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Importance of the Size of Local Government in Avoiding the Fiscal Distress – Empirical Evidence on Communes in Poland

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Abstract

Theoretical background: In the literature on finance there are findings which examine reasons for the fiscal distress of units of the public sector, including local governments. However, this distress might be differently defined. Therefore, it determines both the approach to identify this phenomenon and the types of explanatory variables. Nevertheless, in the field of the business sector in the econometric models concerning the financial distress the size of the unit is considered. In this case there are also some possibilities to apply the correct proxy variable. This results from the fact that the size of local government might determine its fiscal capability as well as the level and structure of expenditures, which affect fiscal distress.
Purpose of the article: The aim of this paper is to examine the influence of the size of the local government on the probability of the decrease of the exposure to the fiscal distress.
Research methods: The author reviewed the literature in the field of the fiscal distress and introduced a multi-criteria decision analysis as well as a logistic regression modelling to examine this. The research procedure also required the use of the linear ordering to construct the dependent variable of the fiscal distress in order to analyse the "size effect" on the fiscal distress.

Main findings: Fiscal distress of local governments is a core issue, which should be constantly analysed. It depends on the financial, economic, social and even political aspects. To identify exposure to this distress the TOPSIS method can be used. However, the fiscal distress can be affected by the size of the unit, which influences lots of budgetary categories. Due to the specificity of dependent and independent variables in the econometric models the "size effect" might be represented through the level of the population or the assets. Using the ordinal logistic regression in the research, the authors should consider that this effect can differ between the units with the disparate exposure. So, the partial proportional odds models can be required. Thus, the growth of the size of the unit, measured by the population, increases the odds of reaching very low exposure to fiscal distress. Simultaneously, there are some other important issues which should be included in this type of research.

Introduction

In the literature there are studies analysing the fiscal distress of the public units. At the central level of the public finance a fiscal distress episode is perceived as a period when government experiences extreme funding difficulties. Therefore, there are identified four types of criteria to capture this phenomenon: (1) debt default or restructuring, (2) sovereign bond yield pressure, (3) large International Monetary Fund-supported programme and (4) excessive inflation. In many cases these episodes coincide with currency and banking crises as well as may have originated outside of the fiscal sector (Bruns & Poghosyan, 2018, pp. 1455–1456). It is seen that in these circumstances there are barriers to constantly deliver required public services and maintain fiscal stability. This distress results especially from the endogenous condition of the public budget and its capability to react to the appearance of some stress factors. In this context Muñoz and Olaberria (2019, p. 30) proved that relatively high shares of rigid (observed) components of public spending (wages, pensions and interests) contribute to getting countries into the fiscal distress. Furthermore, the effect of rigid expenditure seems to be more relevant for economies with high income inequality, governments with lower margin of majority as well as countries with lower institutional quality.

In turn, in the local public finance a fiscal distress is perceived as a failure to meet standards in the areas of an operating position, a debt, and community needs and resources over successive years. Moreover, it is attributed to population and job market shifts, governmental growth, interest group demands, and poor management (Kloha et al., 2005, p. 314). So, it can concern various units functioning on the different tiers of the decentralized public sector.

Furthermore, considering the fiscal distress in the public finance, it is significant to analyse the issues of the financial distress in business sector. In the corporate finance this term is understood as the process of business failure that progresses over time and leads to its bankruptcy, or, as described by Ehrhardt and Brigham (2008, p. 854), when a firm is unable to meet scheduled payments or when cash flow projections indicate that it will soon be unable to do so. Simultaneously, in the studies lots

of variables are presented as potential determinants of this distress. Some authors also analyse the influence of the size of the business unit (Gruszczyński, 2020, p. 43, 84, 109). Dang et al. (2018, pp. 159–176) indicate that the size is an important unit characteristic, and in many situations, the "size effect" is included in the econometric models as a dependent variable. So, they present the most popular firm size proxies in corporate finance, i.e. total assets, total sales, and market value of equity, which might be applied as natural logarithm forms of these categories. However, other measures, such as number of employees and net assets, also appear in findings. They conclude that different size proxies capture various aspects of "firm size", and have different implications. Thus, the choice of these measures can be a theoretical and an empirical question.

