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Measuring fiscal distress at local municipalities

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Due to the rise of New Public Management (NPM), accounting systems and organizational best practices have changed greatly in the public sector. The idea promotes the public sector adopting processes and methods from the private sector. This widespread paradigm has a tremendous effect on the importance of measurement of the efficiency, effectiveness, and economic performance of the public sector. However, traditional profitability indicators provide a misleading picture of the financial viability of municipalities. The financial performance of local government can be better evaluated with the level of their fiscal distress.

Besides these new approaches, the financial problems of large American cities called for better monitoring systems several decades ago. Recently, the global crises of the last decade have drawn attention to the importance of this issue. However, there is no universally accepted model for measuring fiscal distress. Due to the special characteristics of the public sector, the measurement of financial distress should be customized for the sector. The goal of this research is to introduce and compare definitions, models, and theories which describe the importance of the evaluation of the fiscal health of the local governments.

Keywords: fiscal distress, public sector, distress prediction

1. Introduction

The aim of this study to compare the definitions and select the most relevant variables of fiscal distress models, on the theoretical level. However, the private sector has several well-known financial distress models (e.g. Altman's multi-discriminant analysis, Ohlson's logit model, Zmijewski's probit model, or the Black-Scholes option-pricing model) (Wu et al. 2010), while in the public sector, there are no universally used models. There are several barriers which have prohibited measuring this kind of financial performance. Besides the changes and the differences in the legal environments, the financial reporting system can cause difficulties, too. Earlier, the cities of the United States used cash or modified accrual accounting. The systems applied here varied greatly. This made the comparability of the public sector entities difficult (Clark 1977). Without an up-to-date standardized accounting system, there is no possibility of creating an efficient predictive model for fiscal distress.

The financial accounting environment of the public sector has changed significantly. From the 1970s, public sector reforms were promoted internationally. These reforms aimed to reduce the inefficiency of the public sector (Christensen et al. 2018). Due to the rise of the NPM, the importance of efficiency, effectiveness, and accountability increased. NPM called for more business-like solutions (Hood 1995). The reform of the accounting system was one of the key areas.

The adoption of accrual accounting in the public sectors started in the 1990s. Firstly, we can mention New-Zealand and Australia as early adopters who were followed by other Anglo-Saxon countries. This process cannot be described as an

English-speaking 'club' phenomenon, as several OECD countries adopted it, or started to adopt accruals by 2000 (Carlin 2005). According to PwC's survey, 80% of OECD countries are planning to introduce accrual accounting by 2020 (PwC 2015). These changes in the financial reporting system have made it more transparent, comparable, and reliable. The improvement of the accounting system enabled the creation of early warning systems. The appearance of fiscal distress modeling is the consequence of both broader public management reforms and the inefficient operation of the public sector. However, fiscal distress modeling is usually not connected to NPM, but the changes which were promoted by the idea provided tools for these kinds of investigations. The fiscal distress models can be a proper indicator of the effectiveness of local governments. The goals of these organizations can be reduced to two points: first they have to meet their financial obligations, and secondly, they have to provide services to their citizens. These two motives can be measured with fiscal distress indicators.

In the 1970s there was increased attention paid to fiscal distress predictions because of the bankruptcies of American cities (Gorina et al. 2018). From this period there were several public sector-specific distress models created, mostly in the Anglo-Saxon countries. This research aimed to recognize financial emergencies (Kloha et al. 2005). However, in the 1990s there was a drop in the amount of research regarding this issue, although interest in fiscal distress measurement recovered in the new millennium (Gorina et al. 2018). In Europe, the measurement of fiscal distress was enabled after the reform of public sector accounting (Cohen et al. 2012). Accrual accounting can provide a more punctual and reliable picture of an organization. This accounting method can improve the valuation of the assets of an organization, and it can show a more actual picture of its revenues and obligations (Simon 2011). The higher validity of the accounting system and the available data provide an opportunity to create and test fiscal distress models. Accrual accounting can capture all of the transactions immediately, full updating accounting reports (European Commission 2013)

The Hungarian public sector (similarly to several European countries) adopted accrual accounting in 2014 (Balog–Jakab 2017), making the measurement of fiscal distress among Hungarian local governments topical and viable. The previous accounting system was not able to create a punctual report on the processes of local governments. Their debt burden was not predictable, and the data provided by accounting reports was not reliable (Simon 2011).

Besides the changes in the financial reporting system enabling proper measurement, the problems of the local government sector highlighted the importance of fiscal distress measurement. During the crisis, the financial health of the Hungarian local governments destabilized (Halmosi 2013). The inappropriate regulation of the local government sector had a key role in indebtedness of the sector (Lentner 2014). These problems called for higher efficiency, more effective control activities, and performance measurement.

The paper introduces nine fiscal distress indicators, which have been applied in previous research. The measures presented can be useful for local managers to examine the conditions and the risk of their municipality, but they are suitable for

external users (auditors, creditors, and other stakeholders) as well. The research was based on different datasets. There are examinations from the United States, Australia, and European countries. The comparability of the results and the models are limited due to the different methodical approaches, and the different regulation of the local governments involved. Ziolo (2015) highlighted that it is impossible to adapt to the financial variables that are used in international papers, which could explain the lack of cross-country studies. These measurements are usually customized by one particular country and its regulations. The paper is not trying to create answers and tools for local managers to handle financial problems, the aim is to examine different methods and approaches to measure and predict the level of fiscal distress.

