Default, or breach of loan repayment commitments, is defined in Articles 220 and 221 of Basel III (BCBS, 2017). The greater the PD, the greater the EL and EC and, therefore, the higher the risk-adjusted interest rate. In our analysis, credit risk is assessed from the PD, using a panel data logistic regression model applied to each of the population strata considered.

This procedure was adopted for several reasons. First, discrete choice models are appropriate when the study aim is to analyse the determinants of the PD of an individual economic agent (Huyghebaert et al., 2014; Kukuk and Rönnberg, 2013). Second, the models proposed meet all the statistical requirements of the Basel III regulations (BCBS, 2017, 2011) and their transposition into European legislation (Capital Requirements Directive 2013/36/EU and Capital Requirements Regulation No. 575/2013 of the European Parliament and of the Council) for calculating the PD. Third,

international organisations have highlighted the need to study the consequences of high levels of government debt and to determine how the credit risk of public organisations should be measured (EC, 2021; IMF, 2021; World Bank, 2021).

3. Methods

3.1. Sample selection

This empirical study focuses on local governments in Spain, a country that is of interest for two main reasons. First, international organisations (IMF, 2021, EU, 2015; FASAB, 2014) and researchers (Buendía-Carrillo et al., 2020; Benito et al., 2015) have concluded that levels of debt in the Spanish public administration, and especially in local government, are excessive (current public debt is at a historically high level) and among the highest in the European Union. Moreover, the problem of dangerously high public debt (currently >120% GDP) has been aggravated by the health and socioeconomic crisis caused by the COVID-19 pandemic, which has provoked a significant increase in public spending (OECD, 2021). Second, Spanish local governments are particularly exposed to the impact of the economic crisis; moreover, there is a wide diversity of population sizes and a large number of small and medium-sized municipalities (Rodríguez et al., 2016). All of these factors highlight the timeliness and appropriateness of studying the probability of local government loan default in Spain, according to the population size of the municipality.

Our study sample is composed of 6,456 Spanish local governments, segmented as shown in Table 1, with data for the period 2009-2018 (ten years). The financial behaviour of these municipalities was analysed to identify demographic and socioeconomic factors that may influence the PD of these municipalities.

This period was chosen because it includes years of recession and economic crisis (2009-2013) followed by a recovery (2014-2018) (Ariño, 2020); the economic crisis increased the problem of depopulation in Spain (Pinilla and Sáez, 2017; De la Torre, 2018), which worsened during the period considered (Collantes and Pinilla, 2020). Among other data, the GDP, the risk premium and the unemployment rate all worsened significantly from 2009-2013 and improved between 2014 and 2018 (Bank of Spain, 2021). Coinciding with the unfavourable evolution of GDP and the unemployment rate, non-performing loans at Spanish banks continued to rise, reaching 13.62% of total credit in December 2013 (Ponce Huerta, 2019).

Our decision to segment municipalities by population size is in line with recent research into local government finances in Europe (Mourao et al., 2020; Banaszewska,

2018; Benito et al., 2015), and is supported by the differentiation set out in Spanish legislation (Article 26 of Act 7/1985) by which public services are required to be provided according to municipal size (more services in larger municipalities and fewer in smaller ones). For example, the public passenger transport service is only mandatory for municipalities with more than 50,000 inhabitants, and the public library service for those with more than 5,000 inhabitants; however, the public lighting service is mandatory for all municipalities.

Table 1. Number of municipalities per population segment

Population segments (inhabitants)	Total (a)	Sample (b)	% Sample/ Total (b/a) x 100
Seg. 1: ≤5,000	6,813	5,209	76.46%
Seg. 2: 5,001-20,000	905	859	94.91%
Seg. 3: 20,001-50,000	254	247	97.04%
Seg. 4: ≥50,001	145	142	97.72%
TOTAL	8,117	6,456	79.54%

The above data were obtained from the annual accounts presented by Spanish municipalities to the Spanish Court of Auditors (www.tcu.es) and from the financial statements in this respect published by the same institution.

3.2. The dependent variable

Assuming the Basel III definition of default (BCBS, 2017; 2011), we define our dependent (or outcome) variable as a dichotomous variable that takes the value 1 if the local government faces significant risks in meeting its payment obligations (and therefore is liable to experience loan default) and the value 0 if the local government has sufficient financial capacity to meet its credit obligations and therefore is at little or no risk of default.

In line with methods used in previous research (Buendía-Carrillo et al., 2020; Navarro-Galera et al., 2020; Lara-Rubio et al., 2017) and in accordance with Royal Decree-Law 17/2014, of 26 December, *on financial sustainability measures for the Autonomous Communities (Spanish regions), local authorities and other entities of an economic nature*, and with Royal Decree-Law 8/2013, of 28 June, *on urgent measures to prevent/redress late payment by public administrations and to support local authorities with financial problems*, we assume that a local government is at risk of

default when it meets one or more of the following conditions, which are expressed as specific values of the corresponding indicators:

- $Y_{it}(d_1) \in \{0,1\}$. When the debt outstanding at 31 December of the previous fiscal year exceeds 110% of the current income settled or accrued on that date. According to Spanish legislation on local government budgets (Order EHA/3565/2008) and the Consolidated Text of the Local Tax Regulatory Act. (2/2004, Art. 53.2). If 110% of current income is less than the volume of debt, the local government will have fewer available resources and a lower payment capacity and, consequently, will be at greater risk of default. Therefore, under this criterion there exists the risk of default because the amount of current income is insufficient to repay the bank loans owed.
- $Y_{it}(d_2) \in \{0,1\}$. Negative net savings. When the difference between current income and expenses, after deducting loan repayment obligations, is negative, there exists a situation of reduced solvency, in accordance with art. 53.1 of the Local Public Finance Act and art. 221 of the Basel III regulations (BCBS, 2017).
- $Y_{it}(d_3) \in \{0,1\}$. Negative treasury surplus for general expenses. In accordance with art. 193 of the Local Public Finance Act and arts. 220 and 221 of the Basel III regulations (BCBS, 2017), the treasury surplus is calculated as the sum of liquid funds and rights pending collection less obligations pending payment. When this indicator is negative, the local government is in need of finance and therefore has a very low level of solvency.