Analysing the issues of the fiscal distress in the local public finance, the author noted that there is a deficit of studies, in which the "size effect" of the unit is examined in the estimated models to explain the sources of this problem. In the majority of cases only the budgetary variables are studied. However, the size of local government could be explored and compared in the international researches.

Therefore, the aim of this paper is to examine the influence of the size of the local government on the probability of the decrease of the exposure to fiscal distress. The author reviewed the literature in this field and introduced multi-criteria decision analysis as well as logistic regression modelling to study this. The research procedure also required the use of linear ordering to construct the dependent variable of fiscal distress. Based on the literature review, the main hypothesis of the research is that there are certain possibilities to include the "size effect" in the studies concerning the local government fiscal distress.

Literature review

In literature there is no one definition of the fiscal distress of local government. Some authors indicate that this phenomenon reflects short-term consideration as well as long-term consideration. In the short perspective it is analysed through the ability to meet the payroll and generally make payments in a timely manner. In turn, in the long perspective this distress is considered analysing local government's tax base relative to its expenditures and commitments (Ziolo, 2015, p. 14). Moreover, in some cases it is defined in terms of whether a government is sufficiently meeting the needs of its community (Maher et al., 2020, pp. 694–695). According to the other definition, it is considered as a significant and continuous imbalance between revenues, expenditures, and transfers (Ansori et al., 2021, p. 600). Therefore, certain relations between budget inflows and outflows are measured (Maria et al., 2021, p. 60).

In turn, Jones and Walker (2007, pp. 396–409) consider a distress in local government as an inability to maintain pre-existing levels of services to the community at the background of the financial distress in the private sector as a failure to meet

financial commitments. They found that distress in local councils is positively associated with the population serviced within the unit boundaries and also with the size of local councils. So, larger local councils are relatively more distressed than smaller units. In the context of these findings Winarna et al. (2017, pp. 37–40) highlight that the wider the area coverage of local government, the heavier the cost of infrastructure and maintenance cost that become burden for the unit. Thus, a local government is more susceptible to face the financial distress. So, they applied local government coverage area as an explanatory variable. However, due to its lack of variability over the time, it has a low diagnostic value (Goryl et al., 2009, p. 28).

Trussel and Patrick (2014, p. 1) underline that financial distress in municipalities is an intergovernmental problem. It might also impair the willingness of businesses to move into local areas, due to the fact that business decisions are often based on the level of local taxes, fees, services, or development of the infrastructure. Therefore, the fiscal distress refers to a situation, in which a local government's provision and sustainability of public service delivery is threatened by various issues in the field of administration and finance, such as (Henshaw, 2022, p. 4):

– financial liquidity aspects, structurally imbalanced budgets, debt overload, deficit spending, and inability to capture the expenditures,

– revenue shortfalls and billing and revenue collection inadequacies and discrepancies, which can include problems with tax expenditures (Galiński, 2021, p. 266),

– an inability to meet obligations to other public entities,

– a lack of trained and qualified staff to process administrative and financial transactions.

The complexity of the fiscal distress is also proved by the fact, that lots of explanatory variables (fiscal distress predictors) are used. For example: Alaminos et al. (2018, p. 302) have selected a set of financial variables, from among those most used in the literature, as risk factors in this field, i.e.:

1. Financial variables: financial debt / commercial debt, own revenue / total revenue, short-term debt / long-term debt, total debts / total assets, own revenue / total debts, short-term debt / own revenue, operating expenses / own revenue, subsidies /population, own revenue/population.

2. Transparency variables: voter turnout, political competence, political ideology, population, unemployment, total debts, investment, political party fragmentation, political fragmentation.

