Fighting depopulation in Europe by analyzing the financial risks of local governments

Abstract

Throughout Europe, one of the main problems facing policymakers is that of falling rural populations. In many cases, this is aggravated by high levels of local government borrowing. Although researchers have sought to determine the causes of this debt, much remains to be known about the factors influencing the default risk of small and medium-sized towns, information that would help them formulate policies to combat the loss of population. The aim of our study is to identify factors relevant to this default risk. We analyzed demographic, socioeconomic and financial factors in a sample of 6,456 Spanish local governments by their population size. Our findings show that financial policies applied to reduce this risk should vary according to the population size, as certain factors exert a specific influence on smaller municipalities. Nevertheless, socioeconomic and financial variables have more impact on default risk than demographic factors. Our findings are novel and useful for all concerned in combating the depopulation of rural areas in Europe, due to the relevance of conclusions for the design of public policies based on the sustainability of public services in small municipalities.

Keywords:

Depopulation; Default risk; Local governments; Population size effect.

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1. Introduction

International organisations have warned that Europe faces a major demographic problem, namely the depopulation of small and medium-sized towns (SMSTs). However, until recently, depopulation has been an issue that has not received great attention, either from the academic point of view or from the political or social (Pinilla & Sáez, 2021; Miyauchi et al., 2021). The EU has over 100,000 municipalities, of which 95% have fewer than 20,000 inhabitants, and countries with a majority of rural areas represent 33% of the European population (Eurostat, 2022b). The European Observation Network for Territorial Development and Cohesion (ESPON) reported that this depopulation has been greatly aggravated by agricultural restructuring and the concentration of employment in large cities. Indeed, in most European countries, demographic growth has been lower in rural than in urban areas, and population is more concentrated in or around larger cities and metropoles; meanwhile, immigration will not compensate for depopulation and ageing in the rural parts of Southern Europe (ESPON, 2020). Considering these problems of depopulation and in line with the UN Sustainable Development Goals (2019), the OECD (2019) recommended that studies be conducted of demographic, socioeconomic, and financial factors to design public policies aimed at avoiding the disappearance of small municipalities.

In this context, too, international organisations (World Bank, 2021; IMF, 2021; OECD, 2021a; UN, 2021) and research studies (Buendía-Carrillo et al., 2020; Lara-Rubio et al., 2017) have concluded that the financial viability of public services is essential to the sustainability of SMSTs. This financial sustainability has three dimensions: service, revenue, and debt (IFAC, 2013). So, policies aimed at improving these dimensions could contribute to improving the

financial sustainability of government services in SMSTs, thus potentially leading to an increase in the population living in rural areas affected by depopulation.

Similarly, ESPON (2020) stated that access to government social and economic services is a key factor in the quality of life in European territories. Thus, ESPON (2020) and the OECD (2019) concluded that sparsely populated areas tended to have poor access to public services, mainly due to insufficient income to meet citizens' demands, which often led their residents to move to larger cities. In turn, this drop in population implies a reduction in the resources for local governments (LGs) since their main source of income is subsidies from taxes collected by the central government, whose volume depends on the number of inhabitants (Park & LaFrombois, 2019). García and Muñiz (2020) concluded that in municipalities, the reduction in the number of inhabitants caused the contributions of other public administrations to decrease too.

Therefore, depopulation has a direct negative impact on the resources of LGs, which lose the capacity to provide public services to citizens, and, indirectly, worsens their quality of life and favours the exodus to large cities. Thus, in SMSTs, subsidies from the central government to finance local services are an interesting solution to combat depopulation since a scarcity of their own revenues (such as housing or vehicle taxes) can increase debt.

2. Literature review and theoretical framework

The findings of the previous research fostered the interest and opportunity to study the influence of three types of variables on the default risk of LGs: demographic variables, socioeconomic variables, and financial variables (Santis, 2020; Merino & Prats, 2020; García & Muñiz, 2020; Dzialo et al., 2019; Shon & Kim, 2019; Alam et al., 2019; Lara et al., 2017). At the same time, other works found utility in some theories to study the financial behaviour of public entities, but these studies did not specifically analyse the default risk in medium and small LGs (Gómez et al., 2022; Buendía-Carrillo et al., 2020; Rodríguez et al., 2018; Ortiz et al., 2018).

Specifically, these theories were institutional theory, legitimacy theory, stakeholder theory, agency theory, intergenerational equity theory, and pragmatic municipalism theory.

The conclusions of some authors allow us to deduce that four of these theories (institutional theory, legitimacy theory, stakeholder theory, and pragmatic municipalism theory) can be used to analyse demographic and socioeconomic factors that may influence the LG default risk (Gómez et al., 2022; Sinervo, 2014). For one, institutional theory postulates that organizations attempt to fulfil social obligations in order to gain the support and acceptance of the environment necessary for their own success and survival (Dowling & Pfeffer, 1975). Moreover, according to legitimacy theory, the survival of the organization will depend on its ability to achieve goals desirable by society and distribute economic, social, or political benefits to the groups from which it derives its power (Shocker & Sethi, 1974). For its part, the stakeholder theory postulates that the objective of management must be the long-term maximization of the well-being of the interested parties, which are the groups or individuals that can affect or be affected by the efforts of an organization to achieve their goals (Freeman, 1984). Finally, the theory of pragmatic municipalism maintains that local governments face austerity by innovating and exploring alternative provision of public services, within the limits of political and community needs (Kim & Warner, 2016).