Therefore, the dependent variable that is ultimately used as an indicator of LG default is $Y_{it}(d_{1,}d_{2,}d_3)\epsilon\{0,1\}$, where 0 indicates no default and 1 represents default.

$$Y_{it}(d_1, d_2, d_3) = \max\{0, \max(d_1, d_2, d_3)\} \quad (1)$$

Under Basel III rules, if $Y_{it}(d_m) = 1\ (\text{for m} = 1,2,3)$ when at least one of the three indicators is met the observation is classed as default. Therefore, in our work, the value 1 of any $Y_{it}(d_1, d_2, d_3)$ is a sufficient condition for default to be declared. In fact, Royal Legislative Decree 2/2004 (of 5 March, approving the revised text of the Law Regulating Local Finance) establishes that to consider a local government at financial risk, it is sufficient for any one of these three indicators to be met.

3.3. Independent variables

Based on Institutional Theory and Stakeholder Theory, and taking into account the findings of previous research, we identified factors that might influence the PD of local

governments of different population sizes (i.e., independent variables), distinguishing between two types of variables: demographic and socioeconomic.

Stakeholders are groups or individuals that may affect or be affected by the efforts of an organisation to achieve its objectives (Freeman, 1984). According to stakeholder theory, in the context of municipal government, the aim of management is to achieve the long-term maximisation of public well-being (Rusconi, 2007). Institutional theory, on the other hand, postulates that organisations comply with social obligations in order to achieve the support and acceptance from the environment necessary to their own success and survival (Dowling and Pfeffer, 1975). Underlying both theories is the understanding that in a municipality the demographic and socioeconomic characteristics of its population (in areas such as dependency, unemployment, immigration, gender balance, economic level and generational turnover) can condition the needs of the inhabitants, influencing government decisions on spending and borrowing and hence the municipality's ability to pay.

With respect to gender balance, Spain has a highly decentralised political system, in which local governments have broad powers to define their social, family and equality policy objectives; within this context, the regions have developed and consolidated institutions and policies aimed at reducing gender differences within their territory, via a wide variety of approaches (Artola et al., 2018). Regarding gender balance, Stakeholder Theory highlights the relevance of a possible relationship between the profile of the female population and the effectiveness of LG financial management, in which the possibility of default is an overriding concern; in this respect, too, Ribeiro and Scapens (2006) refer to the postulates of Institutional Theory, according to which it may be useful to consider whether the size and characteristics of the female population might also affect LG spending and the risk of default.

In addition, the demographic and socioeconomic characteristics of the population may affect citizens' ability to pay local taxes, thus determining the level of municipal income and, therefore, the LG's ability to meet its payment commitments. Accordingly, any or all of these factors may affect the PD.

Based on these theories and previous research findings, we analyse nine demographic and twelve socioeconomic variables, the definitions and expected signs of which are shown in Table 2. A positive sign is assumed when an increase in the value of the independent variable is expected to increase the PD, while a negative sign means that an increase in the independent variable is expected to lower the PD. The statistical descriptions of all the input variables are shown in Appendix 1.

Table 2. Description of the independent variables

VARIABLE	Description	Expected sign (β)
	Demographic variables	
Pop_Size	Population size (in millions) Numerical variable. Source: National Institute of Statistics (INE).	+
Pop_Dens	Population density: Inhabitants / Area (km^2). Numerical variable. Source: INE and Anuario La Caixa.	+ / -
Depend_pop16	Proportion of dependent population aged under 16 years: Population under 16 years / Total population. Numerical variable. Source: INE	+
Depend_pop65	Proportion of dependent population aged over 65 years: Population over 65 years / Total population. Numerical variable. Source: INE	+
Depend_female	Proportion of female dependent population: Female population aged under 16 years and over 65 years / Total dependent population. Numerical variable. Source: INE	+
Immigr_pop	Proportion of immigrant population: Total immigrants / Total population. Numerical variable. Source: INE.	+
Immigr_female	Proportion of female immigrant population: Total female immigrants / Total immigrant population. Numerical variable. Source: INE.	+
Depend_immigr	Proportion of dependent immigrant population: Total dependent immigrants / Total immigrant population. Numerical variable. Source: INE.	+
Generat_t/over	Index of generational turnover: Total population aged 15-19 years / Total population aged 60-64 years. Numerical variable. Source: INE	-
	Socioeconomic variables	
Male_unempl	Proportion of male unemployment: Unemployed men / Total male population. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+
Female_unempl	Proportion of female unemployment: Unemployed women / Total female population. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+
Agric_unempl	Proportion of unemployment in agriculture: Unemployment in the agricultural sector / Total unemployment. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+
Industr_unempl	Proportion of unemployment in industry: Unemployment in the industrial sector / Total unemployment. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+
Constr_unempl	Proportion of unemployment in construction: Unemployment in the construction sector / Total unemployment. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+
Serv_unempl	Proportion of unemployment in services: Unemployment in the services sector / Total unemployment. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+
Unempl_pop	Proportion of the unemployed population without previous employment: Unemployed without previous employment / Total unemployed. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+

