FINANCIAL ENGINEERING LABORATORY
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Assessing Financial Distress where Bankruptcy is not an Option: An Alternative Approach for Local Municipalities

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ASSESSING FINANCIAL DISTRESS WHERE BANKRUPTCY IS NOT AN OPTION: AN ALTERNATIVE APPROACH FOR LOCAL MUNICIPALITIES

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Abstract

The goal of this paper is to identify the key financial distress performance indicators of local governments by using published financial data. Thus, using proper financial ratios the financial performance of municipalities is assessed through a multicriteria methodology that combines simulation analysis approach (stochastic multicriteria acceptability analysis) with a disaggregation technique. In particular, an evaluation model is developed on the basis of accrual financial data from 360 Greek municipalities for 2007. A set of customised to the local government context financial ratios is defined that rate municipalities and distinguish those with good financial condition from those experiencing financial problems. The model is validated by testing its outputs on a subsample of 100 local governments assessed in two time periods, 2007 and 2009. The model succeeded in correctly classifying distressed municipalities according to a benchmark set by the central government in 2010. Such a model and methodology could be particularly useful for performance assessment in the context of several European Union countries that have a similar local government framework to the Greek one and apply accrual accounting techniques.

Key words: Local governments, financial distress, multiple criteria analysis, financial ratios, Greece

1. INTRODUCTION

The assessment of local government performance has become a major issue worldwide since municipalities take on increasingly more responsibility in terms of providing essential services to taxpayers. The increasing decentralization in decision-making from central to local governments has made the measurement and evaluation of their financial performance critical. Within this context, one could define sound financial performance as a municipality's

ability to meet its financial obligations and to satisfy its service obligations to its citizens, currently and in the foreseeable future. Municipalities with poor financial performance are not able to offer quality municipal services to their residents, a fact that causes a plethora of problems to the local community. Thus, local government interested parties would like to know the indicators that signal the prospect of a municipality's financial distress, as the implications to political, social and economic state of affairs could be significant (Carmeli, 2003). This is of outmost importance, as municipalities, with rare exceptions, cannot declare bankruptcy. In the same vein, the recent global financial crisis of 2007 has considerably influenced the financial condition of local governments obliging them to cut down costs and to focus more on efficiency improvements.

In the private sector the recent collapse of a significant number of large corporations has resulted in an increased interest in distress modeling (e.g., Altman, 2001; Neofytou and Mar Molinero, 2004). Distress prediction models are extensively used for screening and monitoring purposes such as going concern, loan default and corporate performance assessment. On the other hand, limited amount of effort has been devoted to develop such models for the not-for-profit sector, despite the fact that these would provide important insights for local government performance, albeit with notable exceptions (Kloha et al., 2005; Murray and Dollery, 2005; Jones and Walker, 2007; Zafra-Gómez et al., 2009a; 2009b).

The scope of our research is to identify the key financial performance indicators of local governments, using published accrual financial data. Therefore we develop a rating model for evaluating municipalities according to their financial conditions and distinguishing those that have a sound financial position from those that exhibit poor performance. More specifically, our model ranks municipalities according to their financial status and it constitutes a robust early warning system of financial distress for both external stakeholders as well as municipality management. Such a model would be useful to policymakers and stakeholders to identify a potential crisis, and also to assist municipalities that face financial trouble. Moreover, our research is timely, at least for Greece, where the recent financial crisis has considerably affected the financial condition of local governments. It is interesting that Moody's has recently (June, 2011) downgraded the municipality of Athens, the biggest municipality in Greece that hosts the capital of the country with the reasoning that the financial condition of the country could unavoidably influence local governments as well due to the high level of integration of its local economic base with that of the national economy[1].

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[1] http://www.moodys.com/research/Moodys-downgrades-City-of-Athens-to-Caa1-negative-outlook?lang=en&cy=global&docid=PR_220129.

The model is developed by using a multicriteria decision making methodology (Doumpos and Zopounidis, 2002; Zeleny, 1982), based on a simulation approach, which enables the consideration of a large number of different evaluation scenarios to be examined. At a second stage, the results of the simulation analysis are aggregated to build up an operational evaluation model, which can be used to evaluate and rate the performance of any municipality at any point in time. The model is developed on the basis of data retrieved form a large sample of Greek municipalities for year 2007. However, we expect this model to have a wider application, as there has been a recent shift towards accrual accounting adoption in the European local government area (Pina et al., 2009). As the majority of European Union countries have a financial reporting framework that shares similarities to the Greek one, we anticipate that such a model and the proposed multicriteria methodology could be of particular use to assess their performance as well. Moreover, our study expands research on local governments' financial distress in a European context, as past research has been mainly focused on US and Australia.

The paper is structured as follows: in the second section we present the literature review. The third section provides a short description of the characteristics of local governments in Greece. Section 4 is devoted to the description of the methodology. In section 5 we present the results of the application of the methodology to our sample. Finally, the last section of the paper discusses the conclusions of our study.

2. LITERATURE REVIEW

Even though there are a number of models that predict financial distress in the private sector, such models are rare in the public sector. There are two main reasons for this. Firstly, the majority of municipalities in Europe started publishing accrual accounting financial statements only a few years ago, in contrast to the US local government sector that has a long reporting history albeit under fund accounting (i.e. modified accrual accounting). Thus, the calculation of financial ratios (i.e. liquidity ratios, activity ratios and capital structure ratios) that are commonly used in corporate distress prediction models becomes feasible only after the aforementioned accounting reform. Secondly, as municipalities in the majority of countries cannot declare bankruptcy, the researchers cannot rely on historical data to identify the characteristics that distinguish failed municipalities from healthy ones. Nevertheless, there are some well known cases of local financial crises in the US such the New York City's in 1976, Philadelphia's in 1990, Orange County's in 1994 and Miami's in the 1990's (Holande, 2003).

On the other hand, the application of private sector financial distress models in the public sector is unsuitable. This is because both the interpretation of the financial ratio values and their desirable magnitude is different in the public sector compared to the private sector due to the intrinsic characteristics of the former. For example, the existence of high ROA (return on assets) and ROCE (return on capital employed) values that characterize efficient private sector corporations, is not a socially desirable outcome for municipalities due to their non-profit character. Increased profitability may be interpreted not as an indication of efficiency but as a result of unjustified high taxes imposition. In a similar vein, extensive debt exposure may not result into debt default as the central government can help municipalities to overcome liquidity problems. Moreover, the archetypal two-state failure model (i.e. failed vs non failed) that is commonly used in the private sector is not applicable in the public sector, as financially distressed entities do not actually declare bankruptcy.