In contrast, in the research of Gorina et al. (2018, pp. 79–88) the fiscal distress consists of cash solvency, budgetary solvency, long-term solvency, revenue structure, local economy, government type, and size as well as state and year effects. Considering the size they divided analysed units into three groups, i.e. small, medium and large ones according to the level of the population, indicating that larger governments are less likely to become fiscally distressed than smaller entities. In turn, Kloha et al. (2005, pp. 316–319), besides budgetary variables, applied population growth in order to measure this problem. They signalled that some studies did not

incorporate social or economic characteristics of the units. The change of population is also included in the study of Ziolo (2015, p. 23). In the other research, the degree of the fiscal distress is positively associated with the size of the population and the nature of the revenues (Alaminos et al., 2018, p. 297). However, Navarro-Galera et al. (2017, p. 403, 412) found no empirical evidence that the risk of a default in local governments is affected by the population size, but a growth of the population density may decrease the probability of this default. These authors indicate that some scholars conclude that larger populations generate more government spending, which may lead to a greater indebtedness and to difficulties in the process of the debt service. Finally, an increase in the volume of the debt could increase the likelihood of the default.

According to some studies, municipalities with an average period of payment of less than 30 days are considered to be in a non-financial distress situation, while those with an average period of payment greater than 30 days are classified as being in a financial distress situation. In turn, Bumgarner et al. (1991, p. 39) indicate that the fiscal distress results in a decrease in the maintenance and in the investment in order to finance other expenditures. So, this problem concerns not only the local authorities but also the whole local community. As a consequence, Wolman identifies both budgetary and structural approaches in the analysis. The first one tends to focus on imbalances in municipal budgets, whereas the second one considers the economic base and the population structure (determining the extent of service need) as factors of this distress (Diaz & Green, 2002, p. 8). Therefore, the size of the unit might be tied both with the budgetary situation and the economic condition.

It is worth to mention the conclusions of Arnett (2012, p. 45), who underlines that many terms, i.e. "fiscal distress", "fiscal stress", "poor fiscal health", "poor financial condition", and "weak fiscal condition", are used to describe the predicament of local governments dealing with economic difficulties and are often treated as synonyms.

Research methods

The measurement of the fiscal distress requires, as it was described, taking into consideration various aspects of the functioning of local governments. Therefore, TOPSIS method (Technique for Order of Preference by Similarity to Ideal Solution), as the multi-criteria decision analysis, might be applied in order to assess the exposure to this phenomenon. Simultaneously, the approach of Galiński (2021, pp. 361–389) was used, in which in the final TOPSIS estimation three variables were included, i.e.:

– debt to total revenues – destimulant,
– own-revenues in relation to total revenues – stimulant,
– total revenues to total expenditure – stimulant.

It should be mentioned that these variables were chosen, in the research of Galiński, as the representatives of some spheres of fiscal distress determinants after the cluster

analysis and the correlation analysis in order to avoid misleading results. Moreover, above variables appear in many findings as the separate measures of this distress.

So, in the process of the TOPSIS estimation the procedure of normalization of variables is applied (2), i.e. (Bąk, 2016, pp. 26–27):

$$z_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}} \tag{1}$$

in which: x_{ij} – observation of j-th variable for i-th object; $i = 1, 2,\ldots, n$ – object number, $j = 1, 2, \ldots, m$ – variable number.

Furthermore, there are determined: the positive/best ideal solution z_{0j}^{+} and the negative/worst ideal solution z_{0j}^{-}, separately for stimulant and destimulant (Perło & Roszkowska, 2017, pp. 72–73), i.e.:

$$z_{0j}^{+} = \begin{cases} \max_i\{z_{ij}\} \text{ for stimulant} \\ \min_i\{z_{ij}\} \text{ for destimulant} \end{cases} \tag{2}$$

$$z_{0j}^{-} = \begin{cases} \min_i\{z_{ij}\} \text{ for stimulant} \\ \max_i\{z_{ij}\} \text{ for destimulant} \end{cases} \tag{3}$$

Then, for each object a distance from positive-ideal solution d_{i0}^{+} and negative-ideal solution d_{i0}^{-} is calculated according to the formula (4) (5) (Fahami et al., 2019, p. 3):

$$d_{i0}^{+} = \sqrt{\sum_{j=1}^{m}(z_{ij} - z_{0j}^{+})^2} \tag{4}$$

$$d_{i0}^{-} = \sqrt{\sum_{j=1}^{m}(z_{ij} - z_{0j}^{-})^2} \tag{5}$$

As a result, a synthetic measure, i.e. Fiscal Distress Index (FDI_i), is estimated for each analysed unit:

$$FDI_i = \frac{d_{i0}^{-}}{d_{i0}^{+} - d_{i0}^{-}} \tag{6}$$

where: $FDI_i \in [0; 1]$, $\max_i \{FDI_i\}$ – the best unit (the lowest exposure to fiscal distress), $\min_i \{FDI_i\}$ – the worst unit (the highest exposure to fiscal distress).