VARIABLE	Description	Expected sign (β)
Unempl_25	Proportion of the unemployed population aged <25 years: Unemployed population aged <25 years / Total unemployed. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+
Unempl_25_44	Proportion of the unemployed population aged 25-44 years: Unemployed population aged 25-44 years / Total unemployed. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+
Unempl_44	Proportion of the unemployed population aged >44 years: Unemployed population aged >44 years / Total unemployed. Numerical variable. Source: Ministry of Employment and Social Security (ME&SS) and INE.	+
IPC	Income per capita: Total revenue budget settlement (in thousands of €) / Municipal population. Numerical variable. Source: Ministry of Finance and Public Administrations and INE.	-
Fiscal_pressure	Fiscal pressure: Chapters I and II of revenue budget / Municipal population. Numerical variable. Source: Court of Auditors and INE.	-

With respect to the demographic variables considered, large populations tend to generate higher levels of spending. In consequence, municipalities may incur larger volumes of debt and hence are more exposed to PD (Wang and Hou, 2012; Greer, 2016; Vera, 2018). Similarly, Buendía-Carrillo et al. (2020) observed a positive relationship between population size and credit risk. Therefore, we expect to obtain a positive sign for this estimator.

Studies have also shown that a lower population density in large local governments is associated with larger volumes of public borrowing (Wang & Hou, 2012; Guillamón et al., 2011) and consequently with a higher PD (Navarro-Galera et al., 2017; Lara-Rubio et al., 2017). However, for municipalities with 20,001 to 50,000 inhabitants, Buendía-Carrillo et al. (2020) recorded the opposite sign for the population density indicator. The same authors observed no influence of this variable in municipalities with fewer than 20,000 inhabitants, many of which are affected by rural depopulation (Buendía-Carrillo et al., 2020). In view of these conflicting findings, we make no forecast of the sign of the estimator (i.e., it could be positive or negative).

The relative size of the dependent population is a factor that has been widely used in the study of sustainability and public finances, with many researchers observing that an increase in this indicator is associated with higher levels of public borrowing and thus a greater PD (Guillamón et al., 2011; Benito et al., 2015; Navarro-Galera et al., 2017; Lara-Rubio et al., 2017; Rodríguez et al., 2016). However, to our knowledge no empirical evidence has been produced that this variable impacts on the rate of loan default by small and medium-sized municipalities. Furthermore, we analyse this question in greater detail than previous studies by including the effect of gender

(*Depend_female*) and, similarly to Santis (2020), that of age (*Depend_pop16; Depend_pop65*) within the dependent population. In view of previous research findings, we expect to obtain a positive sign for these estimators.

Regarding the economic impact of immigration, the Spanish Economic and Social Council (2019) concluded that the immigrant population, proportionally, receives more social aid than it contributes in taxes and social security contributions. Corroborating this view, previous studies have reported that the presence of a larger immigrant population in the municipality is associated with greater government debt (Choi et al., 2010; Guillamón et al., 2011; Vera, 2018). However, there are large differences in the skills, assets and ages of the immigrant population, and all of these factors can influence the local economy (Alessandria et al., 2020). In this respect, Buendía-Carrillo et al. (2020) measured an inverse relationship between the size of the immigrant population (and that of the female immigrant population) with PD in large local governments, although no such evidence (in either direction) was found for small and medium-sized municipalities. The present study extends the scope of previous investigations by considering the impact of the immigrant population on municipal PD, with respect to different population sizes. To do so, in addition to the overall variable *Immigr_pop*, we include two specific variables (*Immigr_female; Depend_immigr*). For these cases, we expect to obtain a generally positive sign. We have chosen these two variables for two reasons. First, previous studies have not studied their effect on default, via population size. Second, according to Stakeholder Theory, immigrant and dependent women could have a negative effect on a LG's financial situation, due to their lesser capacity to pay taxes and greater need of social assistance.

The index of generational turnover measures the proportion of the population entering employment with respect to those who will soon retire. In recent years, the declining birth rate in Spain and the aging of the population have notably reduced generational replacement, especially in rural areas and smaller municipalities (Pinilla and Sáez, 2017). This trend is provoking economic impoverishment in small municipalities, reducing their capacity to attract resources and increasing the demands placed on municipal resources by the dependent population (Merino and Prats, 2020; Sáez et al., 2011). These circumstances may increase public borrowing and reduce the ability to pay, thereby heightening PD. Accordingly, we expect to obtain a negative sign for the generational turnover variable.

Among the socioeconomic variables included in our study, unemployment has been used by many researchers in this field. García (2019) considered it an explanatory factor of trends in public spending, and Balaguer-Coll and Toneva (2019) a factor with

direct effects on municipal debt, while Lara-Rubio et al. (2017) and Navarro-Galera et al. (2017) included this parameter in their analysis of financial risk in large local governments. According to the findings reported, rising unemployment is associated with a greater need for public finance and with reduced tax revenues. Both of these outcomes are likely to raise the level of public debt and hence provoke loan repayment difficulties.

However, to our knowledge previous studies in this field have not included factors such as unemployment by gender, age and activity sector, in municipalities of different population sizes, in their analyses. We believe it appropriate and useful to address the impact of these variables, in the detail described, in our study of public finance. Accordingly, we seek to determine the relationship between PD and each of these categories of unemployment. Specifically, the following variables are addressed: male/female unemployment, unemployment in the agriculture, industry, construction and service sectors, the proportion of the unemployed population without previous employment, and unemployment among those aged >25, 25-44 and >44 years. In every case, a positive sign is expected for the estimator. The female unemployment variable was chosen because its relationship with default in terms of population sizes has not been previously studied and because Stakeholder Theory highlights its relevance for our research objective.