The remainder of the paper organized as follows: In Section 2 the paper discusses the definition and the possible causes of fiscal distress, Section 3 shows researches and variables regarding the measurement of fiscal distress. Section 4 collects the expectations regarding fiscal distress models. Finally, Section 5 summarizes the main findings of the paper.

2. Theoretical background

In this section, different definitions will be introduced, along with major features of the relevant research. Firstly, the different definitions of fiscal distress literature. Most of the research uses similar definitions, however, they are not equivalent. Table 1 presents the commonly used definitions.

Table 1 Commonly Used Definitions Found in The Fiscal Distress Literature

Term	Definition	Author
Fiscal Health	Underlying or structural ability to deliver public services to its residents, independent of the budgetary decision made by city officers	Ladd–Yinger (1989)
Fiscal strain	An institutional lack of adaption to a changing environment	Clark–Appleton (1989)
Fiscal Stress	The imbalance between the revenue raising capacity and the expenditure needs of a local government	Badu–Li (1994)
Financial distress	Occurs when the entity, municipality or province, is no longer able to perform its essential functions and deliver due services, or when it is no longer able to meet debt within third parties through the ordinary means of restoring fiscal balance or the debt instrument with a balance sheet	Costanz–Rossi–Zito (2012)

Source: Ziolo (2015), p. 16.

The terms and definitions can be dissimilar in different works of research. Clark (1977) examined fiscal strain and aimed to apply indicators which could forecast fiscal strain. He differentiated three approaches to fiscal strain through the data of the bond market. In this research, he defined fiscal strain as a situation when there is a drop in the offering price of a new issue, or it can be indicated by changes in the price of the bond on the secondary market. Both of the indicators related to the probability of the issue meeting regular payments of principal and interest. He examined the third approach. Fiscal strain may then be viewed as deriving from the relationship between resources and expenditures established by municipal leaders. As the socioeconomic features of a municipality or its resources change, municipal leaders differentially adopt new policies to cope with their changing environment. Some local governments adapt rapidly enough to avoid straining themselves fiscally, while others adapt much more slowly, and in the meantime develop considerable fiscal strain. These changes largely influenced by national trends, the leaders of the municipalities have only modest control on any of them (Clark 1977).

Kloha et al. (2005) have a similar definition of fiscal distress. They defined fiscal distress as a failure of the municipalities to meet their standards in the areas of operating position, debt, and community need and resources over successive years. They also examined different definitions, too. "Fiscal distress reflects short-term considerations, such as a local government's ability to meet is payroll and generally make payments in a timely manner" (Kloha et al. 2005). It also could be described as imbalances between the level of the allocated resources and the potentially available resources. However, the definition may also include long-term considerations, including the tax base relative to its expenditures and commitments. Nevertheless, the meeting of financial obligations is not the only task of the municipalities. They also have to meet with needs of the community. The local governments have a wide range of purposes and tasks, and this aspect of distress is particularly difficult to operationalize (Kloha et al. 2005).

According to the study of Kloha et al. (2005), there are four causes of fiscal distress. Shifts in the population and the job market, governmental growth, interest group demands, and poor management. Population and job market shifts represent what is called the migration and tax base erosion model, which is the point that the major cause of the fiscal distresses originate from negative changes of the demographical features. Governmental growth, which is also referred to as bureaucratic growth focuses on the lack of market signals in the public sector. The government's spending increases rapidly. The government has to calculate population growth and inflation. According to the third approach, the cause of the financial vulnerability is the demands of the interest groups. The elected mayors or officials usually must meet with the expectations of different interest groups and this could reduce the effectiveness of the municipality. The fourth reason for fiscal distress is poor management. In this scenario, the accounting and management practices can be described as unfertile practices, the budgeting and estimation procedures are inaccurate (Kloha et al. 2005). Carmelli and Cohen (2001) have a similar explanation for the financial problems. They attributed fiscal distress to a lack of organizational

resources and managerial skills, which in turn lead to inappropriate service delivery and inefficient adaptation to changing conditions (Carmelli and Cohen 2001).

Jones–Walker (2007) used a different approach. Distress can be defined as an inability to provide services at pre-existing levels. In order to provide services to the community, municipalities are expected to invest in infrastructure and to maintain legacy infrastructure. In their research, they used the estimates developed by local governments of the cost of restoring infrastructure to a satisfactory condition as a measure of degrees of distress. The binary classification (failed or not failed) is not suitable ord relevant) for the public sector (Jones–Walker 2007).

Trussel–Patrick (2013) defined fiscal distress as the existence of financial and other problems that could cause the municipality to reduce its current level of public services. The situations are caused by the imbalances between the financial resources a municipality has committed to providing services and the potential resources it has available to provide those services (Trussel–Patrick 2013).

Beck–Stone (2017) examined the relationship between the dissolution of the municipalities with fiscal distress. The financial condition of a municipality can be distributed into two components. The first is the probability that a government will be able to meet both its financial obligation to creditors, consumers, employees, taxpayers, suppliers, constituents, and others as they become due. The second one is to meet service obligations to constituents. The municipalities have to fulfill both kinds of obligations. The first component is similar to the concept of financial condition for private entities, but the second can be described as public sector-specific. They emphasized that fiscal distress is difficult to be isolated from other reasons for dissolution. For example, a decrease in the population lowers the tax base, which affects the financial conditions (Beck–Stone 2017).