While there have only been a few attempts to predict local government financial distress in the research literature, several different techniques have been employed to identify municipalities that may be facing financial difficulties. These techniques range from heuristic approaches, such as financial statement analysis to more sophisticated methods such as statistical modelling approaches.

The majority of these studies have been conducted in US and Australia where the financial reporting systems are demanding in accounting information disclosures. More specifically, Kleine et al. (2003) after reviewing existing assessment models developed a simple fiscal distress index based on a weighting of nine variables for assessing the performance of local governments. The same authors applied their model to a sample of Michigan local governments and reported that it performed better than Michigan's current system of identifying potentially distressed local councils (Kloha et al., 2005).

Honadle (2003) in his survey that included fifty states in the US found that less than half of these states made some attempt to predict local government's fiscal crises. Their prediction was mainly based on reviewing audit reports, local government reporting, or from information gathered from discussions or regional workshops. Murray and Dollery (2005) developed an econometric distress prediction model, applied it on Australian councils and tested its validity against the results of a "watch list" compiled by a state government agency. The categorisation in which they resulted was different from that of the government agency. Jones and Walker (2007) developed a statistical model to explain sources of distress in local governments. Their main finding was that the degree of distress, defined as the cost of restoring infrastructure, in local councils is positively associated with the size of the

population they serve and the size and composition of their revenues. Zafra-Gómez et al. (2009a) developed a model, which indicates whether a local government heads for financial trouble and tested it in Spanish local governments. Their model scores local governments and makes an assessment of their financial condition that ranges from emergency to excellent. Nevertheless, they mostly use budgetary variables in their model that they consider to be more relevant for their research setting.

An important aspect of the financial distress surveys is the proxy used in order to distinguish local governments that experience financial problems from the healthy ones. Several variables have been proposed for this purpose such as ratio indicators (Clark, 1977; ICMA, 2003; Burne, 1992), the incidence of mergers or amalgamations, the quantity or quality of service delivery and the cost of restoring infrastructure assets to satisfactory condition (Jones and Walker, 2007).

3. CHARACTERISTICS OF GREEK MUNICIPALITIES

Greek municipalities provide traditional local government services such as the local registry, refuse collection, development and maintenance of local infrastructure, cultural activities and events. Recently they have also assumed several other responsibilities due to the decentralization policy followed by the central government. As a result they offer primary and secondary education services, transportation services, health services, etc. Municipalities' revenues include taxes and fees as well as subsidies. Municipalities are forbidden to institute their own taxes, while their fees and charges can only be varied between certain legal boundaries and must be used for the specific purpose addressed by the fee or charge. The subsidies cover both operating and investment needs and are mainly financed by specific types of governmental revenues (e.g., a percentage of income tax, tax duties, etc.) which according to legislation and are attributable exclusively to municipalities. Municipalities are subject to the restrictive expenditure control mechanisms that govern the public sector financials. The financial autonomy of local government (while guaranteed by the Constitution) is in practice rather limited. Local governments, with the exception of the largest municipalities, receive the largest part, roughly 57% of their revenues, from the central government. Approximately 30% of that amount is received as earmarked grants, the remainder as a general purpose grant (IMF, 2006, p. 12-13). Finally, it has to be noted that the loans that local governments contract with banks are guaranteed for their payment by the central government.

4. MULTICRITERIA METHODOLOGY

4.1. General framework

The construction of multicriteria evaluation models requires subjective judgments with respect to the parameters of the evaluation process. These parameters should reflect the judgment policy of a specific decision maker or a group of decision makers. In the context of this study, however, this line of approach is not applicable, due to the lack of a decision maker who could provide the necessary information and be the actual user of the evaluation model. Furthermore, the difficulty of defining the concept of financial distress for local municipalities in Greece and the complete lack of historical distress data make it impossible to develop distress prediction models similar to the ones used for private entities (firms).

To overcome these difficulties, a combination of a simulation-based approach with a disaggregation model is employed instead. An outline of the multicriteria methodology is illustrated in Figure 1. A detailed description of the main parts of the methodology is given in the following subsections.
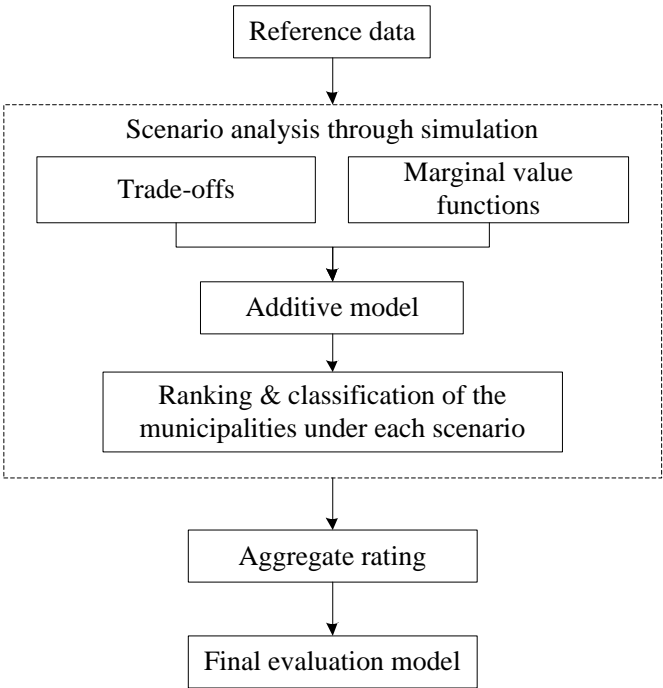

Figure 1: Methodological framework

4.2. Selection of reference data

The analysis is based on a set of reference data involving a selected base year. These data provide a reference starting basis for the evaluation of the municipalities. Once the evaluation

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model is constructed (on the basis of the reference data) it can be used to assess the performance of any municipality at any given point in time, having the reference set as a kind of benchmark. In this study, on the basis of data availability, the data for the municipalities in 2007 serve as the reference set. This is the year just before the outbreak of the global financial crisis and the corresponding data provide a useful reference point, which is recent enough but it is not affected by the turmoil caused by the crisis.