Also important to the financial health of municipal government are self-sufficiency and direct control over fiscal resources. The findings of previous research suggest that council income is the major financial determinant of local government borrowing (Ehalaiye et al, 2017) and, as observed by Olmo and Brusca (2021), financial autonomy allows municipalities greater availability and control over their own resources. Although access to greater financial capacity might increase municipal borrowing, research has shown that financial autonomy limits the need for debt (Pérez-López et al., 2014) and hence the probability of default. This conclusion has been corroborated in the literature, where it has been reported that a higher income per capita is associated with a lower PD in large local governments (Lara-Rubio et al., 2017; Navarro-Galera et al., 2017) and in municipalities with more than 5,000 inhabitants (Buendía-Carrillo et al., 2020). In view of these considerations, we analyse the influence exerted by income per capita and fiscal pressure in municipalities of different population sizes. In both cases, we expect to obtain a negative sign for the corresponding estimator.

Table 3 shows a chronological selection of the most recent papers relevant to our research.

Table 3. Relevant research on the issue

AUTHORS	TARGET	MAIN VARIABLES
Navarro-Galera et al., 2017a	Influence of political factors on governmental default	• Mayor's gender • Educational background of the mayor • Type of university studies completed by the mayor • Absolute majority • Index of political fragmentation • Indicator of political strength
Balaguer-Coll and Toneva, 2019	Analyse the debt by spatial interactions	• Grants and transfers • Net savings rate • Capital expenditure • Average payment period • Population density
Buendía-Carrillo et al., 2020	Influence of financial variables on default risk	• Financial autonomy • General financing structure • Debt composition and maturity • Origin and nature of the debt • Capacity of the income derived from the tax on real estate (IBI) • Proportion of vehicle tax income to liabilities due
Santis, 2020	Analyse the influence of demographic and economic variables on financial sustainability in local governments	• Population size • Population density • Dependency ratio: population aged under 15 years • Dependency ratio: population aged over 65 years • Immigrant population • Current revenue/capital revenue • Current expenditure/capital expenditure • Level of indebtedness
Olmo and Brusca, 2021	Analyse the effect of variables on average payment period	• Political ideology • Governments in absolute majority or minority • Unemployment rate • Immigration

3.4. Logistic regression model with panel data

In accordance with the structure of the study sample, our analysis is based on a panel data model that combines the temporal dimension with a cross-sectional dimension, using a vector of explanatory variables for N local governments in T time periods (10 years), defining X_{it} for i = 1 ... N and t = 1 ... T.

This methodology, which has been used in several recent studies of issues related to public administration, enables the long-term behaviour of local governments to be monitored, with large samples providing more information and insights into details such as the unobservable heterogeneity between individuals (Train, 2003). This technique

offers a more complete perspective of the problem and provides a better interpretation of the explanatory and predictive factors. Moreover, the use of panel data reduces multicollinearity and improves the efficiency of the model (Roodman, 2009; Wooldridge, 2010), thus enhancing the reliability of the results obtained. On the other hand, in analyses of public finance, drawing inferences with this type of model can be challenging due to the need to apply numerical methods to integrate the likelihood function.

Considering the structure and characteristics of our sample and the results of the Hausman test (1978) performed, we used the theoretical framework proposed by McFadden (2001) and McFadden and Train (2000) to build a discrete choice panel data model with random effects, in which for each observation *i* there can be *j* alternatives within time *t*, given a deterministic indirect utility function of the alternative *j* that can be explained by the independent variables, as follows:

$$Y_{it} = \alpha_i + \sum_{j=1}^{k} \beta_k X_{k,it} + \varepsilon_{it} + \eta_i$$

where α_i represents the constant term, X_{it} is the vector of explanatory variables of PD for each year, ε_{it} is the error term that incorporates the unobservable factors that, for each local government, may vary from one period to another (i.e., the idiosyncratic error) and η_i is the unobservable heterogeneity, or the unobservable characteristics of local governments that may impact on the dependent variable.

The dependent variable is encoded as follows: Y_{it} is a dichotomous variable which takes the value 1 if the local government is in default at time *t*, and the value 0 otherwise. Thus:

$$Y_{it} = \begin{cases} 1 \quad if\ local\ government\ i\ defaults \\ 0 \quad if\ local\ government\ i\ does\ not\ default \end{cases}$$

Next, in accordance with the study aim to measure and quantify PD, we estimate the parameters $\hat{\alpha}$ and $\hat{\beta}_i$ by maximising the value of the likelihood function, as follows:

$$Prob\ (Y_{it} = 1) = PD_{it} = \frac{e^{\hat{\alpha}_i + \sum_{j=1}^{k} \hat{\beta}_k X_{k,it}}}{1 + e^{\hat{\alpha}_i + \sum_{j=1}^{k} \hat{\beta}_k X_{k,it}}}$$

The heterogeneity that arises because observations are taken at different time points is controlled by means of logistic regression, the parameters of which are modelled using a random effects estimator (Bellamy et al., 2005).

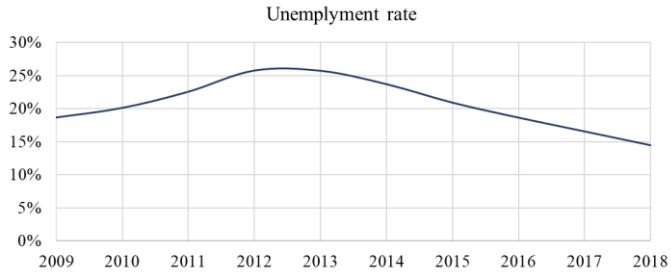
Finally, the correlation or otherwise between explanatory variables and unobserved effects is usually examined by the Hausman test (1978), which compares the estimators of the regression coefficients of fixed effects with the coefficients of random effects, under the null hypothesis that over time no constant variables are omitted. If the differences between the two regressions are not significant this could mean that no correlation correction is needed. If the differences are very large, correlation problems must be addressed and fixed effects should be used (Gujarati 2004).