Due to this estimation it is established the objects' ranking, in which the best object (i.e. local government with the lowest exposure to the fiscal distress) has the biggest value of a synthetic measure (Dudek & Jefmański, 2015, p. 21). Therefore, the higher the level of this index, the greater the resistance to the fiscal distress. On the other hand, the lower the level of FDI_i, the higher exposure to fiscal distress. However, in order to apply the ordinal logistic regression, the analysed objects are grouped into one of

the implemented categories, taking into consideration the mean ($\overline{FDI}$) and the standard deviation (sd_{FDI}) of the Fiscal Distress Index (*FDI*), i.e. (7), (8), (9), (10):

– group "D" (*Y*=1): a high exposure to fiscal distress:

$$FDI_i < \overline{FDI} - sd_{FDI} \tag{7}$$

– group "C" (*Y*=2): a moderate exposure to fiscal distress:

$$\overline{FDI} - sd_{FDI} \leq FDI_i < \overline{FDI} \tag{8}$$

– group "B" (*Y*=3): a low exposure to fiscal distress:

$$\overline{FDI} \leq FDI_i < \overline{FDI} + sd_{FDI} \tag{9}$$

– group "A" (*Y*=4): a very low exposure to fiscal distress:

$$FDI_i \geq \overline{FDI} + sd_{FDI} \tag{10}$$

Hence, the categorical variable is constructed, which enables to implement the ordinal logistic regression. It is worth to mention that other categories might be introduced, e.g. $FDI_i < \overline{FDI} - 2sd_{FDI}$ – very high exposure to fiscal distress. However, the aspects of minimum "events per parameter" should be kept in order to meet the requirements of the econometric modelling (Hosmer & Lemeshow, 2000, pp. 346–347).

This king of the dependent variable enables to implement the ordinal regression model (logit model). It is commonly presented as a latent-variable (*Y**) model, i.e. (11) (Long & Freese, 2014, p. 310; Long, 1997, pp. 115–117):

$$Y_i^* = X_i\beta + \varepsilon_i, \tag{11}$$

where: X_i is a row vector with a 1 in the first element for the intercept and *i*-th ($i = 1, 2, \ldots, n$) observation for X_{ik} ($k = 1, 2, \ldots, p$); β is a column vector of structural coefficients with the first element being the intercept β_0, and ε_i is a random error. So, this model describes the relationship between an ordered categorical response variable, with *J* categories, and the collection of *p* explanatory variables ($X_1, X_2..., X_p$) (Fagerland & Hosmer, 2017, pp. 668–679), which can be quantitative and qualitative.

Simultaneously, the proportional odds model (the parallel-lines model, the ordered logistic regression) is distinguished here. It assumes that each predictor has the same effects across the categories of the ordinal outcome variable (coefficients are the same across the ordinal categories) (Liu, 2016, pp. 194–199). However, this assumption might be violated (the parallel-lines in ordered logistic regression), which can be verified by the Brant test. As a results, the partial-proportional odds models

might be estimated, in which some of the β coefficients are the same for all values of j, while others can differ (Williams, 2006, pp. 58–60). This kind of the modelling may help to avoid serious errors concerning the statistical significance that could lead to an erroneous conclusion that an explanatory variable has little or no effect on the outcome variable (Williams, 2016, p. 19). Moreover, a specific variable can significantly affect the odds of transition only between certain levels of the dependent variable but not through all categories.