In the research, six reasons for the dissolutions were differentiated. The dissolution could be motivated by seeking greater efficiency, it could be caused by low participation in the local government. The exodus of the population could also lead to dissolution. The dissolution also could be forced by the state or country. The authors created a group for other reasons too (Beck–Stone 2017). As they highlighted, fiscal distress can be one of the main reasons for a dissolution, but it is difficult to identify as an isolated reason for this process. They summarized the process of measurement of financial distress.

Financial distress is affected by a wide range of factors according to this concept. As a first step, the environmental conditions should be examined. A decrease in the population or, the increase in the average age can also be an early warning sign. The dependence on a declining or struggling industry or the declining price of property (or the greater inventory of homes for sale) could indicate financial distress as well. As a second step, the likelihood of continuation as a going concern should be assessed. In that step, the local conditions, citizens' initiatives, and state initiatives should be considered. As the third step, the likelihood of severe financial distress could be evaluated. The estimation contains short- and long-term indicators. The performance can be assessed through the ability to meet current and future obligation with the available resources. The recent trends in fiscal conditions should also be

reviewed. Besides the financial ratios, the behavior of management matters. The competence of and the steps taken by management affects the probability of fiscal distress (Beck–Stone 2017). However, this line of investigation provides a truly unique approach to understanding fiscal distress, for which no model has yet been created.

In consort with the above theories, Skidmore–Scorsone (2011) differentiated external or economic factors and management-type determinants. In the first group, we can find the increasing cost of health insurance or the property market (through the effects the taxation) could be a key driver, too. These elements cannot be influenced by local managers. The second cause is linked to poor financial management. In their research, they measured fiscal distress through the gap between the change of Government Services Cost Index and the change of the Government Revenue Index. The Government Service cost index is divided into Government Employee Cost Index and Capital Cost Index. Both of the Indices are affected by external conditions (Skidmore–Scorsone 2011).

The definitions and approaches introduced above highlight that several financial and social determinants (which are can used by internal or external factors) should be in the scope of further investigations. However, these things should be revised regularly, because there can be different relations in different places, or at different times. For example, in different countries, the local governments can collect different taxes, and have different obligations. In the studies which examine local government in the United States, the role of the property tax is enhanced and as a consequence property, market-related indicators can be involved in the examinations, too. In other countries, different revenues and markets should be investigated.

3. How to measure fiscal distress?

Cohen et al. (2012) highlighted that limitations of bankruptcy prediction. Municipalities in a majority of countries cannot declare bankruptcy, and as a consequence, researchers cannot rely on historical data to identify the characteristics of that (Cohen et al. 2012). Bankruptcy is the last resort of the central government. The procedure of bankruptcy is not advantageous for any of the entities concerned. The avoidance of bankruptcy is usually encouraged by the regulations. If a local government is not able to pay its obligations, they do not declare (or are not allowed to declare) bankruptcy automatically (Halmosi 2018). As a consequence, the application of private sector bankruptcy models is unsuitable for the public sector.

Another important difference is that profitability is not a goal in the public sector, high ROA (return on assets) and ROCE (return on capital employed) are not socially desirable for the non-profit municipalities. Increased profitability may be interpreted as a result of unjustifiably high taxes and not as an indication of efficiency. Similar to this thread, a high degree of debt may not result in default. The central government can help local governments to solve liquidity problems. Moreover, financially distressed public sector organizations do not always declare bankruptcy (Cohen et al. 2012). The binary classification of the municipalities (failed or not

failed) cannot be a reliable dependent variable in these models. The process of the bankruptcy and the criteria for the declaration of the bankruptcy differ from country to country (Halmosi 2018). This also generates an additional problem.

Bond default and downgrades of ratings are also an ineffective way of measuring the outcome of fiscal distress, as creditors of municipalities typically do not have the power to force the sale of municipal assets in the event of bond defaults. Moreover, the bond can be covered by insurance, which is increases the ratings of a bond (Trussel–Patrick 2013).

Along with the financial ratios, social-economic measures also need to be considered, as the definitions presented highlight. The changes in the financial ratios usually indicate the problem too late, but a decline in the quality of the services could appear earlier. Moreover, local governments with different social-economical features could have a different level of distress, while their financial ratios are similar.

We can differentiate relative and absolute indicators. In the case of relative indicators, the values of each of the ratios involved has to be calculated, then the municipalities have to be arranged into an order based on the received results. Then the local governments can be differentiated in that order. The orders can be summarized with the help of different pointing systems. A negative consequence is that someone always has to be at the top and at the bottom, irrespective of how distressed local government is. An additional problem with relative models is that model users have to calculate the value of the indices for each municipality, even if they are only interested the level of fiscal distress in the case of one municipality (Kloha et al. 2005). In the absolute models, the results of the local governments are independent of each other's, as the values of the indicators are compared to a theoretical threshold.

In this section, there will be 5 categories of financial distress measurements introduced. The research examined is summarized in Table 2.