4.3. Scenario analysis for model building

The main part of the model building process is based on a scenario generation approach implemented within the context of a simulation procedure. Simulation-based techniques have become popular in MCDA as a powerful tool to address the uncertainties involved in multicriteria evaluation problems with respect to the set of preferential parameters and/or the data. A typical example of such approaches is the stochastic multicriteria acceptability analysis framework (SMAA; Lahdelma et al., 1998; Lahdelma and Salminen, 2001), which has been applied successfully in several decision making/aiding contexts (Tervonen and Figueira, 2008). Similar approaches have been used by Arbel and Vargas (1993) within the context of AHP, Butler et al. (1997, 2001) for multiattribute utility models, and Doumpos and Zopounidis (2010) for the PROMETHEE method in bank rating.

In the context of this study, each municipality i is considered as a multivariate vector in $\mathbb{R}^n$, i.e., $\mathbf{x}_i = (x_{i1}, x_{i2}, \ldots, x_{in})$, where x_{ik} denotes the input data for municipality i on evaluation criterion k. For the purpose of the evaluation process, we assume an additive value model defined as follows:

$$V(\mathbf{x}_i) = \sum_{k=1}^{n} w_k v_k(x_{ik}) \tag{1}$$

where w_k is the trade-off constant for criterion k (all trade-offs are assumed to be non-negative, while summing up to 1) and $v_k(\cdot)$ is the marginal value function for criterion k, normalized in [0, 1]. The additive model is well founded from a theoretical point of view (Keeney and Raiffa, 1993) and has been used in a wide range of multicriteria evaluation problems. Furthermore, the additive model retains the comprehensibility of a linear weighted average aggregation, while overcoming its simplistic linearity assumption.

In order to avoid posing any restrictions (other than monotonicity) on the form of the marginal value functions, we employ a piecewise linear modelling approach similar to the one used in the context of the UTA methods (Jacquet-Lagrèze and Siskos, 1982). In particular,

$s_k + 1$ breakpoints $b_0^k < b_1^k < \cdots < b_{s_k-1}^k < b_{s_k}^k$ are introduced on the scale of each criterion k, where b_0^k and $b_{s_k}^k$ are the minimum and maximum values, respectively, of criterion k in the data set. Then, assuming that the performance x_{ik} of a municipality i on criterion k falls in a subinterval $[b_{\ell-1}^k, b_\ell^k]$ (for some $\ell \in \{1,\ldots,s_k\}$), its marginal value can be expressed by linear interpolation as follows:

$$v_k(x_{ik}) = v_k(b_{\ell-1}^k) + [v_k(b_\ell^k) - v_k(b_{\ell-1}^k)] \frac{x_{ik} - b_{\ell-1}^k}{b_\ell^k - b_{\ell-1}^k} \tag{2}$$

Therefore, in context of the additive value function (1) different settings for the criteria trade-offs $w_1,\ldots,w_n$ and the (piecewise linear) marginal value functions $v_1,\ldots,v_n$ lead to a different evaluation model.

As noted above, in the absence of a decision maker that would provide information on these parameters, a simulation-based approach is employed instead. In contrast to the simulation approach, used for instance, in the SMAA framework, the simulation implemented in this study is not restricted only to the criteria trade-off constants. Instead, we also take into consideration the form of the marginal value functions, which is an important part of the additive evaluation model. Thus, the simulation procedure is based on the generation of a set of different scenarios for all the aforementioned parameters of the additive value function (criteria trade-offs and marginal value functions). In this setting, in each simulation run (scenario) a random additive value function is constructed through a two-step process, as follows:

1. For each criterion k, a random marginal value function is constructed by generating $s_k - 1$ uniformly distributed random numbers in (0, 1), which are sorted (in ascending order) and then assigned to $v_k(b_1^k)$, $v_k(b_2^k)$, …, $v_k(b_{s_k-1}^k)$. For normalization, $v_k(b_0^k)$ and $v_k(b_{s_k}^k)$ are set equal to 0 and 1, respectively. In all simulations, four subintervals are used for the criteria (i.e., $s_k = 4$, for all $k = 1,\ldots,n$), with the intermediate breakpoints defined on the basis of the 25%, 50%, and the 75% percentile of the data.

2. The tradeoff constants $w_1,\ldots,w_n \geq \varepsilon$ are generated at random such that $w_1 + \cdots + w_n = 1$. The constant ε is set equal to 0.01 in order to exclude unrealistic scenarios, where a criterion becomes almost irrelevant for the evaluation. The random weights are adjusted with the entropy approach proposed by Zeleny (1982), in order to take into account the information introduced by each criterion in the analysis, according to the corresponding marginal value function generated in the previous step.

The additive value function obtained with this procedure is used to evaluate all municipalities in the reference set. The evaluation leads to a ranking of the municipalities from the best to the worst performing ones. A relative rating scheme can also be employed. In this study, a five-point rating (classification) of the municipalities is performed: top performers, good performers, intermediate municipalities, poor performers, and very poor performing municipalities (details on the rating process are given in section 5.3). Five-point rating scales are widely used in many areas, ranging from questionnaire design (e.g., Likert scale), to corporate performance evaluation and risk analysis. In that regard, the use of a five-point rating scale provides a convenient way to present the results of an evaluation model, which is easy for policy makers to understand.

4.4. Aggregation of the results and building of an operational evaluation model

At the end of the scenario-simulation analysis process, a set of evaluations is available for the reference municipalities (rankings and ratings for each scenario run). These can be analyzed with various statistical procedures and measures to obtain a holistic view of the strengths and weakness of each municipality. However, this set of multiple evaluations is not very helpful from an operational point of view. For instance, evaluating a specific municipality in the future would require performing again the whole simulation process.

To address this issue, the results of the scenario analysis are aggregated to build an operational evaluation model expressed in the form of an additive value function aggregating (as best as possible) the complete set of evaluations. In the context of this study, the simulation analysis results are first aggregated into a "collective" rating of the municipalities, which is specified on the basis of the ratings obtained under each evaluation scenario in the simulation process. This aggregate rating is then used as an input to a disaggregation method in order to build the final evaluation model. At this step we use the UTADIS method (Doumpos and Zopounidis, 2002) which enables the development of a multicriteria classification model from a given set of reference data. Alternatively, it could also be possible to define a range of possible ratings for each municipality (according to the simulation results) and then employ recently proposed variants of the UTADIS method which are suitable for handling this kind of input data (see for instance Greco et al., 2010).