The logistic regression data panel was chosen for several reasons. First, discrete-choice models are appropriate when the research aim is to analyse the determinants of the probability of an individual economic agent (Jacobson et al., 2013). Moreover, these models meet all the statistical requirements of the Basel III rules (BCBS, 2017). Second, this technique is useful to control and adjust for the unobserved heterogeneity in data with sample size and characteristics similar to ours (Buendía-Carrillo et al, 2020). Third, this method has been used in several previous studies for similar samples (Joy and Panda, 2020; Lara-Rubio et al., 2017; Navarro-Galera et al., 2017).

4. Results

Our calculations regarding PD indicate that the local governments at greatest financial risk are those of large municipalities (more than 50,000 inhabitants), which present an average PD of 47.56%, while the PD for the smallest municipalities (fewer than 5,000 inhabitants) is only 26.32%. Our results should be interpreted in the context of the evolution of macroeconomic variables in Spain, such as GPD, risk premium and unemployment rate, as shown in Figure 1.

Figure 1. Evolution of the main macroeconomic magnitudes 2009-2018



The slight correlations among our explanatory variables demonstrate the robustness and reliability of the results obtained. Table 4 describes these results in detail, with the coefficients transformed into odds ratios via the exponential of the β coefficient, both for the total sample and for the four population segments considered.

The results of the Hausman (1978) test ($p>0.05$) show that the null hypothesis of equality at 95% confidence must be accepted, confirming that the estimates using random effects are consistent and that the model is satisfactory. Moreover, the correlation between independent variables is low. In this regard, the VIF test results shown in Table 5 reveal acceptable levels of multicollinearity between the variables. Therefore, the results obtained are robust and reliable.

The classification matrix (Table 6), which contrasts the estimated and observed values, is indicative of the precision of our results, in terms of the percentage of correct classifications obtained by each model.

Table 4. Results of the logistic regression (random effects)

Variable	Model of total sample (all segments)			Model of Segment 1			Model of Segment 2		
	Coef. (β)	Std. Err.	Exp (β)	Coef. (β)	Std. Err.	Exp (β)	Coef. (β)	Std. Err.	Exp (β)
Demographic Variables									
pop_size	2.3266***	0.1071	10.2426	1.2436	0.2992	3.4679			
pop_dens	-0.0497**	0.0551	0.9515						
depend_pop16							0.4636***	0.2155	1.5897
depend_pop65							0.4686***	0.2148	1.5977
depend_female							0.3411***	0.1747	1.4064
immigr_pop									
Immigr_female	1.6804***	0.6277	5.3675	1.0218	0.6142	2.7781			
depend_inmigr							0.2874***	0.1496	1.3329
generat_t/over	0.4285***	0.0937	1.5349	0.2299***	0.0950	1.2584	0.8718***	0.3239	2.3911
Socioeconomic Variables									
male_unempl	1.5637***	0.3061	4.7762	1.0584***	0.3058	2.8816			
female_unempl	0.6203***	0.2458	1.8594	0.4695***	0.2412	1.5991			
agric_unempl	0.8348***	0.3712	2.3042	0.9390***	0.3737	2.5573	0.3113***	0.1890	1.3651
industr_unempl	2.2078***	0.3800	9.0953	1.9896***	0.3867	7.3123	0.3110***	0.1816	1.3647
constr_unempl	3.9160***	0.3597	50.1970	3.4154***	0.3608	30.4277	0.7107***	0.1918	2.0353
serv_unempl	2.3792***	0.3378	10.7958	2.1889***	0.3379	8.9250	0.2777***	0.1763	1.3200
unempl_pop	2.9145***	0.3939	18.4388	2.3585***	0.3964	10.5746	0.5570***	0.2105	1.7453
unempl_25	0.9858***	0.2910	2.6798	1.0463***	0.2309	2.8470	1.3922***	0.3064	4.0235
unempl_25_44	2.0033***	0.1626	7.4131	1.4379***	0.1624	4.2117			
unempl_44		0.0548							
ipc	0.0003***	0.0020	1.0003	0.0003***	0.0020	1.0003	0.0004***	0.0021	1.0004
fiscal_pressure	-0.0049***	0.0550	0.9951	-0.0477***	0.0549	0.9534	-0.0489***	0.0553	0.9522
cons	-4.6530***	0.3539	0.0095	-4.1287***	0.3570	0.0161	-2.3403***	17.4433	0.0963
Hausman (1978) Test:	10.72: sig.: 0.1057			12.33: sig.: 0.1027			12.99: sig.: 0.0988		

Note: *** indicates significance at 1. ** at 5% and * at 10%.