Therefore, the partial proportional odds model can be expressed as (Liu, 2016, p. 238):

$$\text{logit}\left(\pi(Y > j \mid x_1, x_2, \ldots, x_p)\right) = \ln\left(\frac{\pi(Y>j \mid x_1, x_2, \ldots, x_p)}{\pi(Y \leq j \mid x_1, x_2, \ldots, x_p)}\right) = \alpha_j + (\beta_{1j}x_1 + \beta_{2j}x_1 + \cdots + \beta_{pj}x_p), \quad (12)$$

where: α_j are the intercepts (*cons*) or cut points; $\beta_{1j}, \beta_{2j}, \ldots, \beta_{pj}$ are the logit coefficients and $\pi(Y > j \mid x_1, x_2, \ldots, x_p)$ is the probability of being beyond category j given a set of predictors, $j = 1, 2, \ldots, J\text{-}1$. The formulas for the parallel-lines model and the partial-proportional odds model are the same, except that in the parallel-lines model the β's (but not the α's) are the same for all values of j.

In the interpretation of this model the term "odds" is used, i.e.:

$$\text{odds}(Y_i \geq j) = \frac{P(Y_i>j)}{P(Y_i \leq j)} \quad (13)$$

So, the odds of being beyond a category are the probability of being above a category relative to the probability of being at or below that category (Liu, 2016, p. 238).

As a consequence, the author estimated two models with one explanatory variable of the "size effect". There were applied in the first model the level of the population (logarithm to the base 2) and in the second model the value of assets (logarithm to the base 2) as proxy variables. Their use results from the literature review and the specificity of the fiscal distress. In practice, the choice of this explanatory variable will be also affected by the problem of multicollinearity, hence the types of other predictors.

For each model, the results of a likelihood-ratio test (LR test) and a pseudo R^2 (Cragg-Uhler/Nagelkerke) are presented. The author also performed the Pregibon link test. This is a statistical test of whether the coefficient on the squared predicted value (hatsq) of the dependent variable is statistically different from zero in a regression of the dependent variable on the linear index and its square. It is examined to check whether the model is misspecified (Deb et al., 2017, pp. 58–63). This procedure is also applied in the partial-proportional odds models (Soon, 2010, p. 104).

In this research the data from the consolidated balance sheets of local governments and the information on the implementation of the budget (extracted from the Ministry of Finance database) as well as from the Local Data Bank of Statistics Poland were employed for the year 2021. Only the value of the assets concerns 2020, besides one unit, in which the information for 2017 was used due to the lack of the current data. As a results, the study concerns 2,411 communes.

Results

In 2021, the communes accumulated 49.03% of total revenues as well as were responsible for 38.36% of expenditures and 37.51% of the debt of the local government sector in Poland. In this year, the average level of debt to revenues was 18.72%, whereas own-revenues to total revenues and total revenues to total expenditures were 36.96% and 108.09% (Table 1). Therefore, this sector generated budget surplus. Simultaneously, these units differed in terms of the level of the assets and the population (Table 1).

In turn, in 2021, in the communes the average estimated Fiscal Distress Index, that was measured by the author, was 0.65 with the standard deviation (Stand. Dev., Table 1) at the level of 0.09. As a result, each entity was categorized into one of the four groups, which indicated its exposure to the fiscal distress (Table 2). The most numerous group formed units with the low exposure to the analysed feature. This distribution, according to the methodological approach, allowed to implement the dependent variable (*Y*) in the ordinal logistic regression modelling in order to find the relationships between the level of the exposure to fiscal distress and the size of the unit.

Table 1. Descriptive statistics of the applied variables and measures

Details	Min	Max	Mean	Median	Stand. Dev.
Debt to Total Revenues (%)	0.00	92.07	18.72	16.58	13.28
Own-revenues to Total Revenues (%)	14.44	88.74	36.96	35.42	11.76
Total Revenues to Total expenditures (%)	75.60	162.24	108.91	108.09	8.53
Fiscal Distress Index	0.15	0.89	0.65	0.67	0.09
Assets (m)	9.01	2,090.60	136.16	76.19	178.49
Population	1,294	87,175	10,639	7,286	9,858.46

Source: Author's own study.

Table 2. Distribution of the communes according to the exposure to fiscal distress

Exposure to fiscal distress	Rating (Y)	Number of units
High	D (1)	340
Moderate	C (2)	669
Low	B (3)	1,122
Very low	A (4)	280

Source: Author's own study.