5. CASE STUDY ON THE EVALUATION OF GREEK MUNICIPALITIES

5.1. Data description

At the end of 2010 there were around 900 municipalities in Greece. Municipalities that meet the size criteria (either population or revenue thresholds) for accrual accounting adoption and therefore should report financial statements are 577 according to EETAA's[2] calculations. The sample used in this study uses the financial data of 364 Greek municipalities for year 2007. Therefore our sample corresponds to the 63% of eligible population. The financial statements have been collected from various sources in either hard copy form or as an electronic file. As mentioned in the previous section, the 2007 data define the reference set on which the evaluation model is built. An additional sample of 130 municipalities for 2009 is used to examine the effect of the recent sever financial crisis in Greece (which became evident in the beginning of 2010) on the financial performance of the municipalities. Furthermore, the 2009 data also facilitate the "validation" of the evaluation model.

In our analysis we selected six financial ratios. The selection of these financial ratios is based on both private sector and public sector literature (ICMA, 2003; Berne, 1992; Anthony and Young, 2003; Finkler, 2005; Cohen, 2008) as well as on the intrinsic characteristics of Greek municipalities' financial structure. Moreover, we believe that our model meets the key attributes and criteria defined by Kloha et al. (2005) as prerequisites of a fiscal distress assessment model. In contrast to other countries, Greece has not adopted explicitly defined procedures for using specific measures in the context of assessing the financial performance of local governments. However, there is an explicit provision included in the Municipal and Communal Code issued in 2006 (Law 3463/2006) that financial ratios will be used. The new law that intensifies the provision of quantitative information (Decision 17838/2010) states that the performance of local governments will be assessed by applying ratio analysis and gives a list of ratios that should accompany the published financial statements. All these ratios are of financial nature. A working definition of financial performance assessment that corresponds to the intentions of the Ministry of Interior is that ratio analysis should reflect an assessment of a municipality's ability to meet its financial obligations and to satisfy its service obligations to its citizens both currently and in the foreseeable future.

The ratios that have been selected for the purpose of our model are the following:

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[2] EETAA is an agency responsible to provide to the local government agencies, the public sector and the social agencies professional and technical support.

- **Total liabilities / Total assets (L/A):** This ratio depicts the reliance of a municipality on third party financing. According to Finkler (2005) a debt to equity value of one or less is a favorable indicator. In other words, a value for L/A of more than 50% is a less favorable indicator. The higher the value of the liabilities to total assets the greater the municipality's leverage and thus the greater the extent to which it utilizes debt funds to supplement internal equity funds.

- **Own revenues / Total liabilities (R/L):** Total liabilities correspond to bank loans (short term and long term) as well as short term debts to suppliers, contractors, and other accounts payable (e.g. social security and pension funds, taxes). In Greece municipalities are permitted to get into contract with banks only for acquiring loans to finance their investments. Getting loans for financing operating expenses in prohibited by law. The capacity of municipalities to pay the interest from their own revenue is a sign of financial health. The more the part of the own revenues that is necessary to cover interest payments, the less the resources available to cover operating expenses. According to data available up to 2005, the indebtedness of local governments was low and balanced by substantial cash holdings (IMF (2006, p.12)[3]. In contrast to other EU countries, until recently there were no restrictions on the modalities of borrowing instruments, and, for example, no maximum debt-revenue or debt-service to revenue limits. However, the memorandum signed between Greece, IMF and EC (Law 3845/2010) after the outbreak of the financial crisis in Greece included a clause that municipalities would be able to contract new loans only if the ratio of total liabilities to total revenues was less than 60%.

- **Short term liabilities / Own revenues (STL/R):** This ratio is indicative of the relation between the short term liabilities and the own revenues. In its reverse form it is a turnover ratio that refers to how many times own revenues are sufficient to cover short term liabilities (in the case of Greek municipalities, short term liabilities mostly involve financial obligations towards suppliers, contractors, as well as taxes and obligations towards social security and pension funds). Therefore, we use this measure as a liquidity indicator. We use this ratio instead of a traditional liquidity ratio such as the current ratio for two reasons. Firstly, as the current assets of municipalities in Greece usually include moving creditor balances, we considered that the traditional current ratio would not be

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[3] There are two main restrictions on local government borrowing. First, for every loan, approval is required from the municipal council and for loans above 3 million euros a council majority of two-thirds must provide this approval, which is rather difficult by taking into account the polyphony in Greece's political context. Second, each loan requires a report on the repayment capacity of the municipality, which must be approved by the regional administration on behalf of the Minister of the Interior.

useful for performance assessment. Secondly, the value of the current ratio could not be interpreted in a continuum scale. This is because either very low or very high values of the current ratio are both indicative of financial operating problems.

- **Operating expenses / Own revenues (OE/R):** Municipalities cannot finance their expenses relaying only on own revenues. They have to complement their financial input from government subsidies. The higher the value of the OE/R ratio the more reliant is a municipality on subsidies in order to have a sound financial condition. Therefore the reliance of a municipality on an external source increases the financial risk it faces as it is depended on an exogenous parameter (i.e. governmental subsidies) that is non directly controllable.

- **Subsidies / Population (S/P):** The use of per citizen ratios are very common in local government ratio analysis literature (Berne, 1992; ICMA, 2003). This ratio reflects the per citizen subsidy acquired by a municipality. The value of this ratio is indicative of a municipality's reliance on central government subsidies. Local governments may experience fiscal problems in part because central governments (or states) are cutting aids (Kloha et al., 2005). Moreover, compared to the next ratio (own revenues per citizen) it reveals the structure of municipality's revenues. As this ratio corresponds to a monetary value it can be easily used for cross-municipality comparisons. In principal, in Greece municipalities facing a disadvantageous external environment (e.g., are rural, poor in terms of regional GDP, etc.) are characterized by a higher S/P ratio. More specifically, the general purpose grants that are given to municipalities from the central government are distributed on the basis of objective criteria defined in law, which include population, accessibility by road, level of tax autonomy, economic growth and unemployment levels, and climatic conditions. These criteria are usually modified on a yearly basis, but only to a limited extent.

- **Own revenues / Population (R/P):** This ratio reflects the average per citizen revenue of the municipality. It is indicative of its financial autonomy and easiness to overcome financing problems when central government faces difficulties in providing subsidies. The value of this ratio is influenced by the sociopolitical and economic environment of the area. For example, municipalities that host (within their geographical boundaries) tourist areas can generate more revenues compared to remote and of low business activity areas.