Table 4. Results of the logistic regression (random effects) [continuation]

Variable	Model of Segment 3			Model of Segment 4		
	Coef. (β)	Std. Err.	Exp (β)	Coef. (β)	Std. Err.	Exp (β)
Demographic Variables						
pop_size				1.7717*	1.0225	5.8806
pop_dens				-0.0002*	0.0001	0.9998
depend_pop16	2.2401***	0.7849	9.3938			
depend_pop65	2.1160***	0.8029	8.2975			
depend_female	0.6953***	0.2360	2.0042			
immigr_pop	1.2662***	0.5148	3.5472			
Immigr_female	0.4458**	0.2557	1.5617	0.4421**	0.2879	1.5559
depend_inmigr						
generat_t/over						
Socioeconomic Variables						
male_unempl				1.3426*	0.8719	3.8288
female_unempl	1.8444***	0.3352	6.3240	1.8563***	0.8217	6.3997
agric_unempl						
industr_unempl						
constr_unempl				0.2197**	0.1100	1.2456
serv_unempl				0.0061***	0.0730	1.0061
unempl_pop				0.1439***	0.1039	1.1547
unempl_25	0.3834***	0.1553	1.4672			
unempl_25_44						
unempl_44				-0.2391***	0.1027	0.7873
ipc				0.0015***	0.0007	1.0015
fiscal_pressure	-0.0500***	0.0561	0.9512	-0.0518***	0.0567	0.9495
cons	6.9609***	2.4922		3.5432**	2.1444	
Hausman (1978) Test:	15.01: sig.: 0.0874			14.64: sig.: 0.0902		

Note: *** indicates significance at 1. ** at 5% and * at 10%.

Table 5. VIF test

Variable	VIF	1/VIF
serv_unempl	10.47	0.0955
industr_unempl	8.15	0.1228
ipc	5.10	0.1961
fiscal_pressure	4.05	0.2469
constr_unempl	3.65	0.2736
agric_unempl	3.53	0.2832
male_unempl	2.18	0.4580
female_unempl	1.82	0.5490
unempl_pop	1.81	0.5538
unempl_25	1.41	0.7085
pop_dens	1.15	0.8723
pop_size	1.12	0.8931
generat_t/over	1.11	0.8976
unempl_25_44	1.10	0.9099
immigr_female	1.06	0.9406
Mean VIF	3.18	

Table 6. Classification matrix (percent)

MODEL 1-5,000 inhabitants				
Observed		Predicted		
		Y		Correct (%)
		Payment	Default	
Y	Payment	29,849	9,262	76.32
	Default	2,619	10,363	79.83
Total correct (%)				**77.19**
Mean PD: 26.32%				

MODEL 5,001-20,000 inhabitants				
Observed		Predicted		
		Y		Correct (%)
		Payment	Default	
Y	Payment	3,989	1,423	73.71
	Default	756	2,422	76.21
Total correct (%)				**74.63**
Mean PD: 38.02%				

MODEL 20,001-50,000 inhabitants				
Observed		Predicted		
		Y		Correct (%)
		Payment	Default	
Y	Payment	1,101	436	71.63
	Default	239	690	74.27
Total correct (%)				**72.63**

Mean PD: 38.97%

MODEL >50,000 inhabitants				
Observed		Predicted		
		Y		Correct (%)
		Payment	Default	
Y	Payment	559	207	72.98
	Default	157	495	75.92
Total correct (%)				**74.33**

Mean PD: 47.56%

MODEL Total sample				
Observed		Predicted		
		Y		Correct (%)
		Payment	Default	
Y	Payment	13,797	3,944	77.77
	Default	9,267	37,556	80.21
Total correct (%)				**79.54**

Mean PD: 28.85%

From the model based on the total sample, the results obtained reflect the strong significance of the population size factor, which corroborates the interest and timeliness of considering PD by population strata. Especially significant are the results obtained for the smallest municipalities (fewer than 5,000 inhabitants) and the largest ones (more than 50,000 inhabitants). The total model also identifies three demographic variables that impact on PD in local governments. Firstly, as well as the total population size, its density is also associated with PD, as observed by Buendía-Carrillo et al. (2020). By population segments, however, the latter variable is only significant for the largest municipalities (more than 50,000 inhabitants).

Another aspect of this question is that of immigration, and in this respect our approach adds to the literature (Alessandria et al., 2020; Buendía-Carrillo et al., 2020)

by making a detailed analysis of the effect of female immigration on municipal PD. The results obtained for the total model suggest that higher levels of female immigration may increase PD, which corroborates the reports of the Spanish Economic and Social Council (2019) regarding the effects of immigration.

Furthermore, in contrast to the smallest (fewer than 5,000 inhabitants) and largest (more than 50,000) municipalities, in the two intermediate population segments (numbers 2 and 3), the size of the dependent population (persons aged under 16 and over 65 years) is positively associated with PD, i.e., the larger this population, the greater the financial risk. Accordingly, in designing policies to improve the financial viability of public municipal services and to combat depopulation, account should be taken of the size and type of population being addressed.

The *generational turnover* variable was statistically significant for medium-sized and small municipalities (with fewer than 20,000 inhabitants), but not in large ones. The association with PD was positive; in other words, in small and medium-sized municipalities, policies aimed at producing generational change may heighten the risk of loan default. This finding is an advance upon previous work in this field (Pinilla and Sáez, 2017; Sáez et al., 2011), which considered the possible relationship between rural depopulation and economic impoverishment. Our results, moreover, corroborate Miyauchi et al. (2021) and Merino and Prats (2020), according to whom pressure exerted by local stakeholders on municipal authorities to raise spending and investment can increase government borrowing and aggravate PD. On the other hand, we obtained no evidence of any influence of generational turnover in the large municipalities considered.

Among the socioeconomic variables, our results highlight the existence of a strong association between unemployment and PD; nine of the ten variables in this respect present high levels of statistical significance. With the sole exception of unemployment among persons aged over 44 years, the employment-related variables present a strongly positive association with PD, which is in line with our original expectations, and also with previous research findings (Table 1).