Table 2 The examined researches

Authors	Methodology	Rating	Sample	Examined years
Clark (1977)	Financial ratios	Absolute	US cities	1970–1974
Brown (1993)	Point-based rating	Relative	US cities under 100.000 residents	1992
Kloha et al. (2005)	Point-based rating	Absolute	Cities of State of Michigan	1998 (Applied data from 1993–1998 period)
García-Sánchez et al. (2012)	Point-based rating	Relative	Spanish municipalities with a population of over 50.000	1988–2008
Jones–Walker (2007)	Regression	Absolute	161 Australian Councils	2001–2002
Trussel–Patrik (2013)	Regression	Absolute	US municipalities	1995–2008
Gorina et al. (2018)	Regression	Absolute	Municipalities of Pennsylvania, Michigan, and California	2007–2012
Cohen et al. (2012)	Simulation-based	Relative	Greek municipalities	2007–2010
Ziolo (2015)	Cluster analyses	Absolute	Polish municipalities	2008–2013

Source: own elaboration

3.1. Financial ratios

Some researches only collect relevant variables, and do not create fiscal distress models. One of the first investigations was Clark's (1977). He created 4 indicators (Table 3) to measure fiscal strain. In the research, cities of the U. S. were examined. The research highlighted that bond defaults and interest rates on bonds are not proper measures of fiscal distress (Jones–Walker 2007).

Table 3 Indicators of fiscal strain

Indicator	**Description**
Default	Default, or the probability of default, where the default is defined simply as not meeting regular bond payments, is a presumed criterion of fiscal strain for bond investors and the two major bond- rating agencies.
Ratio Measures	Several ratios such as gross debt divided by the tax base or short-term debt over long-term debt are frequently published in municipal fiscal reports.
Social and economic base characteristics	Population size and change, median family income, and taxable property value are among the variables commonly included under this heading.
Funds flow measures	These measures are also often included in some form in financial reports.

Source: Jones–Walker (2007)

Clark (1977) enhanced the importance of funds flow and examined the 29 indicators. These indicators relied on debt statistics (long- and short-term were differentiated), interest-payments, general revenues and retirement funds, and liabilities. The indicators examined the short- and long-term sustainability of the financial structure (Clark 1977).

These kinds of investigations do not provide one single value which can describe the status of the municipality. However, this can be an advantage. The research related to one single indicator is often criticized because the aggregate scores can hide the weaknesses which can be shown by an individual indicator (Gorina et al. 2018). This weakness has a much higher impact among the relative indicators, as there is always a best (or a group of best) municipality which appears to be fiscally healthy, irrespectively of the fact that the whole local government sector can be fiscally distressed at the same time, theoretically. A weakness of this kind of approach is that usually there is no clear guidance for how to prioritize among the ratios.

3.2. Point-based ratings

Brown (1993) created a 10-point scale to assess the financial condition of smaller US cities. Ratios and their clarifications are summarized in Table 4.

Table 4 Ten Key ratios of financial condition

Ratio	**Clarification of Ratio Components**
Total revenues/Population	*Total revenues* are the total revenues for all governmental funds.
Total general fund revenues from own sources/Total general fund revenues	*Total general fund revenues from own sources* are the difference between total intergovernmental revenues.
General fund resources from other funds/ Total general fund sources	*General fund sources from other fund* are general fund operating transfers in. *Total general fund sources* are the total of general fund revenues and operating transfers in.
Operating expenditures/total expenditures	*Operating expenditures* is the total expenditures for the general, special revenues and debt service funds. *Total expenditures* are the total expenditure for all governmental funds.
Total revenues/Total expenditures	*Total revenues* are the total revenues for all governmental funds. *Total expenditures* are the total expenditure for all governmental funds.
Unreserved general fund balance/Total general fund revenues	*Unreserved general fund balance* is the total of both unreserved designated and unreserved undesignated fund balance for the general fund.
Total general fund and cash investments/Total general fund liabilities	(The components are self-explanatory).
Total general fund liabilities/Total general fund revenues	(The components are self-explanatory).
Direct long-term debt/Population	*Direct debt* is general obligation to be repaid from property tax revenues.
Debt services/Total revenues	*Debt service* is the total expenditures in the debt service fund. *Total revenues* of all governmental funds.

Source: Brown 1993, p. 22.

The model is a relative one, after the calculation of the ratios, Brown sequenced local governments and created four quartiles. The organizations of the best quartile received –1 point, the local governments of the second quartile received 0, then the next quartile received 1, and the worst municipalities received –2. Then the points received were summarized and the local governments were categorized into five groups:

- 10 or more points: Among the best
- 5 to 9 points: Better than most
- 1 to 4 points: About average
- 0 to –4 points: Worse than most
- –5 or less: Among the worst (Brown 1993).

Kloha et al. (2005) examined the responsibility of the state regarding the level of fiscal distress of local governments. They analyzed the 10-point scale of the State of Michigan that used 9 indicators (Table 5). Kloha et al. (2005) highlighted that, there is no single indicator which can create a picture of a government's fiscal position. If a local government reached "bad" value on an indicator, they gained one point on the scale. In the case of a consecutive operating deficit, the entity received 2. The indicators represented short- and long-term dimension of the fiscal distress. Besides the financial ratios, several socio-economic indicators (population growth, taxable value related indices) were used in their valuation (Kloha et al. 2005). This method could be labeled as a mixed approach, as it integrates management-type factors and external (economic) determinants, too. This model focusses on the predictions of fiscal distress rather than assessing reactions to the distress (Skidmore–Scorsone 2011).

The authors set standards for particular indices. In some cases, this was straightforward, while in other cases they created the threshold. In the latter case, the standard deviation from average values was used to identify a small percentage that is performing relatively poorly (Kloha et al. 2005).

The authors also introduced an early warning system, based on their valuation (Table 6). If a government scored 4 or fewer points, it could be labeled as fiscally healthy. In their cases, there is no action required by the state. A value above 5 points is considered relatively high, and if a local government reaches that amount, they are informed by the state. If a local government receives more points, it will be placed on a published list, and a review team also could be appointed (above 8 points) (Kloha et al. 2005).