It is worth mentioning that the selected set of ratios does not include indicators that are directly associated to profitability. Typical examples of such indicators used for corporate entities include ratios such as earnings before interest and taxes to total assets, net income to

revenues, net income to equity, etc. However, the use of such ratios in the context of evaluating the financial performance of Greek local governments was proved to be misleading. This is because the financial results (operating or net surplus/deficit) of Greek municipalities are heavily influenced by the subsidies received from the central government. As a result, traditional profitability indicators provide a misleading picture of the municipalities' ability to achieve an acceptable level of profitability. Furthermore, if local government subsidies are excluded from the definition of net or operational income (surplus/deficit), then the resulting profitability measures almost coincide with measures related to the expenses burden (e.g., the operating expenses to own revenues ratio). Thus, it is evident that in the context of Greek municipalities the analysis of operating expenses is much more informative than the one based on profitability ratios. In this vein, we decided to focus our analysis on the evaluation of operating expenses, whose control and reduction is crucial for the financial viability of municipalities in Greece.

Some descriptive statistics (means and standard deviations in parentheses) for the selected ratios for 2007 and 2009 are presented in Table 1. The statistics are presented for the samples of 2007 and 2009, as well as for the sub-sample of municipalities for which there are available data in both years. Focusing on the results for the municipalities that are common in 2007 and 2009 (for which the results are directly comparable), it is evident that total liabilities to total assets (L/A) remained rather unchanged between the two years. Therefore no significant changes are observed in the capital structure of the municipalities. However, the relation between own revenues and liabilities (R/L) has worsen, albeit, not considerably (p-values 0.464 according to the Wilcoxon matched-pairs signed-rank test). There was an increase in own revenues per citizen (R/P) between the two periods, indicating a raise in prices or an increase in quantity of services rendered or a combination of both (population remains the same). The increase of the R/P ratio from 2007 to 2009 is found significant at the 1% level according to the Wilcoxon matched-pairs signed-rank test. The same also holds true for the subsidies per citizen ratio (S/P). However, costs had increased with a more intensive mode compared to own revenues as indicated in the OE/R ratio (the difference between the two years is again found significant at the 1% level according to the Wilcoxon matched-pairs signed-rank test). This increase in costs was not witnessed in the bottom line of the financial statements of the municipalities as the per citizen subsidy exhibited an unexpected significant upward change (the average ROA (return on assets) increased from -0.2% in 2007 to 0.96% in 2009, with the difference being significant at the 1% level according to the Wilcoxon matched-pairs signed-rank test).

Table 1: Descriptive statistics for the financial ratios (means and standard deviations in parentheses)

Ratios	Full samples		Sub-sample common in both years	
	2007	2009	2007	2009
L/A	0.135	0.163	0.168	0.164
	(0.137)	(0.168)	(0.161)	(0.174)
R/L	2.069	1.389	1.570	1.382
	(5.838)	(1.518)	(2.175)	(1.648)
STL/R	0.733	0.692	0.690	0.697
	(0.623)	(0.426)	(0.458)	(0.418)
OE/R	2.987	2.867	2.553	2.898
	(1.498)	(1.422)	(1.058)	(1.470)
S/P	204.949	275.017	188.275	267.962
	(55.093)	(100.126)	(51.205)	(69.108)
R/P	214.134	245.222	224.534	239.641
	(188.235)	(173.772)	(217.664)	(160.896)

5.2. Results of simulation analysis

The simulation process described in section 4.3 was implemented with 10,000 scenarios, each corresponding to a different (randomly generated) additive evaluation model.

Figure 2 presents some summary results from the analysis for the 2007 reference data. In particular, Figure 2(a) presents the distribution of the mean scores of the municipalities. The mean scores are obtained by averaging the global values (scores) from model (1) over all 10,000 simulation runs. The distribution is slightly skewed toward lower scores (worst performance) with a skewness of 0.025. A similar result was also observed for the distribution of the median scores, with a slightly higher skewness of 0.041.

Figure 2(b) illustrates the relationship between the mean scores of the municipalities and the stability of their rankings. In each simulation run, the municipalities are ranked (in descending order) from the best to the worst performing ones according to their global values. The stability of these rankings under different evaluation models is an issue worth the consideration. In Figure 2(b) the variability of the ranks for each municipality (i.e., the range between its best and worst rank over all simulation runs) is plotted against the municipality's mean score. As expected, the best and worst performing municipalities (in terms of their mean scores) exhibit a lower variability in their ranking. On the other hand, the variability is highest

for municipalities with an average score. Municipalities whose performance ranking relative to the others is very unstable, have very diverse characteristics (combining strong and weak points), which increase the level of uncertainty with respect to their overall performance.
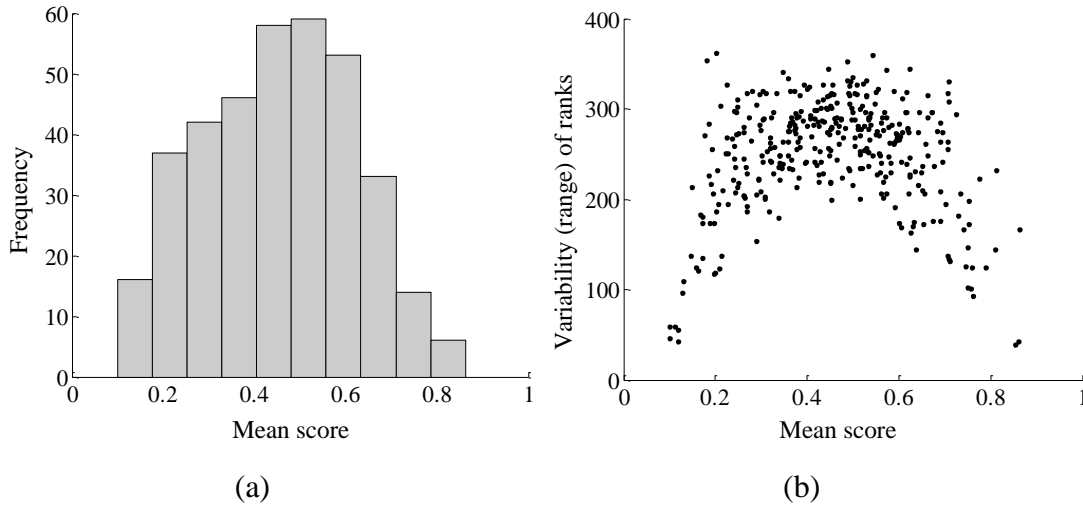

Figure 2: Distribution of the municipalities' mean scores and the stability of their ranking (2007 data)