Regardless of size, all municipalities considered in this analysis were affected to a similar degree by most of the socioeconomic variables related to unemployment. However, among those in segment 3 (20,001 to 50,000 inhabitants) this impact was in closer balance with that produced by the demographic variables. These findings advance on previous research (Lara-Rubio et al., 2017; Navarro-Galera et al., 2017) by demonstrating that unemployment, whether considered by gender, age or business

activity sector, is associated with the PD of local governments, both in large municipalities and, especially, in small and medium-sized ones. Thus, based on the findings of Alamá-Sabater et al. (2021) and Park and LaFrambois (2020), public policies aimed at alleviating the negative impact of unemployment on the financial viability of local governments should be tailored to suit local characteristics, as small and medium-sized municipalities have qualities in this respect that distinguish them from larger local authorities.

Our results also show that the *per capita income* variable is statistically significant in the general model and in almost all of those differentiated by population size. Although the effect is very small, the sign obtained is positive, in contrast to previous research findings. We suggest that the gradual economic recovery that followed the 2008 financial crisis may have encouraged less prudent financial behaviour, with increased public spending and borrowing, and hence a greater PD. This situation would also have been affected by the legal requirement imposed on local authorities by the Ministry of Finance to obtain authorisation for the expansion of public debt and to demonstrate the existence of sufficient income to repay the loans obtained. In any case, the value of this estimator is very low.

Building upon the conclusions presented in earlier research (Lara-Rubio et al., 2017; Navarro-Galera et al., 2017; Buendía-Carrillo et al., 2020), we show that in all population segments an increase in fiscal pressure reduces PD, since the availability of higher tax revenues increases the municipality's resources with which to meet payment commitments, and therefore lowers the risk of loan default. Given these relationships, we expect taxation policies aimed at alleviating PD to be similar in municipalities of all sizes.

Finally, we performed a comparative analysis of the results obtained for each of the four population segments, which produced empirical evidence that every study variable influenced at least one of these segments. In general, the variables most strongly related with PD, for all population segments, were unemployment among women and in the construction services sectors. The single most significant variable was the fiscal pressure in the municipality.

In segment 1 (municipalities with up to 5,000 inhabitants), the socioeconomic variables exerted a much stronger influence than the demographic ones, a situation that was reversed in segment 3 (municipalities with 20,000 to 50,000 inhabitants). In segments 2 and 4, the influence of these two types of variables was more evenly balanced.

In segments 2 and 3 (the medium-sized municipalities), our study results show that an increase in the size of the female dependent population increases PD. However, we found no evidence of any such effect in the smallest and largest municipalities.

In general, regardless of municipal size, the socioeconomic variables exerted a stronger influence than the demographic ones. However, in segment 3 we found no evidence of influence by variables that were significantly associated with PD in segments 1, 2 and 4, namely unemployment in the agricultural, industrial, construction and service sectors and among the general population. In segment 3, however, unemployment among persons aged under 25 years and female unemployment were both associated with a higher PD.

These findings represent an advance on previous research in this field, which has only considered the question of PD in large local governments (Navarro-Galera et al., 2017; Lara-Rubio et al., 2017; Rodríguez et al., 2016; Benito et al., 2015; Guillamón et al., 2011). In contrast, we identify variables that exert a specific, individual influence on PD in local governments of various sizes, thus providing useful new information for policymakers seeking to promote the financial viability of public services as a means of combating rural depopulation.

Our results confirm the relevance of gender in the analysis of PD in LG and suggest that, for different population segments, when the relative size of the dependent, immigrant or unemployment female population increases, so does the probability of default. These disadvantaged characteristics in the female population contribute to increased PD, which, therefore, is not independent of gender. In particular, it should be noted that in larger local governments, the unemployment rate of the female population has a greater impact than that of its male counterpart. Our findings confirm the validity of Institutional Theory and Stakeholder Theory as a means of explaining PD in terms of gender issues.

Finally, the results of this study are subject to the limitation that the analysis only considers financial debt. Although this parameter represents over 70% of the total debt, future research should also address the question of commercial debt.

5. Conclusions

To identify and characterise the explanatory factors of PD by local governments, an empirical study was conducted of 6,456 Spanish municipalities, with respect to the period 2009-2018. These municipalities were divided into four segments, by population

size: very small (up to 5,000 inhabitants), small-medium (5,000 to 20,000 inhabitants), medium-sized (20,000 to 50,000 inhabitants) and large (more than 50,000 inhabitants).

We show that larger municipalities are at greater risk of loan default than small ones. Furthermore, population size is strongly associated with PD, which justifies the decision to focus our analysis on various population segments. This finding is novel, as previous studies in this area limited their analysis to the variables influencing the financial management of large local governments. Our study findings suggest that the measures adopted to prevent or correct problems of local government loan default should be tailored to suit the local characteristics in terms of population size. We also provide valuable new information for the design of policies aimed at promoting the financial viability of public services as an instrument to combat depopulation, a policy that is line with IFAC (2013), according to which borrowing is a key aspect of governmental financial sustainability.

For the total sample of municipalities, we identify the following demographic factors for PD: reduced population density, increased proportion of female immigrant population and increased rate of generational turnover. The corresponding socioeconomic factors are increased unemployment (among men and women, in those aged under 44 years and those in the agricultural, industrial, construction and service sectors), increased income per capita and reduced fiscal pressure.

By population segments, in the municipalities with fewer than 5,000 inhabitants the variables with the greatest influence on PD are socioeconomic, while in the municipalities with a population of 20,000 to 50,000 inhabitants, the most influential variables are demographic, and not socioeconomic. The effects of these two types of variables are much more balanced in municipalities with more than 50,000 inhabitants.