Table 5 Indicators of fiscal distress

Name	Description
Population growth	Two-year growth
Real taxable value growth	Two-year growth
Large real taxable value decrease	Looks for large drop over a two-year period
General fund expenditures as a percentage of taxable value	Current general fund expenses divided by current taxable value
General fund operating deficit	Current general expenditures subtracted from current general fund revenues, divided by general fund revenues
Prior general fund operating deficits	Checks "General fund operating deficit" for two previous years
Size of general fund balance	General fund balance as a percentage of general fund revenues
Fund deficits in current or previous year	Current or previous year deficit in major fund
General long-term debt as a percentage of taxable value	Current general long-term debt divided by current taxable value

Source: Kloha et al. (2005), p. 319.

Table 6 Early Warning System

Points from scale	Category	State action
0–4 points	Fiscally healthy	No action
5 point	Fiscal watch	Local government is notified about relatively high score
6–7 points	Fiscal warning	Local government notified and placed on published list for current and following year
8–10 points	Fiscal emergency	Local government notified, placed on published list for current and following year, automatic consideration of review team

Source: Kloha et al. (2005), p. 321.

García-Sánchez et al (2012) used a similar approach. They created a relative model and they compared their model's results with the evaluations of the model of Kloha et al. (2005). The models were compared using the data of Spanish municipalities for the 1988–2008 period. The Authors used seven indices to predict fiscal distress, the

indicators associated with flexibility, independence, and sustainability are the most important ratios to set the limits of municipal fiscal situations. Table 7 introduces the applied indicators.

Table 7 Indicators of fiscal distress model of García-Sánchez et al. (2012)

Indicator	Descriptions
Net Saving Index (NSI)	Difference between the receivables from current budget resources and the budget obligations from non-financial current expenditures, reduced by annual amortization payment-interest and principle-per inhabitant
Current financial independence index (CFII)	Current budgetary payable divided by current budgetary receivables except current grants
Total Finance Independence Index (FII)	Budgetary payables divided by budgetary receivables except grants
Non-financial budgetary result index (NFBRI)	Current budgetary payables, non-financial capital budgetary payables divided by non-financial current budgetary receivables, non-financial capital budgetary receivables.
Financial Charge per inhabitant (FCII)	Annual amortization payment-interest and principal – per inhabitant
Net Debt Index (NDI)	Annual accumulation variation long-term credit operations per habitant
Fiscal revenue Index (FRI)	Fiscal receivables divided by net current budgetary receivables.

Source: García-Sánchez et al. (2012).

The authors calculated the value of the indicators for each of the municipalities examined, then ranked the municipalities according to their values. After that, the municipalities received points based on their rank. The organizations of the best quartile received 0 point, the next quartiles received 0.25, then 0.5 and 1 point. In the case of Net Saving Index and the Fiscal Revenue Index, the higher values were preferred. In contrasts, the rest of the indicators received lower points for lower values. A municipality could score between 0 and 7 points. The authors proposed the following classification:

- 0 to 1.5 points: Excellent
- 1.6 to 2.5 points: Good
- 2.6 points to 3.5 points: Watching
- 3.6 points to 5 points Warning
- 5.1 points to 7 points: Emergency (García-Sánchez et al. 2012).

After the evaluation of the municipalities with their model, they tested which model had more significant explanatory variables. The authors created an overall model of their and the absolute model of Kloha et al. (2005). During the

investigations, only six indicators were statistically significant (at the 99 percent confidence level). All of them originated from the model of Kloha et al. (2005). According to this result, the absolute models were proven to be better than the relative indicators, however, the absolute models need to incorporate certain indicators of financial independence as taken into account in other alert systems (García-Sánchez et al. 2012).

3.3. Regressions

Jones–Walker (2007) created two models: a quantitative and a qualitative regression. In the case of the quantitative regression, the dependent variable was a quantitative measure (e.g. physical output levels) of service delivery, while in the second case the quality of the services was the dependent variable (Jones–Walker 2007). The aim of the research was to create an early warning system. According to the authors, the drop in quality of services can do so, meanwhile Table 8 summarizes the explanatory variables of the regressions.

Table 8 Explanatory variables of the fiscal distress

Jones–Walker (2007) quantitative	Cash flow operations to total assets
	Long-term interest bearing debt to total assets
	Cash resources to total assets
	Interest cover
	Gross debt to operating cash flow
	Operating cash flow to total infrastructure assets
	Ordinary revenue (less waste and sewerage charges) to total assets
	Total expenditure by total assets
	Surplus to total assets
Jones–Walker (2007) qualitative	Population within council boundaries
	Local council large or small
	Rates revenue to total ordinary revenue
	Ordinary revenue (less waste and sewerage charges) to total assets
	Road program costs over total assets
	Number of full-time (equivalent) staff
	Carrying value — total infrastructure

Source: Jones and Walker (2007), pp. 409–410

For the qualitative regression, the authors used data and indicators of financial reports, while in the other regression, some social and service-specific factors appeared. The measurement of the dependent variables is an interesting issue. First, the services which have to be provided by the local governments should be collected. This could differ from country to country.