5.3. Rating of the municipalities

As mentioned in section 4.4, in order to build an operational evaluation model for assessing and monitoring the performance the municipalities, an "aggregate" rating is constructed on the basis of the simulation/scenario analysis results. In order to construct this rating, the municipalities are first rated (classified) on the basis of their evaluation in each simulation run (model scenario). The rating is defined in relative terms, given the difficulty of defining specific norms for each financial ratio that would lead to a rating of the municipalities in absolute terms. In particular, let $V_t(\mathbf{x}_1)$, $V_t(\mathbf{x}_2)$, etc., denote the overall performance of the municipalities according to the additive model under scenario t and let P_α^t denote the corresponding $\alpha\%$ percentile of the municipalities' global scores. Then, the group of top performing municipalities is defined to include the top 10% (i.e., every municipality i with $V_t(\mathbf{x}_i) \geq P_{90}^t$). The next group of good performers includes municipalities whose overall score falls in the range $[P_{67}^t, P_{90}^t)$. Similarly, the intermediate group consists of municipalities with scores in the range $[P_{33}^t, P_{67}^t)$, the group of poor municipalities includes cases in the range $[P_{10}^t, P_{33}^t)$, whereas the bottom 10% of the municipalities are classified in the very poor

performance group. The cut-off points used to define these five grades introduce a symmetrical Gaussian-type distribution of the municipalities in the rating scale, which is in good accordance with the distribution observed for the mean scores of the municipalities (cf. Figure 2b) and it is often considered as a desirable property of financial rating systems. On the basis of this rating process, a global (aggregate) rating is introduced on the basis of the class membership probabilities of the municipalities. In particular, for each municipality i and rating class k, the group membership probability π_{ik} is defined as the percentage of simulation scenarios under which municipality i is classified in rating class k. Each municipality i is then classified in the rating class for which the corresponding membership probability is highest.

Table 2 presents some results on the class membership probabilities averaged over all municipalities in each aggregate rating group. The results indicate that the top and very poor performing classes are well distinguished from the three other groups. For instance, on average, top performing municipalities (in terms of their aggregate rating) were classified in the top group in 63.57% of all simulations scenarios. In about 25.3% of the simulation runs, top performing municipalities (in terms of their aggregate rating) were classified in the group of good performers. On the other hand, top performing cases were classified in the poor or very poor classes in only about 1% of the scenarios (on average). Similarly the "confidence" on the classification of municipalities in the "very poor" rating group is also high (average membership probability 74.52%). Overall, the aggregate rating seems to be robust, in the sense that two or more notch differences (compared to the ratings defined under the simulation runs), are infrequent.

Some further statistics on the obtained aggregate rating in relation to the global scores and financial ratios of the municipalities are given in Table 3 for the 2007 data. The results show that there is a clear differentiation between the groups, both in terms of the mean score and the financial ratios for the municipalities in each group. Furthermore, there is (almost consistently) a strong monotonic relationship between the ratings and the financial ratios.

Table 2: Mean group membership probabilities (in %)

	Top	Good	Intermediate	Poor	Very poor
Top	63.57	25.31	7.40	0.98	0.00
Good	11.86	57.34	27.56	3.23	0.01
Intermediate	0.28	18.40	60.61	20.60	0.11
Poor	0.04	2.21	26.54	58.55	12.65
Very poor	0.05	0.51	4.53	20.39	74.52

Table 3: Statistics for the global scores and the financial ratios of the municipalities in each rating class

	Rating	Score	L/A	R/L	STL/R	OE/R	S/P	R/P
Means	Top	0.733	0.058	5.460	0.199	1.804	194.928	432.025
	Good	0.600	0.094	2.230	0.360	2.234	197.583	273.809
	Intermediate	0.456	0.148	1.180	0.596	2.744	205.388	196.174
	Poor	0.293	0.174	0.614	1.043	3.780	206.902	122.667
	Very poor	0.173	0.172	0.328	2.025	5.154	226.743	79.978
Medians	Top	0.727	0.039	4.441	0.194	1.546	174.907	370.890
	Good	0.600	0.076	1.807	0.339	1.984	182.418	242.522
	Intermediate	0.453	0.101	0.931	0.556	2.503	191.697	169.331
	Poor	0.297	0.125	0.540	0.956	3.328	202.192	112.916
	Very poor	0.178	0.156	0.318	2.074	4.945	230.494	80.408

5.4. Construction and validation of an operational rating model

On the basis of the aggregate five-point rating described in the previous subsection, an operational evaluation and rating model is built. The model has the form of an additive value function of the selected financial ratios, which best fits the aggregate rating defined for the municipalities in 2007. In order to build this global evaluation model, the variant of the UTADIS multicriteria method presented by Doumpos and Zopounidis (2007) is employed. UTADIS uses linear programming to fit an additive value model to a sample of reference data, for which the rating (classification) of the alternatives (municipalities) is available. The variant proposed by Doumpos and Zopounidis (2007) has been shown to improve the robustness of the estimated decision model and the accuracy of the results.

The final evaluation model can be presented in the following form:

$$V(\mathbf{x}) = 0.130v_1(\text{L/A}) + 0.246v_2(\text{R/L}) + 0.162v_3(\text{STL/R}) + \\ 0.144v_4(\text{OE/R}) + 0.172v_5(\text{S/P}) + 0.146v_6(\text{R/P}) \tag{3}$$

where the marginal value functions $v_1(\text{L/A})$, $v_2(\text{R/L})$, $v_3(\text{STL/R})$, $v_4(\text{OE/R})$, $v_5(\text{S/P})$, $v_6(\text{R/P})$ of the six ratios are shown graphically in Figure 3. On the basis of the trade-off