Thus, two models were estimated, separately for the population (log to the base 2 of the population) and the assets (log to the base 2 of total assets) as the proxy variables (explanatory variable) of the size of the local government (Table 3). In both cases, the results of the Brant test show that the partial-proportional odds model should be applied. Because in these models χ^2 in LR test is significant, it could be claimed that there is a relationship between the fiscal distress and the size of the

unit. However, the results of the link test indicate that only for the population, as a proxy of the size of the unit, the applied functional form of the model is correct (Table 3). In this model the analysed predictor was only significant for $Y>3$. So, if in the communes the population would be doubled their odds of achieving very low exposure to fiscal distress increase by 47.31% (($e^{0.3874} - 1$) × 100%). However, this relationship was not significant for other variants. It means that the growth of the size of the unit is important to increase odds to reach very low level of fiscal distress. It is worth to add that the higher Fiscal Distress Index appears in the units with lower debt burden, higher budget surplus as well as larger financial independence, which results from more effective fiscal capability. Nevertheless, the relatively low pseudo-R^2 (Cragg-Uhler/Nagelkerke) in the model for the population indicates that there are other risk factors in this field.

Table 3. Results of the estimated models

Details		Model for the population	Model for the assets
Y>1	cons	2.7007*** (0.7422)	5.5333*** (1.1627)
	β	-0.0688 (0.0568)	-0.1408*** (0.0438)
Y>2	cons	1.0577** (0.5228)	2.1225*** (0.8128)
	β	-0.0561 (0.0401)	-0.0679** (0.0308)
Y>3	cons	-7.1174*** (0.7736)	-14.5440*** 1.1587
	β	0.3874*** (0.0580)	0.4690*** (0.0428)
LR test		[<0.001]	[<0.001]
Brant test		[<0.001]	[<0.001]
R^2 Cragg-Uhler/Nagelkerke		0.026	0.070
Link test			
Y>1	hatsq	[0.114]	[<0.001]
Y>2		[0.252]	[0.028]
Y>3		[0.496]	[0.005]

Note: ***, ** and * denotes statistical significance at 1%, 5% and 10% levels, respectively. Standard errors are presented in parenthesis. Results of statistical tests reported as *p*-value.

Source: Author's own study.

Discussions and conclusions

Summarizing the above consideration, it is seen that the fiscal distress is the complex phenomenon, which concerns units of the public finance sector at the central and the local level. Therefore, the various economic, financial, social, demographic and political risk factors should be included in the research. Thus, the budgetary and structural approaches are distinguished in the studies. In the process of the research,

the size of the unit might be considered, which is often applied in a business finance. In this case the size effect is often represented through the value of assets, total sales or number of employees. Hence, in most of the studies in the local public sector this risk factor could be characterized through the level of the population or the level of assets. So, the main hypothesis of this paper was positively verified. The author does not recommend using the value of the revenues or the expenditures due to their potential strong relationships with other budget categories, that can be used in the econometric modelling. So, the applied approach depends on the functional form of the model or types of other variables in order to decrease the problem of the multicollinearity. It is also affected by the method of the identification of the level of the exposure of local governments to the fiscal distress. Thus, applying the linear ordering technique, both the population and the assets might be used. Moreover, the proxy variables of the size can differently affect the local governments due to their current exposure to the fiscal distress. Therefore, the growth of the size of the unit, measured by the population, increases the odds of achieving very low exposure to fiscal distress. In turn, this significant relationship does not appear to reach moderate or low exposure. These results are partly consistent with the findings of Navarro-Galera et al. (2017), in which the population size was not significant for the local government default in contrast to the population density (the higher this density, the lower probability of the default). However, in the literature, there is no clear evidence about the analysed relationship. As a result, the author revealed that the size effect may be significant only for some local governments to reach a specific fiscal distress position. At the same time, there are other crucial risk factors of the fiscal distress, i.e. the budget imbalance, costs of debt servicing, the tax base or the expenditure structure, which affect this. So, the size of the unit is only the additional issue in the research and it is crucial to find other financial, economic and social ties. Moreover, the units should firstly implement some budgetary measures to avoid analysed problems. The local governments can be also grouped according to the level of the population or the assets in order to examine different relations within the types of the units between some other risk factors and the exposure to fiscal distress.

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