These four theories suggest the relevance of analysing the relationship of demographic and socioeconomic variables to the default risk of governments since the financial decision-making of local governments may be affected by the structure and characteristics of the population, as conditioning factors of the environment, as well as by the social and economic profile of the citizens. Thus, following these theories, the demographic and socioeconomic characteristics of the population can affect the spending and tax-collection decisions of the LGs' leaders, which can have considerable effects on the default risk. Based on this theoretical framework, previous research on financial health in large LGs suggested the need to analyse

the influence on the default risk of SMSTs of some demographic variables, such as population size, generational turnover, population density, dependency, immigration, and gender (Alessandria et al., 2020; Merino & Prats, 2020; Buendía-Carrillo et al., 2020; Santis, 2020; Guerron-Quintana, 2020; Mahía, 2018; Vera, 2018; Rodríguez et al., 2016). At the same time, other works on financial management in large LGs suggested the need to study the effect on the default risk of SMSTs of several socioeconomic variables, including total unemployment, unemployment by sectors, unemployment by age, and unemployment by gender (García, 2019; Lara-Rubio et al., 2017).

Turning to financial variables, previous literature has suggested to analyse their influence on government default risk based on the agency theory and the intergenerational equity theory (Rodríguez et al., 2018; Pérez-Lopez et al., 2014). According to the agency theory, one or more individuals (principals) grant mandates to another individual (agent) to carry out activities in accordance with the interests of the principal (Jensen & Meckling, 1976). Additionally, in the theory of intergenerational equity, the objective is to preserve for future generations their right to an adequate standard of living, preventing current generations from resorting to excessive indebtedness as a result of expenses exceeding income. (Letelier, 2011). These two theories suggest that in the LGs, the citizens will demand responsible management from the rulers, who should feel obliged to synchronize their interests with the population's and to be prudent in the adoption of financial decisions such as those related to indebtedness and default risk, which can compromise the future and demand higher payments from taxpayers. From these theoretical foundations, the conclusions of some works on financial management in large local governments suggest analysing the influence on the default risk of SMSTs of some financial variables, such as financial autonomy, fiscal pressure, structure and nature of income, and structure and nature of expenses or financial liabilities (Olmo & Brusca, 2021; Alam et al., 2019; Ribeiro et al., 2019; Balaguer et al., 2015).

3. Method

3.1.Sample selection

This empirical study focuses on LGs in Spain. This country was chosen for analysis because public debt has grown sharply in the Mediterranean region, reaching levels well above the EU average (Eurostat, 2021). In Spain, public sector debt, especially that of LGs, is among the highest in the EU, exceeding 120% of GDP and threatening the sustainability of public services (Buendía-Carrillo et al., 2020; Navarro et al., 2021; IMF, 2021; OECD, 2021b). This focus is corroborated by Buendía-Carrillo et al. (2020) and Rodríguez et al. (2016), who have observed that Spain is a very appropriate country in which to study the financial management of LGs, because it has 8,117 municipalities and a wide diversity of population sizes that can be classified according to the public services provided (Pinilla and Sáez, 2017).

The study sample was composed of 6,456 LGs (see Table 1), with data for the period 2009-2018. These municipalities were classified into four population segments, reflecting the different levels of public services that each local entity must provide, according to its population, under Spanish legislation (Article 26 of the Local Government Law 7/1985). This approach is in line with previous research in Spain on LGs financial management (Balaguer-Coll et al., 2016; Balaguer-Coll and Ivanova-Toneva, 2019). In each segment, the data for calculating the default risk were obtained from the annual accounts submitted to the Spanish Court of Auditors (www.tcu.es) and from the financial statements published on municipal websites.

3.2.Dependent variable

Following the current concept of default established by the Basel Committee on Banking Supervision (BCBS, 2017), we define the dependent (or explained) variable as a dichotomous variable assigned the value 1 when there is a plausible risk that the municipality will be unable to meet its loan payment obligations and, therefore, will be in default, or the value 0 when the municipality has sufficient payment capacity to meet its obligations.

Following prior research in this field (Buendía-Carrillo et al., 2020; Lara-Rubio et al. 2017) and in accordance with Spanish legislation, we consider that a LG is in a situation of default when it meets at least one of the conditions defined in Table 2. The choice of these criteria is based on the usefulness of accounting information for government decision-making (Ehalaiye et al., 2021; Gómez et al, 2022; Ehalaiye et al., 2020)

The rule prohibits LGs from arranging long-term loans if the debt is greater than 110% of current income (Art. 53.2). In addition, Royal Decree Law 8/2010 establishes that, starting in 2011, LG with outstanding debt between 75% and 110% of the income can sign long-term loans credits but previously requesting authorization from the regional government of financial guardianship. Therefore, considering the period of time analyzed (2009-2018) and the indicator of the norms to prohibit loans, in this work we apply these risk criteria that are uniform throughout the period analyzed and they reflect high risks of default.

Consequently, our dependent variable, indicative of LG default risk, can be represented as follows:

$$D_{it}(d_1, d_2, d_3) = max\{0, max(d_1, d_2, d_3)\}$$

3.3.Independent variables

Based on the previous literature and the theoretical framework explored in Section 2, we used 33 independent (or explanatory) variables. Table 3 defines these variables and describes the expected sign (positive or negative) of their relationship with default risk (the dependent variable).

Based on institutional theory, legitimacy theory, stakeholder theory, and pragmatic municipalism theory, we chose 11 demographic variables and 10 socioeconomic variables that could affect default risk. This influence is due to the relationship of the characteristics of the population with the demand for spending and the LG's ability to generate income.

Así, Buendía-Carrillo et al. (2020) reported a positive relationship between population size and municipal default risk, warning that the higher level of spending required to meet the needs of a larger population could increase government debt and result in greater difficulties in its repayment (Vera, 2018). Therefore, we expect to find a positive relation between the variable *population size* and default risk.