constants of the six ratios in the model, it is evident that the own revenues to total liabilities ratio is an important factor for the evaluation and rating of the municipalities, followed by the subsidies/population and short term liabilities/own revenues ratios.
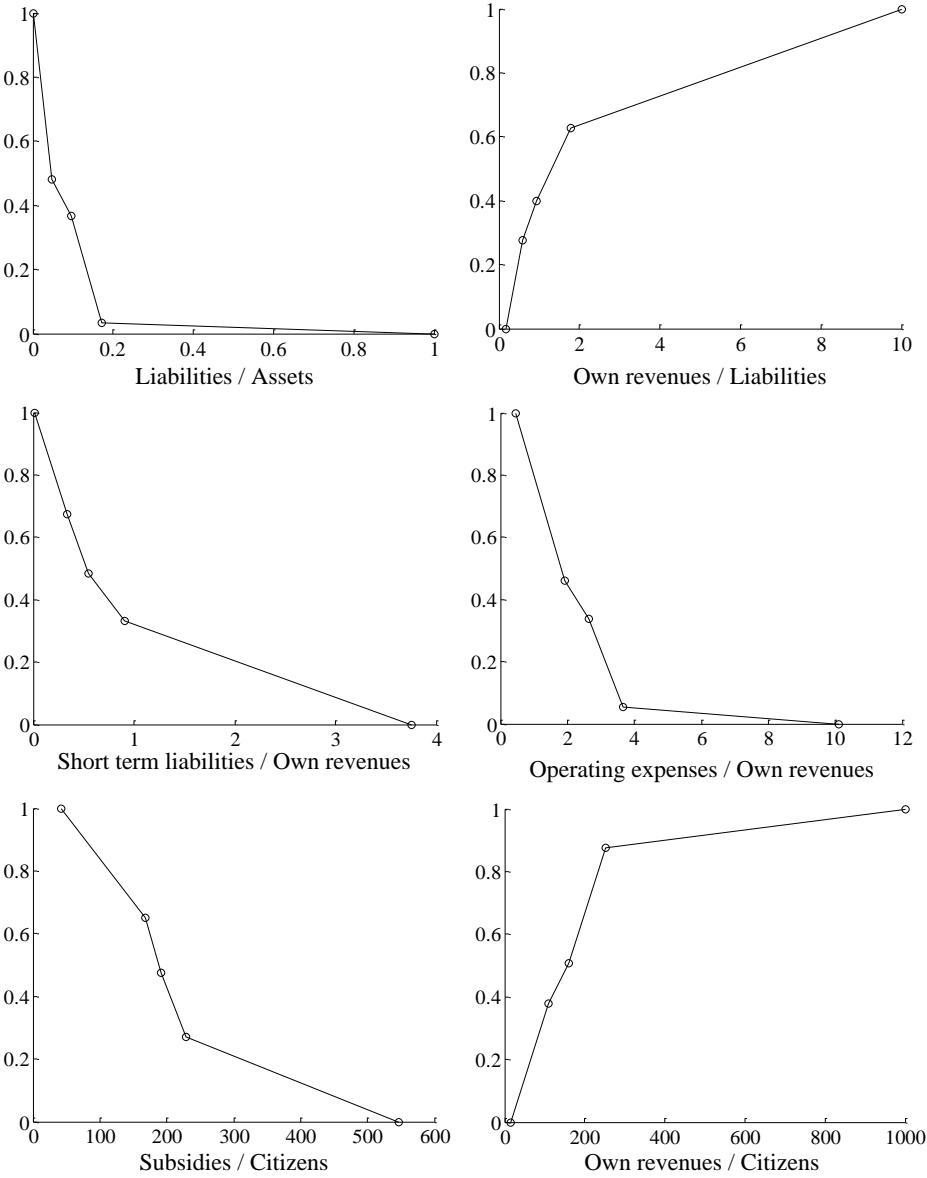

Figure 3: Marginal value functions of the aggregate rating model

The constructed model fits the rating of the municipalities in 2007 very well, with the overall accuracy rate being equal to 96.43%. Furthermore, the differences between the rating estimated through the aggregate model and the predefined rating never exceed one notch.

In order to perform of kind of validation of the constructed model, the 2009 data are used. The 2009 data refer to 130 municipalities, including 100 cases for which data is also available in 2007. By the end of 2009 the recent crisis began to be evident in Greece with the

country's economic condition starting to deteriorate. As mentioned in section 5.1 this situation has affected the financial characteristics of the municipalities, whose operating expenses increased considerably together with their reliance on obtaining financing from the central government (subsidies).

Within this context, one should expect that the evaluations obtained from the constructed model would be in accordance with the deteriorating condition in the characteristics of the Greek municipalities. Indeed, this is true. According to the aggregate model, the average global score of the municipalities in 2007 is 0.443 vs. 0.409 in 2009. This is reduction of 7.6%, which is significant at the 5% level (according to both a parametric t-test and the nonparametric Mann-Whitney test). The comparison is clearer when focusing on the municipalities for which data are available in both years. The average global score of these municipalities in 2007 is 0.455 vs. 0.404 in 2009; a reduction of 11.4%, which is statistically significant at the 1% level (verified with the paired samples t-test and the Wilcoxon signed ranks test).

Figure 4 presents a comparison of the distribution of the ratings obtained through the evaluation model in 2007 and 2009. Figure 4(a) involves all municipalities, whereas Figure 4(b) focuses only on the 100 municipalities for which data are available in both years. The results indicate a clear increase in the number of municipalities classified in the very poor and poor groups. On the other hand, the number of municipalities classified as good or top performers decreases considerably in 2009. Once again the deterioration in the rating of the municipalities is more clearly evident in the direct comparison involving the cases for which data are available in both years.

(a) All municipalities   (b) Municipalities common in 2007 & 2009
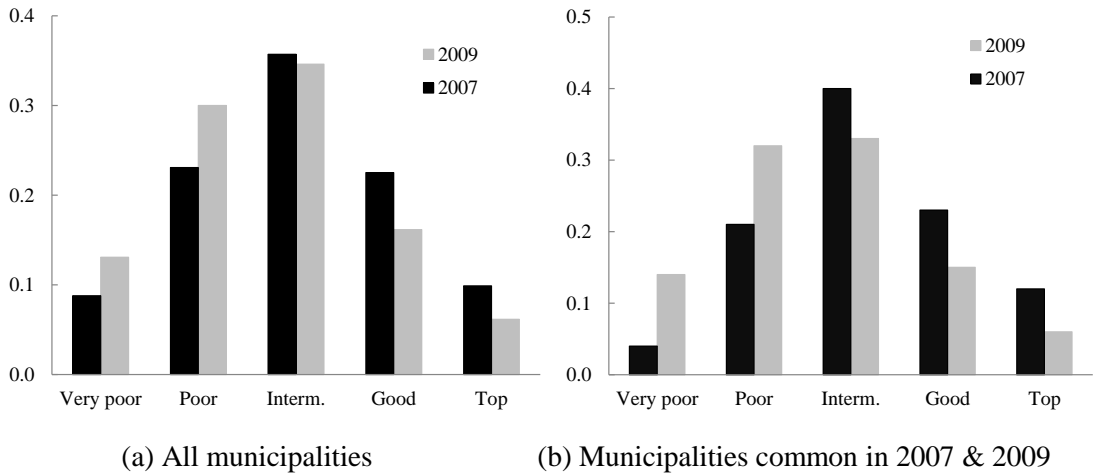
Figure 4: Distribution of ratings

Table 4 presents the migration matrix for the ratings of the municipalities for which data are available in both 2007 and 2009. The mobility of the ratings towards worst groups is clearly evident. For instance, about 50% of the top performing municipalities in 2007 were downgraded to the group of good performers in 2009. On the other hand, there is no municipality rated as "very poor" in 2007 which was upgraded in 2009. Overall, out of the 100 municipalities common in both years, only 4 managed to improve their rating in 2009 as opposed to 2007 (by one notch at most), 45 retained the same rating, and 51 were downgraded (47 cases with an one-notch downgrade and 4 cases with a two-notch downgrade).