The differentiation of results by population segments is a contribution to the literature in this field. Our findings suggest that in medium-sized and large municipalities the policies adopted to reduce PD should focus on factors such as population density and population size (although these parameters are largely beyond the control of local government). In smaller municipalities, on the other hand, financial policies should be employed to address variables that are more open to government influence, such as employment and tax levels. Specifically, we suggest that public policies aimed at strengthening the contribution of employment patterns to local government financial viability should differ according to municipal size, because small municipalities present notably different characteristics from large and medium-sized ones.

The study results also show that, overall, socioeconomic variables exert a stronger influence on PD than demographic ones, although in the segment 3 municipalities (those with 20,000 to 50,000 inhabitants) we found no evidence of the influence observed elsewhere by unemployment (in the four dimensions considered). In contrast, every population segment reflected an inverse association between fiscal pressure and PD. From the results obtained, we conclude that policies aimed at reducing PD should focus more on socioeconomic factors than on demographic ones, especially in small and medium-sized municipalities.

An increase in the rate of generational turnover aggravates PD only in small and medium-sized municipalities (i.e., those with fewer than 20,000 inhabitants). This finding is novel since previous studies in this field have not considered the influence of generational turnover on public finance. However, this result should be interpreted considering that, in general, younger people are less able to pay taxes, and so the presence of a higher proportion of younger inhabitants will probably have a negative impact on the municipality's financial situation. This represents an advance on previous research findings, according to which depopulation worsens the financial situation of local authorities and therefore local governments should invest in policies to foster population growth, rather than other areas of attention.

Our finding highlights the need for repopulation policies in small and medium-sized municipalities to be accompanied by active measures to promote employment, especially for workers aged 25 to 44 years. In addition, fiscal pressure should be maintained at a reasonable level, per capita income supported and a greater population density encouraged.

Therefore, the central government could provide incentives (for example by subsidising loan interest rates) for small municipalities to help them combat depopulation by creating new infrastructure, promoting employment among young people and increasing generational turnover. In addition, small municipalities could be encouraged to reduce the property tax burden on young people, which would increase population density. Such political measures could reduce PD and enhance local governments' ability to fight against depopulation.

For both small and medium-sized municipalities, our findings also suggest that the sustainability of public services could be promoted by a greater willingness of fiscal control bodies to authorise local governments to obtain bank loans in order to promote employment, to provide incentives for business investment (thus increasing tax revenues), and to promote population density.

In line with these political implications, our findings can help local governments meet the SDGs, since government debt is a key element of the financial sustainability of public services (IFAC, 2013). The socioeconomic factors identified can help small municipalities arrange loans for investments aimed at creating youth employment and, in addition, can allow them to negotiate lower interest rates with banks. Default risk analysis suggests these policies increase revenues and reduce expenses, which are two essential dimensions of public service sustainability (IFAC, 2013). Thus, political decisions taken in accordance with the results we present could contribute to meeting SDGs 8 (sustainable and inclusive growth), 9 (sustainable infrastructure), 10 (equal opportunities) and 11 (sustainable settlements).

In addition, actions such as those we suggest would contribute to SDG 5 (gender equality and empowerment of women and girls). We show that the characteristics of the female population are relevant to political decisions that may affect default risk. Therefore, political measures are necessary to counteract the negative effect of female immigration on default, for example by specifically encouraging female employment, thus promoting gender equality in the workplace. Our findings suggest that political measures to ensure men and women have equal financial opportunities can reduce the risk of default and thus promote financial sustainability, especially in small municipalities, and combat depopulation.

Finally, future research should be undertaken to extend our understanding of gender differences and their impact on PD in local governments, focusing not only on population variables but also on the political structure of governments. It would also be interesting to include poitical variables that might influence PD. Two limitations of the present study are its limited consideration of political variables and the exclusion of commercial debt from the analysis. These questions remain to be examined in future research.

Nevertheless, our findings are useful, not only for policymakers in Spain, but also for those in other European countries, where population structures are often similar. Thus, according to Eurostat, 80% of EU municipalities have fewer than 5,000 inhabitants and are obliged to provide a range of services similar to that offered by the governments in our sample (water, refuse collection, sanitation, lighting, etc.).

Declaration of competing interest

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Appendix 1. Statistical description of independent variables (all cases)

Variable	Minimum	Maximum	Mean	Std. Deviation
pop_seg	1,00000	4,00000	1,27524	0,63838
pop_size	0,00001	3,27305	0,00699	0,05237
pop_dens	0,00035	23,56667	0,20708	0,96556
depend_pop16	0,00000	0,30000	0,11683	0,05302
depend_pop65	0,03399	0,78947	0,26843	0,10720
depend_female	0,00000	0,92308	0,41932	0,08518
immigr_pop	0,00000	0,88048	0,07368	0,07931
Immigr_female	0,00000	0,89744	0,07176	0,07751
depend_inmigr	0,00000	0,83688	0,04646	0,07078
generat_t/over	0,00000	10,00000	0,74340	0,44820
male_unempl	0,00007	6,08247	0,06875	0,05655
female_unempl	0,00002	7,19540	0,07510	0,09715
agric_unempl	0,00000	1,00000	0,08016	0,10257
industr_unempl	0,00000	1,00000	0,16869	0,19349
constr_unempl	0,00000	1,00000	0,14584	0,11908
serv_unempl	0,00000	1,00000	0,52764	0,23161
unempl_pop	0,00000	1,00000	0,06022	0,06855
unempl_25	0,00000	1,00000	0,11401	0,09815
unempl_25_44	0,00000	1,00000	0,45327	0,14703
unempl_44	0,00000	1,00000	0,43769	0,16348
ipc	0,00722	6,99141	1,32664	0,89377
fiscal_pressure	0,08619	6,07427	0,38259	0,46625