Regarding *population density*, recent studies have obtained conflicting results. In large towns, a lower population density is associated with a higher default risk (Lara-Rubio et al., 2017), in medium-sized ones (population 20,001 to 50,000 inhabitants), the opposite effect has been observed, and in smaller ones (<20,000 inhabitants) this variable is not statistically significant (Buendía-Carrillo et al., 2020). So, we expect this estimator to have a positive or negative sign, depending on the size of the population.

In Spain, rates of dependency are rising due to population aging. However, this trend may be offset by the parallel rise in numbers and economic integration of the immigrant population, which presents special sociodemographic characteristics. In some age groups and municipalities, the immigrant population now represents a significant proportion of the total Spanish population (Mahía, 2018). Among other consequences, in large municipalities the relative presence of the dependent population (Rodríguez et al., 2016) and of the immigrant population (Vera, 2018) is associated with higher levels of public debt. So, we examine the relation between the proportions of the immigrant and the dependent populations on default risk, expecting to find a positive sign.

Likewise, we also consider the effects of gender (Buendía-Carrillo et al., 2020) and age (Santis, 2020) of the dependent population, since either of these characteristics could impact on SMSTs' financial capacity. Migratory movements can pose significant financial challenges to host countries (Guerron-Quintana, 2020) and the local economy may be influenced by specific characteristics of the immigrant population (Alessandria et al., 2020). Therefore, we extend previous research findings by including migrants' gender and their degree of dependency. The latter consideration is of particular interest, in view of the changes produced by immigration in the composition of the Spanish population, and because few studies have addressed the role of immigrants as recipients of welfare state benefits (Mahía, 2018). For all these variables, we expect to obtain a positive association with LG default risk.

In addition, falling birth rates and rising life expectancies have changed the age structure of the population, reducing the presence of the young and increasing that of the older population. This is an unprecedented global phenomenon, with long-lasting and pervasive repercussions at all levels and which will have major consequences on the demand for infrastructure and public services (Merino and Prats, 2020). This demographic aging, which can be measured through the index of generational turnover, will decrease the size and importance of the economically active population, with significant economic implications, especially in smaller municipalities with high levels of youth unemployment (Pinilla and Sáez, 2017). We believe this variable may have a positive or a negative sign, depending on whether or not the decrease in generational rotation impoverishes LG finances.

With respect to socioeconomic variables, previous research suggests that high levels of unemployment can have an unfavourable effect on the finances of large municipalities, raising public spending, increasing the debt and making repayment more difficult (García, 2019; Balaguer-Coll and Ivanova-Toneva, 2019; Lara-Rubio et al., 2017; Navarro-Galera et al., 2017). However, the latter studies did not stratify the unemployed population by gender, age

and business activity sector, nor did they relate it to municipal size, unlike our own analysis. We expect to obtain a positive sign for the relationship between each of these variables and default risk.

Although rising per capita income is associated with increased public spending (García, 2019), in large LGs this increase is also associated with a lower probability of loan repayment difficulty (Lara-Rubio et al., 2017; Navarro-Galera et al., 2017). Our analysis considers whether this relationship holds, too, in SMSTs. We expect to obtain a negative sign.

Turning to the financial variables, the postulates of the agency theory and the intergenerational equity theory justified the choice of 12 such variables. The selection of these 12 variables was based on their influence on the financial capacity of the government to respond to the needs of citizens, as well as on the financial result of its decision-making that can foster the future capacity to provide services. Budget regulations in Spain (Organic Law 2/2012, on Budgetary Stability and Financial Sustainability), establish that LGs must maintain a balance between their income and expenses. The income obtained is the main financial determinant of municipal borrowing requirements (Ehalaiye et al., 2017). Therefore, LGs should take advantage of periods of higher tax receipts and/or transfers from the central government to reduce their debt levels (Ribeiro et al., 2019).

By itself, depopulation in rural areas reduces the revenues of LGs and their ability to provide services, which increases the interest of citizens in migrating to large cities (ESPON, 2020; OECD, 2019; Park & LaFrombois, 2019). Therefore, it is interesting to study the influence of central government subsidies and aids on the default risk of SMSTs. Thus, we selected financial sustainability or autonomy as our independent variable, which is measured as (total income - subsidies and aids) / total income. An increase in state aid reduces the autonomy of LGs, and a reduction increases this autonomy.

Financial autonomy provides LGs with greater availability and control of their resources (Olmo and Brusca, 2021), reduces borrowing needs (Pérez-López et al., 2014), enhances financial health (Balaguer-Coll et al., 2015) and hence reduces default risk (Buendía-Carrillo et al., 2020). We expect, therefore, to obtain a negative sign for the variables that measure fiscal pressure, financial autonomy and the balance of financial liabilities per inhabitant in LGs of different population sizes. However, we also expect to obtain a negative sign for *expenditure on financial liabilities per inhabitant*, since an increase in this variable might reduce the level of debt and hence default risk.

Revenue diversification contributes to financial stability, helping LGs better manage their operating budgets and invest in more ambitious capital projects (Shon and Kim, 2019). To our knowledge, however, no previous studies have considered the relationship between the specific weight of different types of revenue and LG default risk. In our analysis, following previous research (Alam et al., 2019), we expect to obtain a negative sign for variables concerning the nature and specific weight of tax revenue, i.e., *real estate tax*, *vehicle tax* and *public fees and charges*.

Another study (Buendía et al, 2020; Rodríguez et al, 2016) concluded that the nonfinancial budget outcome, capital revenue and capital expenditure all increase the debt requirements of large LGs. Our analysis considers the influence of capital revenue on the default risk of municipalities of different population sizes, for which a positive sign is expected.