Jones–Walker (2007) examined Australian councils. At this time (2001–2002), the councils had to collect taxes (rates), and they were responsible for the roads and the collection waste for disposal. The councils were usually providing a wide range of other services, but they were less significant and they were funded by Commonwealth and State governments. For waste disposal management, the following variables were used: domestic waste pickups per week, the number of residential properties receiving waste management services, and total kilograms of recyclables collected. The councils were also obligated to provide and maintain infrastructure. The infrastructure variables in the analysis were: the carrying values for buildings, roads, other transport, water, sewerage and drainage infrastructure; estimated cost to bring buildings, roads, other transport, water, sewerage, and drainage infrastructure to a satisfactory condition; and budgeted maintenance expenditure for buildings, roads, water, sewerage, and drainage infrastructure (Jones–Walker 2007).

The financial variables are similar to other financial distress models, but the authors enhanced the importance of cash flow. The Australian councils have had to publish statements, which includes cash flow, since the early 1990s. This made possible examination of the significance of cash flow based indicators. They also tested operating cash flows (e.g., operating cash flows to total assets); cash position (e.g., cash and short term investments to total assets); liquidity and working capital (e.g., current ratio); rate of return (e.g., reported surplus to total assets); financial structure (e.g., total debt to total assets); and debt servicing capacity (e.g., operating cash flow to interest payments) (Jones–Walker 2007).

The quantitative model was not able to provide a statistically significant relationship between the level of fiscal distress and the explanatory variables. According to the results of the qualitative model, the population within council boundaries and the size of the council were positively associated the level of fiscal distress. This means that the councils with a larger population are relatively more distressed than the smaller councils. The councils' distress level is negatively associated with revenue-generating capacity (this variable has the highest statistical impact), while the entities with a smaller number of full-time equivalent employees appeared to be more distressed. The conditions of the infrastructures (carrying value) were also significant, the more written down assets (these assets are older or they are in poor condition) are positively associated with fiscal distress (Jones and Walker 2007). The paper was able to provide the above-mentioned connections that highlight the importance of the monitoring of the condition of assets and revenue-generating capacity. The proper management of the factors can help to reduce the probability of financial problems.

Trussel–Patrick (2013) examined the fiscal distress of US municipalities in the period of 1995-2008. They operationalized the fiscal distress as a 5% decrease in the public service expenses per capita. They highlighted that the proper measurement of the outputs of the public services are complicated, which was the reason they measured efforts (expenditure per capita).

Based on their hypothesis they examined the effects of six indices (Table 9).

Table 9 Financial Indicators of Public Service Reductions

Indicator	Measure	Expected Relationship with Public Service Reductions
Revenue Risk (REVRISK)	Revenues from Other Governments/Total Revenues	positive
Administrative Cost per Capita (ADMIN)	Administrative Expenditures/Population	negative
Capital Outlays (CAPREV)	Capital Expenditures/Total Revenues	negative
Debt per Capita	Total Liabilities/Population	positive
Debt Issued to Revenue (DEBTISSUE)	Debt Issued/Total Revenues	positive
Revenue Growth (GROWTH)	Change in Total Revenues/Total Revenues	negative

Source: Trussel–Patrick (2013)

The model classified correctly 83 percent of the examined municipalities. According to the result, the municipalities who receive more intergovernmental revenue (compared to their own-source revenues), spend less on capital items relative to total liabilities and bond proceeds, and use more debt tend to reduce their public services (Trussel–Patrick 2013).

Gorina et al. (2018) built a regression too, to test their action-based measure of fiscal distress. They labeled a municipality fiscally distressed in a given year if, its financial management was characterized by at least one of the following: a blanket prohibition of overtime, a comprehensive reduction of employee salaries, personnel furloughs or layoffs that affect multiple employees, late payments to vendors and other payees, large across-the-board budget cuts of at least 10 percent of the budget that produce cuts in services, budget enactment later than two months after the beginning of the fiscal year, pension contributions less than 75 percent of annual required contributions, unusual inter-fund transfers of at least 10 percent of general fund, excluding fund balance reclassifications pursuant GASB 54 (Government Accounting Standard Board), unusual tax rate or fee increase that are not related to debt issuance, declaration of fiscal emergency, default on municipal debt, bankruptcy, auditor doubts that the entity may continue to be a "going concern", or a takeover by state or significant state financial assistance (bailout). This evidence-based measurement of fiscal distress is a unique way to conceptualize fiscal distress (Gorina et al 2018).

One of the hypotheses of the authors was that the revenue structure can be an important determinant of fiscal health because of its effects on revenue collections. Governments with diversified revenues have higher revenue volatility in an economic

recession. The empirical model used the general fund balance to capture *Cash Solvency*. For *Budgetary Solvency*, they used the operating ratio and total revenues per capita in governmental funds. *Long-term Solvency* is calculated as the level of debt and annual contributions to the pension plans. *Revenue Structure* captures a share of own-source revenues coming from property tax. The models were also controlled for the size and type of the government, local economic factors, the change in the housing prices, and the change in the population in the previous year. The authors ran logistic regression models with state and year fixed effects. The different economic and institutional environment of the three states (Michigan, Pennsylvania, and California) were taken into account (Gorina et al 2018).

According to the results of the research, cash solvency, long-term solvency, and revenue structure can be used for fiscal distress predictions, while budgetary-level solvency, socio-economic indicators, and government type are not as informative. The property tax was negatively associated with fiscal distress. Even though the dramatic effects 2007-2009 recession on the property market, the local governments which were more heavily depended on the property taxes were less likely to be fiscally distressed (Gorina et al 2018).