Table 4: Ratings migration matrix (municipalities common in 2007 and 2009)

		2009 rating				
		Top	Good	Intermediate	Poor	Very poor
2007 rating	Top	41.7	50.0	8.3	0.0	0.0
	Good	4.3	34.8	52.2	8.7	0.0
	Intermediate	0.0	2.5	45.0	50.0	2.5
	Poor	0.0	0.0	9.5	47.6	42.9
	Very poor	0.0	0.0	0.0	0.0	100.0

As already mentioned an important aspect of the financial distress surveys in the public sector is that there is not an unanimously proxy used in order to distinguish local governments that experience financial problems from the healthy ones. In our case we use a benchmark that streams for the memorandum signed between Greece, IMF and EC (Law 3845/2010) as a proxy of financial distress. According to a relevant decision, municipalities can only contract new loans if the ratio of total liabilities to total revenues (L/TR) is less than 60%. Therefore, we could infer that municipalities could be classified as "solvent" if their L/TR ratio is less than 60% and "insolvent" otherwise. Therefore, as a further test for validating the model we tested the global scores obtained through the model, with the dichotomous classification based on the above threshold.

Table 5 presents the results on the relationship between the ratings of the municipalities and their classification according to their L/TR ratio. The presented figures are the frequencies of insolvent municipalities (i.e., L/TR>60%) in each rating class. Three comparisons are performed. In particular, the first two columns of Table 5 involve the comparison between the ratings of all municipalities in each year with their corresponding L/TR classification. The third column of Table 5 is a kind of predictive test, where the rating of the municipalities in 2007 is compared to their L/TR classification in 2009 (this

comparison applies only to municipalities common in both years). Furthermore, Table 5 also reports the area under the receiver operating characteristic curve (AUROC; Fawcett, 2006) which is a popular non-parametric test of the discriminating power of rating systems. In this case, AUROC is used to measure the association of the municipalities' scores estimated through the evaluation model with their L/TR classification.

Table 5: Frequencies (in %) of insolvent municipalities (L/TR>60%) in each rating class

	2007 rating, 2007 L/TR (all municipalities)	2009 rating, 2009 L/TR (all municipalities)	2007 rating - 2009 L/TR
Top	0.0	0.0	0.0
Good	22.0	0.0	26.1
Intermediate	36.2	33.3	25.0
Poor	61.9	38.5	57.1
Very poor	75.0	64.7	75.0
AUROC (%)	75.9	75.8	72.4

The results of Table 5 indicate that there is a strong relationship between the results of the developed rating model with the classification of the municipalities according to their L/TR ratio. For instance, there is no a top performing municipality with an L/TR ratio higher than 60%. On the other hand, a significant majority (65-75%) of municipalities rated as "very poor" has an L/TR ratio higher than 60%. The "predictive" test (third column of Table 5) further indicates that the rating of the municipalities in 2007 is strongly associated with their L/TR classification in 2009, thus indicating the validity and robustness of the results over time. These findings are also supported by the AUROC test, which is significant (in all cases) at the 1% level.

6. CONCLUSIONS

The global financial crisis had considerable effects on both governments and public sector organizations. The new financial environment not only calls for the intense application of the 3Es (Efficiency, Effectiveness and Economy), but it has also affected the viability and the financial health of the public sector, including local governments. In this new era, benchmarking the financial performance and viability of local governments is of major importance for policy makers, oversight bodies, politicians and citizens. It is also useful for the elected officials that are responsible for the every-day operation of local governments.

In this paper we have developed a financial rating model for local governments according to a set of financial ratios customised to the local government context. In this way we distinguish those municipalities with strong financial performance from those experiencing financial problems. The model was developed on the grounds of a multicriteria decision making methodology. The model was built on financial information retrieved for a large sample of Greek local governments for 2007 and has been successfully tested for validity and robustness through various tests.

Our model has several practical implications. The model has been developed by using information retrieved by accrual financial statements. This type of information is publicly available and periodically reported. As there is a worldwide trend in accrual accounting adoption in local governments, we believe that our model has potential applications that go beyond the boundaries of Greece. The use of accrual accounting information albeit being a standard in the private sector, is rather rarely encountered in the public sector financial distress modelling. This is because public sector customarily used and was mainly assessed on the basis of either cash (budgetary) accounting data or fund accounting information. Secondly, the model is easy to apply and can be used for benchmarking purposes, offering early distress signals to multiple stakeholders that could be used for informing decision-making.

Of course our analysis is subject to some limitations. Firstly, the analysis is based on financial statements and therefore the quality of financial information affects the accuracy of the results. Nevertheless, accounting information has been retrieved by audited financial statements, which mitigates the risk of poor information quality. Secondly, we did not try to give an explicit definition of the terms "financial stress" or "financial crisis" which is an issue encountered in relevant literature (Holande, 2003). The severity of financial problems that local governments experience may take different forms depending on the context (e.g., environmental, social or economical) in which they take place. However, the comparative classification that we have developed is useful for performance benchmarking. Finally, our model does not take into account conditions that are exogenous to municipalities such as their wealth that could be proxied by regional GDPs or the type of economic activity (e.g., tourist activity). Empirical research has shown that such parameters influence the values of financial ratios per se (Cohen, 2008; Zafra-Gómez et al., 2009b).

As a concluding remark it should be noted that the relations that exist between local governments and the central governments, at least in Greece, are highly influenced by strong political bonds (Hlepas, 2010). In the same vein, IMF (2006, p.14) mentions there are cases of

politically pressured bail-outs in cases of financial mismanagement in local governments. Therefore political decisions may assist municipalities to overcome financial problems when such problems emerge. This might be the case if the central government had not being experiencing severe financial problems itself. Therefore in the current global financial situation, in which central governments such Greece strive for financial resources, an objective and easy to apply performance assessment system is not only useful but also necessary for public financial goals achievement.

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