Finally, certain costs (such as personnel, current and financial expenses) and their structure may also affect the level of debt (Dzialo et al., 2019; Vera, 2018). To our knowledge, their influence on default risk in municipalities of different population sizes has not been considered previously. We expect to find a positive sign for these variables.

3.4.Logistic regression model with panel data

The use of a panel data method substantially expands the study sample by combining temporal and cross-sectional dimensions. In the present study, our analysis is based on a vector formed by 32 explanatory variables for N LGs in T periods of time (ten years). Thus, the parameter X_{it} is defined for i = 1 ... N y t = 1 ... T.

This technique has been used in recent studies in government entities (Gómez et al., 2022; Navarro et al., 2021, Lara et al., 2017) since it allows monitoring the behaviour of each LG over time. In addition, panel data have managed to reduce multicollinearity and improve the efficiency of the model, guaranteeing the reliability of the results (Wooldridge, 2010).

We applied Hausman's (1978) test to find out if we selected fixed effects or random effects in the logit data panel. The test establishes that the random effects logit data panel method be used when Prob > chi^2 is greater than 0.05, and the fixed effects method otherwise. In the first case, changes in the behaviour of each explanatory variable for non-payment are not considered, while in the fixed effects mode the behaviour of each individual does influence the explanatory variables.

In accordance with the structure and characteristics of our sample and the Hausman test (1978) results, we built a discrete choice panel data model with random effects, based on the theoretical framework proposed by McFadden (2001) and McFadden and Train (2000). Thus, for each observation *i*, there may be *j* alternatives according to time *t*, given a deterministic indirect utility function of alternative *j* that can be explained by the 33 independent variables defined in section 3.3 and justified following the theoretical framework set out in section 2. Therefore, from

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

α_i is defined as the constant, independent term, X_{it} represents the vector of explanatory variables of default risk for each year, ε_{it} is the random disturbance or error term that includes

the unobservable factors that can take a different value in each period, and η_i is the unobservable heterogeneity designed to measure the unobservable characteristics of LGs that may impact on the dependent variable.

In accordance with the reasoning set out in section 3.2., the dependent variable Y_{it} is defined as a dichotomous variable with two categories 1 and 0, with the meaning:

$$Y_{it} = \begin{cases} 1 & \text{if LG } i \text{ is in default} \\ 0 & \text{if LG } i \text{ is not in default} \end{cases}$$

Next, we estimated the parameters $\hat{\alpha}$ and $\hat{\beta}_i$ to maximise the value of the likelihood function:

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

In total, five models were used, one for the whole sample and one each for the four segments into which the sample was divided.

4. Analysis of Results

The statistical descriptions of all the input variables are shown in Table 4. Table 5 presents the empirical results obtained, i.e., reliability and consistency, showing the coefficients transformed into odd ratios via the exponential of the β coefficient (Exp [β]), which are measures of association used on dichotomous variables. The odd ratio shows the sensitivity that a variation of the independent variable has on the probability of incurring a default.

Regarding the robustness of the efficiency in the estimators, the results of the Hausman (1978) test ($p > 0.05$) support that the null hypothesis of equality at 95% confidence must be accepted, confirming that the estimations through effects random are consistent. From the

estimated beta parameters, based on the formulas in section 3.4., the probabilities of default for each LG in our sample can be estimated, for the 6,456 estimates distributed in each population segment according to Table 1. After these calculations, the above results indicate that as the size of the municipality increases, so does the mean default risk. In the smaller municipalities (<5,000 inhabitants) mean default risk is 19.01% while in the larger ones (>50,000 inhabitants) it is 44.27%. The overall mean value is 21.59%. Regarding the Overall correct prediction, the best results obtained were in the model of the first population segment with 91.46% where LGs presented a Mean default risk of 19.01%. However, the worst Overall correct prediction was obtained for the segment of large municipalities, with 82.30% and an average default probability of 44.27%. For the total model, the correct percentage of classification was 90.84%, and all the municipalities in the sample had a mean default risk of 21.59%.

We also checked that the correlation between independent variables was low. The variance inflation factor (VIF) test shown in Table 6 suggests acceptable values of multicollinearity between variables, which confirms that there was no relationship among these variables that would account for the event studied. Therefore, our results are robust and reliable.

The results for the total sample indicate that socioeconomic and financial variables have a greater influence than demographic ones on default risk. In the latter case, an increase in the immigrant population (male and female) and in the rate of generational turnover may contribute to default risk. This finding is novel, as previous research only studied large LGs in this respect (Rodríguez et al., 2016), omitting SMSTs from their analysis. However, our results also show that an increase in the dependent population (aged >65 years) may reduce default risk, which is contrary to the conclusions drawn by Santis (2020). Accordingly, in SMSTs with a relatively large dependent population, policymakers should adopt more prudent spending policies, thus supporting financial solvency. Moreover, financial transfers from the central administration to

finance services for the dependent population can increase LG resources by reducing default risk.

Analysis by population segments indicates that an increase in the population aged over 65 years contributes to reducing default risk in SMSTs (segments 2 and 3). In large municipalities, however, the opposite effect is observed, possibly because policymakers are more distant from local inhabitants and therefore less responsive to their needs. With respect to the gender, our evidence is inconclusive. On the other hand, generational change appears to increase default risk in SMSTs (segments 2 and 3), which leads us to conclude that its effect on the demand for public services depends on the size of the municipality. This relationship is an advance on the conclusions reported by Merino and Prats (2020) and Pinilla and Sáez (2017). However, this result should be interpreted taking into account the related findings for socioeconomic and financial variables, such as unemployment.