Gorina et al. (2018) highlighted three applications for practice. First, the local government officials tend to make certain politically and fiscally difficult decisions when they are confronted with strong fiscal pressure. Their study shows the analysis of the government decisions and actions may be used to determine if a government is in fiscal distress. Secondly, their research enhanced that the fund balance as a share of total expenditures and long-term debt as a share of total revenues provide an early warning of fiscal distress. Besides these, the importance of property taxes and the negative effects of the revenue diversifications were demonstrated (Gorina et al. 2018). The action-based method introduced can be useful for external users to evaluate the financial health of an organization.

3.4. Simulation-based approach

Cohen et al. (2012) examined the level of the fiscal distress of Greek municipalities. The authors combined a simulation analysis approach (stochastic multicriteria acceptability analysis) with disaggregation technique. With the help of financial ratios, they distinguished the financially viable municipalities from the distressed ones.

One of the six indices is the total liabilities to total assets ratio (L/A). This ratio shows the municipality's need for third-party financing. The value of the indicator can be described as favorable if its value is under 50%. Another indicator is the ratio of the own revenues to total liabilities (R/L). In Greece, the municipalities had to cover their interest payments with own revenues, in the period examined (2007–2010). As a liquidity indicator, the model uses the ratio of short-term liabilities to own revenues. Both of the exceedingly high or exceedingly low values of the ratio indicates financial operating problems (Cohen et al. 2012).

The comparison of operating expenses and own revenues are also important. The ratio of operating expenses to own revenues shows how the municipality can rely

on its own revenues. The higher value of the ratios is preferred, the increase in the value of the indicator could lower their financial risks (STL/R). However, the municipalities are not able to finance their operation from their own revenues. They usually receive sources from the central government too. The reliance on the sources provided by the central government is measured by the ratio of subsidies to population (S/P). The amount of subsidies is affected by several criteria (Cohen et al. 2012). These criteria vary from country to country. The sixth ratio was of own revenues to population (R/P). The indicator expresses the financial autonomy of the municipality. Theoretically, there are some dependencies between the ratios, because four of the six ratios are contained the own revenues. However, the levels of the correlations were found to be moderate. The selected ratios do not include indicators related to profitability, because the results of the operation are heavily influenced by the subsidies received from the central government. The profitability indicators can be misleading in this context. In the case of the Greek municipalities, the analysis of the operating expenses are more informative (Cohen et al. 2012).

The authors defined relative rating, based on their simulations. The overall performance of a municipality was compared to the overall performance of all municipalities. The municipalities could receive a top, good, intermediate, poor, or very poor rating. The best 10% of the entities were labeled as top. The ratings are summarized in Table 10.

Table 10 Rating of the municipalities

Rating	**Percentile**
Top	90–100
Good	67–90
Intermediate	33–67
Poor	10–33
Very poor	0–10

Source: Cohen et al. (2012)

3.5. Cluster analyses

The research of Ziolo (2015) applied a cluster analysis approach. For the classification of the distressed municipalities, the Hellwig aggregate measure was used. As a first step, the inputs in the matrix had to be expressed, then a normalized matrix could be constructed by the means of standardization. As a third step, the stimulants and the destimulants had to be determined. After that distance of each municipality from the pattern and the worst alternative had to be computed. As a last step, synthetic measure (which value has to be between 0 and 1, where is the 1 most preferred value) can be determined. Ziolo applied nine explanatory variables (Table 11).

Table 11 Description of Variables

Description	Character
General Long-Term Debt as a Percentage of Taxable Value	Destimulant
General Fund Balance as a proportion of General Fund Revenues	Stimulant
Operational Surplus as a Percentage of Current Revenues	Stimulant
Population Decrease	Destimulant
General Fund Expenditure as a Percentage of Taxable Value	Destimulant
Budgetary Payables Divided by Budgetary Receivables Except Grants	Stimulant
Administrative Expenditures as a Percentage of Regional GDP	Destimulant
Fiscal Receivables Divided by Net Current Budgetary Receivables	Stimulant
Revenues from Federal and State as a Percentage of Total Revenues	Destimulant

Source: Ziolo (2015)

According to the Hellwig measure results, there were 3 groups created: fiscally distressed municipalities (Hellwig measure value under 0.1), fiscally neutral municipalities (Hellwig measure value between 0.1 and 0.5) and fiscally stable municipalities (Hellwig measure value above 0.5). Then different ratios were compared for each group to characterize the municipalities of the cluster (Ziolo 2015).

The fiscally stable municipalities have a high level of financial autonomy, they have a high level of independence of the income and expenditure. They are typically urban municipalities with significant revenues from property tax. They have the ability to create an operating surplus. However, the fiscally stable municipalities have liquidity risk arising from high investment activity (Ziolo 2015).

The fiscally neutral municipalities form a very heterogeneous group. They are more dependent on transfers than the fiscally stable ones. They have a controlled process of debt. The policymakers try to minimalize the cost of financing and keep the level of long-term debt at a safe level. The investment of the municipalities is significant. These fiscally distressed municipalities heavily depend on state transfers. In the case of rural municipalities, the agricultural tax is significant, too. The revenue from this tax is largely influenced by external conditions (Ziolo 2015).