The proportion of the immigrant population within the total population, by gender, is relevant to default risk for all sizes of LG except segment 3. Our findings, therefore, show that the immigrant population is associated with default risk, and that the gender of this population should also be considered. These results corroborate the view that LG solvency may be influenced by specific characteristics of the immigrant population (Alessandria et al., 2020), according to the size of the local population.

Regarding the socioeconomic variables, we concur with previous reports (Balaguer-Coll and Ivanova-Toneva, 2019; García, 2019) that most of the unemployment-related variables have a negative impact on default risk. Advancing on previous work (Lara et al., 2017; Navarro et al., 2017), we show that in smaller municipalities the higher the proportion of unemployed males, the greater the default risk. No such relationship was observed for medium-sized or large municipalities. A possible explanation for this finding is that smaller municipalities are mostly located in rural areas, where women's access to the labour market has traditionally been lower.

Another novel aspect of our results is the evidence that in the construction sector the influence of unemployment is greater for workers aged 25 to 44 years, possibly because in recent years the populations of large municipalities are becoming younger, whereas in small ones they are aging (Ministry of Territorial Policy, 2021).

Increased municipal income per inhabitant is associated with a lower default risk, but only in smaller municipalities (segment 1), a finding that extends previous reports in this area (Lara-Rubio et al., 2017; Navarro-Galera et al., 2017). The negative effect of the generational turnover rate might be offset by the increased revenue from the taxes and fees paid by younger inhabitants.

Financial autonomy contributes to increasing default risk, especially in LGs with greater than 20,000 inhabitants. This result, which is contrary to the findings of previous research (Olmo & Brusca, 2021; Balaguer et al., 2015), might reflect the effects of fiscal pressure arising from an increased demand for public services, resulting in higher expenses, greater indebtedness, and, therefore, more difficulty repaying loans. In addition, this result provides empirical evidence for the influence of central governments transfers on the financial risks of LGs. Our findings indicate that the increase in these aids (reduction of financial autonomy) can reduce the default risk and, therefore, improve the capacity of LGs to provide services that encourage citizens to reside in SMSTs.

In all population segments, fiscal pressure seems to reduce default risk, which corroborates previous research (Lara-Rubio et al., 2017; Navarro-Galera et al., 2017; Buendía-Carrillo et al. al., 2020), although this influence is stronger in municipalities with more than 20,000 inhabitants.

In small LGs, all of the variables related to municipal revenues seem to favour a reduction in default risk. However, in those with more than 20,000 inhabitants, the only variable of this type that has explanatory power is that of the proportion of public fees and charges in

budget revenues, an aspect that has not been previously reported (Alam et al., 2019; Shon and Kim, 2019).

Analysis of the variables related to different areas of LG spending shows that these factors are relevant to default risk, thus extending the findings of previous research (Dzialo et al., 2019; Vera, 2018). The influence of these variables is similar for all sizes of municipalities. Investment spending has a similar influence to that of current spending, although the spending structure only influences the default risk of the largest municipalities (population >50,000 inhabitants). Finally, the results show that LGs with a lower level of financial liabilities per inhabitant tend to have a lower default risk. This is true for all population sizes except segment 3 (medium-sized municipalities).

Our results provide evidence for the consistency and validity of the institutional theory, legitimacy theory, stakeholder theory, and pragmatic municipalism theory to explain the influence of demographic and socioeconomic variables on LG default risk. In addition, our findings reinforce the validity of the agency theory and the generational equity theory to explain the influence of financial variables on the risk of default.

5. Conclusions

The results of this study show that larger LGs are more likely to be at risk of default than small and medium-sized ones. This finding, which represents an advance on previous research, suggests that financial policies to fight depopulation should be tailored according to the population size of the municipality. In small ones, loan repayments represent a lower financial risk than is the case in larger towns. This circumstance facilitates the financing of public infrastructure and hence sustainable economic development.

For the sample as a whole, our findings indicate that socioeconomic and financial variables have a greater influence on default risk than demographic variables. LG decisions

seem to affect financial and socioeconomic factors more than demographic ones (such as population age and gender balance), via changes in taxation, spending or investment, commitments to financial consolidation and/or employment promotion. Our study findings suggest that LG policies to combat depopulation should focus especially on measures of a socioeconomic and financial nature, favouring the capacity to finance public investments through bank loans. However, in applying these policies, special attention should be paid to risks such as an increase in the size of the immigrant population and in the generational turnover rate.

In SMSTs, an increase in the size of the dependent population (aged >65 years) reduces financial risk. Hence, this factor may influence the volume of debt but at the same time, reduce default risk. From this, we deduce that policymakers' greater proximity to the population in small LGs may foster greater financial responsibility regarding municipal revenue and spending.

Our results also indicate that in SMSTs, an increase in the rate of generational turnover may worsen default risk. However, when financial variables are included in the analysis, an increase in per capita income could offset the latter effect. Accordingly, in rural areas any such generational change should be addressed by policies aimed at promoting employment and raising per capita income among younger people. So, small LGs could reduce their financial risks and improve their capacity to obtain loans for investments enabling sustainable economic development and enhancing the viability of public services.

A growing immigrant population, too, might provoke a worsening of default risk, in almost all population segments, and therefore policies aimed at increasing a LG's borrowing capacity should seek to raise per capita income and reduce the unemployment rate among the immigrant population. This is especially so for workers in the construction sector. Furthermore, our findings suggest that in smaller municipalities, financial policies to combat depopulation

should pay special attention to reducing the male unemployment rate among those aged 25 to 44 years.