4. Expectations regarding fiscal distress models

Financial distress models have to meet multiple expectations. Kloha et al. (2005) collected the shortcomings of the previous indicators. These remarks appear to be useful during the examination or the creation of a particular indicator. The problem with several indicators is the number of variables. If there are too many variables, they can provide an unclear result. Usually, it is possible for a local government to score poorly on a few of the indicators. In some cases, there is no clear guidance to evaluate the fiscal position of a local government (Kloha et al. 2005). Moreover, there can be dependencies between the variables. If there is a strong correlation between the variables, the multicollinearity has to be tested and processed.

Another problem can be the exclusion of the key variables. The examination of balance-sheet data is not always able to predict financial problems (Kloha et al. 2005), the signs of fiscal distress usually appearing after the emergence of the fiscal distress itself (Jones–Walker 2007). Besides the balance-sheet data, social and economic variables should be examined.

The indicators usually have an ambiguous expectation, in some cases, the local governments cannot meet with all of the requirements created by the fiscal distress indicators. Moreover, the indicators usually fail to allow divergence in preferences. The demand for services is not constant, it can differ from time to time. Another problem with the indicators can be their relativity. In the case of relative valuation, it has some governments to be at the bottom of the ranking, even if it is scored at an acceptable value. The reverse of that is also possible, someone has to be the best, even if all of the local governments score poorly (Kloha et al. 2005).

The indicators should be able to focus on one locality. Requiring all municipalities to be measured before a single government can be evaluated may not be a reasonable use of resources when alternatives that rely on the objective rather than relative performances. The reliance on relative performance is further complicated by the possibility that various government may not send their reports or audits on time. The replacement of the missing data is difficult because the late reporting from governments does not appear to be random, it is more likely to proceed from distressed ones (Kloha et al. 2005).

The measurement of fiscal distress should meet the following nine criteria:

- Theoretical validity, so that the components operationalize from theories of fiscal distress
- Predictive ability, with the help of the indicator, the financial emergencies could be prevented
- Relevance to the interest of the state
- The indicators use publicly available, standardized frequently collected data
- Historical sense of the progression of difficulty
- Accessible and easily understood by local officials and the public
- Resistant to manipulation or gaming
- Hope for those in distress and forgiveness for governments that are doing well generally
- Differentiate well among the governments evaluated (Kloha et al. 2005).

The universality of fiscal distress models is very limited. The tasks and the responsibilities of the local governments differ to a great degree from country to country. Moreover, we can find enormous differences in the way of working in the public sectors, local governments can use different resources, and the origin of these resources varies, too. The fiscal distress models have to be suitable for the particular public sector. This problem was highlighted by Ziolo (2015), too.

5. Conclusion

The examination of fiscal distress poses a lot of questions. First of all, the definition of fiscal distress should be specified. As the related literature shows, the interpretation of fiscal distress is not clear-cut. The binary classification of defaults (failed or not failed) is not suitable for the public sector. The regulation of bankruptcy in the public sector differs greatly from the private sector. Moreover, local governments have an essential role in the supply of different public services. Operationalization of fiscal distress is a key element in the research. The level of fiscal distress is usually measurable by two components: it can be examined through financial ratios and the parameters of the public services. Such parameters can be the quality of the services, the physical output of the services, or the efforts regarding them (amount spent on specific tasks). The financial ratios usually indicate the financial problems at a late stage, so different socio-economic factors should be involved as well. The local governments of different countries have to provide different services, this makes the creation of a model even harder. Furthermore, fiscal distress is inseparable from another phenomenon of society.

The selection of variables creates additional questions. The relevant financial ratios can alter. As the construction and the regulation of the public sectors are unique, the characteristic of the public sectors is very dissimilar. The local governments have different revenues, they get various rates and taxes. As a consequence, the different local government sectors are affected by different social or economic changes. The tax autonomy of the municipalities can differ too. Due to these determinants, the reliance on the own revenues can be dissimilar as well. As the own revenues of local governments differ, so the subsidies can play a different role too.

Besides revenues, the expenses and obligations can be different, too. The set of the examined variables should be customized for the particular public sector. Moreover, the manner of financing can vary as well. The regulation of the acquisition of loans and the controls related to them also play a key role. During the evaluation of the fiscal distresses this should be noted as well. Other institutional factors have an impact on financial distress. Regulation of budgeting, the transparency of the operation, and the sustainability of the financial plans are relevant in this context.

Along with the relevant variables and the institutional factors which affect the local governments, the availability of data determines the creation of a model. In some cases, the data for the theoretically valid variable is not collected very frequently. As a consequence, the set of the variable should be modified, or the value of the missing data should be calculated through approximations, or with the replacement with other related indicators. Both solutions could lower the validity of the results.

The examined models highlighted the importance of cash-flows and the fund balances. Besides that, the source of the revenues, and the debt-management-related indicators appeared to be significant. There was a significant overlap between the introduced models. However, there is lack of studies which compare the results of different fiscal distress models on the same sample. Moreover, there are not much cross-country studies in the literature of fiscal distress. The comparison of the data

based on accrual accounting and cash-based accounting and the comparison of cash-based indicators with accrual-based indicators could be an unresolved problem, too.

The paper has a limitation of its own. There is not a shred of new empirical evidence involved, it remains in the theoretical ground, the assessment of the possible reactions to the fiscal distress are not included. The examined methods could be tested on the Hungarian local government sector, or a country-specific fiscal distress model could be created. This would provide at least some shred of evidence. As a further step, the relations of the fiscal distress can be examined with other characteristics of the local governments. The connection between fiscal distress and the quality of the internal control, or between fiscal distress and the quality of the management, would certainly result in some interesting conclusions.

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