Likewise, our study results show that an increase in fiscal pressure can alleviate default risk, especially in municipalities with more than 20,000 inhabitants. In SMSTs, an increase in budget revenue can reduce default risk, but in larger municipalities the only financial variable that influences financial risk is the revenue from public fees and charges. Therefore, in smaller municipalities, an appropriate financial policy would be to encourage the acquisition of homes and vehicles, thus generating municipal income through the corresponding taxes. This policy would be particularly effective among younger people, according to our analysis of generational turnover. Our results also suggest that smaller municipalities should adopt policies aimed at early debt repayment and that their spending structure (unlike the case of large municipalities) has no influence on financial risk.

For current public policies on depopulation, these conclusions suggest the importance of measures aimed at promoting employment among young people, maintaining fiscal pressure, increasing population density, and creating infrastructure for public services.

Finally, although our findings are based on empirical research in Spain, our conclusions can be interesting for other countries. Recent Eurostat reports (2022b) show that, in European countries, 82.38% of municipalities are very small, 12.40% are small, and 3.28% are large. In addition, many European countries have a population structure very similar to Spain's in terms of the percentage of very small and small municipalities (83.93% and 11.40%, respectively): Portugal (86.03% and 10.32%), Austria (87.68% and 11.03%), France (93.76% and 4.90%), and Germany (72.63% and 20.88%). Likewise, CEMIR (2016) concluded that the competencies of European LGs are very similar, although they depend on their population size. Second, these findings may be interesting for those countries with a high volume of bank debt, similar to Spain. Countries with high volumes of bank debt at the state level (debt greater than 100% of

GDP) include Greece, Italy, Portugal, France, Belgium, and Cyprus; countries with high volumes of bank debt at the municipal level (debt greater than 5% of GDP) include Sweden, Finland, France, Latvia, Denmark, Italy, the Netherlands, and Portugal (Eurostat, 2022a). On the other hand, these conclusions may be useful for designing policies against depopulation in 2022 and beyond. According to Eurostat (2022a), in Europe the percentage of municipal debt over GDP remains very high (5.7%). In addition, as a consequence of the pandemic, many countries increased the specific weight of LG debt over GDP, including France (+1.4%), Portugal (+0.7%), Italy (+0.2%), Germany (+0.2%), and Belgium (+0.2%). Moreover, the IMF (2022), OECD (2022), and World Bank (2022) have recognized a high risk of an upcoming economic recession in European countries, with a special negative impact on unemployment, tax revenue, and public spending. Our findings have identified some of these variables as risk factors for default. However, the usefulness of our findings has some limitations in other countries, due to the diversity of financing models and the different delivery and budgeting methods. The analysis of these problems represents an interesting avenue for future research.

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Table 1. Classification of municipalities by population segment.

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

Table 2. Indicators of PD

INDICATOR	**DEFINITION**
$D_{it}(d_1) \in \{0,1\}$	Outstanding debt at 31 December of the last financial year >110% of the current income settled or accrued on that date, in accordance with art. 53.2 of the Consolidated Local Finance Regulatory Act (Royal decree law 2/2004)
$D_{it}(d_2) \in \{0,1\}$	Negative net savings (<0). When, after the deduction of loan repayment obligations, the difference between income and current expenses is negative, the municipality is considered at high financial risk, in accordance with article 53.1 of the Local Finance Regulatory Act and with para. 221 of BCBS (2017).
$D_{it}(d_2) \in \{0,1\}$	Negative treasury surplus for general expenses. In accordance with article 193 of the Local Finance Regulatory Act and paras. 220 and 221 of BCBS (2017), the treasury surplus is defined as the sum of liquid funds and receivables outstanding less outstanding obligations. When this indicator is negative, the municipality is in need of funding and, therefore, its solvency level is very low.

Table 3. Description of independent variables

VARIABLE	**Description**	**Expected sign (β)**
	Demographic variables	
Pop_seg	Population segment to which the municipality belongs	+
Pop_size	Population of the municipality (in millions of inhabitants). Numeric variable.	+
Pop_dens	Population density	+ / -
Depend_pop16	Proportion of population aged under 16 years	+
Depend_pop65	Proportion of population aged over 65 years	+
Male_depend	Proportion of male dependent population (aged <16 and >65 years)	+

VARIABLE	Description	Expected sign (β)
Female_depend	Proportion of female dependent population (aged <16 and >65 years)	+
Male_immigr	Proportion of male immigrant population	+
Female_immigr	Proportion of female immigrant population	+
Depend_immigr	Proportion of dependent immigrant population	+
Gen_change	Index of generational change: population aged 15-19 years / Total population.	+/-
Source: Spanish Office of Statistics (INE)		
	Socioeconomic variables	
Male_unempl	Proportion of male unemployed population	+
Agric_unempl	Proportion of unemployed population in the agricultural sector	+
Industr_unempl	Proportion of unemployed population in the industrial sector	+
Constr_unempl	Proportion of unemployed population in the construction sector	+
Serv_unempl	Proportion of unemployed population in the services sector	+
Unempl_pop	Proportion of unemployed population who have never worked	+
Unempl_25	Proportion of unemployed population aged <25 years	+
Unempl_25_44	Proportion of unemployed population aged 25-44 years	+
Unempl_44	Proportion of unemployed population aged >44 years	+
BRPC	Budget revenue per capita	-
Source: INE, Ministry of Labour and Social Security and Ministry of Finance and Public Administration		
	LGs financial variables	
Fin_aut	Financial autonomy	-
Fiscal_pressure	Fiscal pressure	-
RETax_Rev	Real estate tax as a proportion of total revenue	-
VTax_Rev	Vehicle tax as a proportion of total revenue	-
PubFees_Rev	Public fees and charges as a proportion of total revenue	-
Invest_Rev	Investment finance as a proportion of total revenue	+
PersCost_BudSp	Personnel costs as a proportion of budget spending	+
CurrSp_BudSp	Current expenditure as a proportion of budget spending	+
FinC_BudSp	Financial costs as a proportion of budget spending	+
Repay_BudSp	Loan repayments as a proportion of budget spending	-
FinL_Inhab	Financial liabilities per inhabitant	-
CurrSp_CapSp	Spending structure: Current expenditure / Capital expenditure	+
Source: Ministry of Finance and Public Administration		

Table 4. Statistical description of independent variables (all cases)

Variable	Mean	Std. Dev.	Min	Max
Pop_seg	1.2752	0.6384	1.0000	4.0000
Pop_size	0.0070	0.0524	0.0000	3.2730
Pop_dens	0.2071	0.9656	0.0035	2.3567
Depend_pop16	0.1168	0.0530	0.0000	0.3000
Depend_pop65	0.2684	0.1072	0.0340	0.7895

Male_depend	0.3548	0.0602	0.0000	0.8182
Female_depend	0.4193	0.0852	0.0000	0.9231
Male_immigr	0.0718	0.0775	0.0000	0.8974
Female_immigr	0.0465	0.0708	0.0000	0.8369
Depend_immigr	0.7434	0.4482	0.0000	10.0000
Gen_Change	0.0688	0.0566	0.0001	6.0825
Male_unempl	0.0751	0.0972	0.0000	7.1954
Agric_unempl	0.0802	0.1026	0.0000	1.0000
Industr_unempl	0.1687	0.1935	0.0000	1.0000
Constr_unempl	0.1458	0.1191	0.0000	1.0000
Serv_unempl	0.5276	0.2316	0.0000	1.0000
Unempl_pop	0.0602	0.0686	0.0000	1.0000
Unempl_25	0.1140	0.0982	0.0000	1.0000
Unempl_25_44	0.4533	0.1470	0.0000	1.0000
Unempl_44	0.4377	0.1635	0.0000	2.0000
BRPC	1.3266	0.8938	0.0000	6.9914
Fin_aut	0.5253	0.1698	0.0126	0.9893
Fiscal_pressure	0.3826	0.4663	0.0001	6.0743
RETax_Rev	0.2077	0.1096	0.0000	0.8511
VTax_Rev	0.0466	0.0243	0.0000	0.6286
PubFees_Rev	0.1486	0.0922	0.0000	0.8760
Invest_Rev	0.2730	0.1793	0.0000	4.4847
PersCost_BudSp	0.3003	0.1150	0.0000	0.8773
CurrSp_BudSp	0.3546	0.1144	0.0226	0.9975
FinC_BudS	0.0089	0.0153	0.0000	0.3387
Repay_BudSp	0.0359	0.0525	0.0000	0.7519
FinL_Inhab	0.0480	0.1594	-9.0415	2.4621
CurrSp_CapSp	0.0571	0.1475	0.0000	3.1482

Table 5. Logit data panel parameters (random effects)

Variable	**Total sample**			**Segment 1**			**Segment 2**		
	Coef. (β)	Std. Err.	Exp (β)	Coef. (β)	Std. Err.	Exp (β)	Coef. (β)	Std. Err.	Exp (β)
DEMOGRAPHIC VARIABLES									
Pop_seg	0.3466***	0.0364	1.4142						
Pop_size				0.6934***	0.2309	2.0005			
Pop_dens									
Depend_pop16							-1.5405***	0.4184	0.2143

Variable	Total sample			Segment 1			Segment 2		
	Coef. (β)	Std. Err.	Exp (β)	Coef. (β)	Std. Err.	Exp (β)	Coef. (β)	Std. Err.	Exp (β)
Depend_pop65	-1.1074***	0.2583	0.3304				-7.5813***	2.5619	0.0005
Male_depend									
Female_depend									
Male_immigr	3.0957***	0.6217	22.1021	2.1482***	0.3004	8.5692			
Female_immigr	1.0382*	0.6713	2.8241				2.0304**	0.8417	7.6169
Depend_immigr									
Gen_Change	0.3084***	0.0367	1.3612	0.2689***	0.0357	1.3085	0.8977**	0.2598	2.4539
SOCIOECONOMIC VARIABLES									
Male_unempl	1.1547***	0.5642	3.1730	1.8917***	0.5545	6.6305			
Agric_unempl	0.6895**	0.4139	1.9927						
Industr_unempl	1.7949***	0.4266	6.0187	1.1329***	0.1791	3.1046	3.0087***	0.9321	20.2605
Constr_unempl	3.3847***	0.4027	29.5084	2.1609***	0.1756	8.6787	7.5439***	0.9833	1889.1335
Serv_unempl	1.9171***	0.3750	6.8010	1.0296***	0.1421	2.7999	4.0090***	0.8677	55.0903
Unempl_pop	2.3380***	0.4164	10.3602	1.4740***	0.2515	4.3666	5.8446***	1.5062	345.3552
Unempl_25	2.6348***	0.5952	13.9402				6.5610***	1.3098	706.9596
Unempl_25_44	3.1196***	0.5612	22.6367	1.1182***	0.1015	3.0593	3.2506***	0.8440	25.8051
Unempl_44	1.4357***	0.5411	4.2025						
BRPC	-0.0359***	0.0284	0.9647	-0.0397***	0.0024	0.9611			
FINANCIAL VARIABLES									
Fin_aut	1.4984***	0.1878	4.4744	1.8742***	0.1946	6.5154			
Fiscal_pressure	-0.3061***	0.0068	0.7363	-0.0393***	0.0128	0.9614	-0.0422***	0.0450	0.9587
RETax_Rev	-5.3428***	0.2968	0.0048	-6.0645***	0.3209	0.0023	-4.4981***	0.8484	0.0111
VTax_Rev	-6.3656***	0.9105	0.0017	-5.4579***	0.9549	0.0043			
PubFees_Rev	-2.1575***	0.2649	0.1156	-1.8889***	0.2781	0.1512	-3.2673***	0.8077	0.0381
Invest_Rev	2.1970***	0.1980	8.9977	2.5867***	0.2023	13.2855	6.1323***	0.9535	460.4819
PersCost_BudSp	5.6475***	0.2853	283.5741	5.0892***	0.2966	162.2557	6.9207***	1.1915	1013.0021
CurrSp_BudSp	5.9856***	0.2797	397.6505	5.8781***	0.2922	357.1206	6.8577***	1.1540	951.1517
FinC_BudS	6.0884***	1.2339	440.7040	6.7413***	1.4204	846.6383	6.4914***	1.1351	659.4285
Repay_BudSp	4.6057***	0.3409	100.0503	4.1232***	0.3933	61.7549	4.6828***	0.8897	108.0694
FinL_Inhab	-0.0063***	-0.0034	0.9937	-0.0064***	-0.0026	0.9936	-0.0065***	-0.0005	0.9935
CurrSp_CapSp	0.0287**	0.0043	1.0291						
Cons	-4.6919***	0.9176		-9.5848***	0.1792		-10.281***	1.8893	
Hausman (1978) Test:	9.28: sig.: 0.1203			11.74: sig.: 0.1185			12.33: sig.: 0.1014		

Table 5. Logit data panel parameters (random effects) (cont.)

Variable	Segment 3			Segment 4		
	Coef. (β)	Std. Err.	Exp (β)	Coef. (β)	Std. Err.	Exp (β)
DEMOGRAPHIC VARIABLES						
Pop_seg						
Pop_size						

Variable	Segment 3			Segment 4		
	Coef. (β)	Std. Err.	Exp (β)	Coef. (β)	Std. Err.	Exp (β)
Pop_dens						
Depend_pop16				2.8451***	1.0804	17.2028
Depend_pop65	-1.3599***	4.3162	0.2567			
Male_depend						
Female_depend	4.8943**	2.9471	133.5265			
Male_immigr				4.9618*	3.0238	142.8469
Female_immigr						
Depend_immigr						
Gen_Change						
SOCIOECONOMIC VARIABLES						
Male_unempl						
Agric_unempl						
Industr_unempl						
Constr_unempl	5.5936***	2.3396	268.7007	2.7299***	4.0750	15.3309
Serv_unempl				5.7060***	1.9728	300.6580
Unempl_pop	2.0100***	3.4215	7.4633	2.1471***	4.7576	8.5598
Unempl_25	1.6604***	4.0953	5.2614	3.0385***	6.5799	20.8734
Unempl_25_44	1.7800***	4.8992	5.9298			
Unempl_44	1.1018***	4.0113	3.0096			
BRPC						
FINANCIAL VARIABLES						
Fin_aut	5.5669***	1.4059	261.6213	5.1538**	2.5354	173.0834
Fiscal_pressure	-0.0405***	0.1941	0.9603	-0.0971***	0.0128	0.9074
RETax_Rev						
VTax_Rev						
PubFees_Rev	-6.2962***	1.9940	0.0018	-9.2777***	3.7934	0.0001
Invest_Rev	6.5422***	1.9607	693.8099	6.4081***	2.5913	606.7237
PersCost_BudSp	6.2899***	2.6102	539.0983	4.2790**	3.9162	72.1663
CurrSp_BudSp	5.1813***	2.3646	177.9136			
FinC_BudS	4.9624**	4.4367	142.9361	6.2420***	3.5894	513.8717
Repay_BudSp	4.9399***	1.7386	139.7560	3.6989***	3.0767	40.4018
FinL_Inhab				-0.0345***	0.0107	0.9661
CurrSp_CapSp				0.1303**	0.0602	1.1391
Cons	-10.4094***	5.0391		-12.4658***	3.5345	
Hausman (1978) Test:	13.21: sig.: 0.0975			13.82: sig.: 0.0841		

Table 6. VIF test

Variable	VIF	1/VIF
Male_immigr	9,85	0,1015

Female_immigr	9,00	0,1111
Female_depend	8,03	0,1245
Male_depend	7,90	0,1265
Agric_unempl	7,64	0,1310
Unempl_44	6,66	0,1500
Depend_pop16	6,64	0,1507
Serv_unempl	6,57	0,1522
Depend_pop65	6,49	0,1541
Industr_unempl	6,14	0,1629
Constr_unempl	5,87	0,1704
Depend_immigr	4,87	0,2051
Unempl_pop	4,85	0,2060
Unempl_25	4,21	0,2373
Unempl_25_44	4,08	0,2453
PubFees_Rev	3,46	0,2886
Pop_size	2,96	0,3382
FinC_BudS	2,77	0,3616
PersCost_BudSp	2,59	0,3865
VTax_Rev	2,44	0,4100
CurrSp_BudSp	2,34	0,4269
Invest_Rev	2,12	0,4708
Repay_BudSp	1,97	0,5080
Fin_aut	1,84	0,5425
FinL_Inhab	1,55	0,6457
Gen_Change	1,53	0,6549
BRPC	1,45	0,6875
Pop_seg	1,39	0,7202
CurrSp_CapSp	1,32	0,7551
RETax_Rev	1,26	0,7929
Fiscal_pressure	1,22	0,8168
Male_unempl	1,15	0,8701
Pop_dens	1,01	0,9869
Mean VIF	4,04	