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Risk assessment of the local government sector based on the ratio analysis and the DEA method. Evidence from Poland

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Abstract The local government (LG) sector plays an important role in the EU economies. Besides providing a vast range of public services, it accounts for over 8% of total investment. The crisis, which started in 2008, resulted in increased LG indebtedness and raised concerns over the sector's debt repayment capacity. This paper proposes an alternative methodology of risk assessment of LGs to statutory debt limits, the Altman model and non-financial indicators. Firstly, it employs a corporate finance approach to evaluate the financial standing of individual entities. The measures are based on free operating cash flow and net debt. Next, Data Envelopment Analysis is used to derive the relative performance of LGs in debt utilization. The indicators used are available from the LG financial reports and also allow risk to be monitored on a quarterly basis. The proposed approach allows the ranking of the risk of individual LGs according to both their debt service capacity and long-term ability to manage costs and carry out a rational investment policy. The results obtained using the DEA method also enable the identification of LGs with persistently inferior risk profile. The quantitative analysis is conducted for the local governments in Poland for the period 2008–2015.

Keywords Local governments · Risk assessment · Unsystematic risk · DEA method

JEL classification C15 · D81 · H72 · H74 · R50

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1 Introduction

Local governments (LGs) play an important role in national economies, providing public services and carrying out investment, especially in infrastructure. In the European Union (EU) countries, LG revenue amounted to 13.7% of GDP in 2015, remaining at a stable level of 13–14% of GDP over the last 10 years. The sector was a noticeable player in the stimulation of domestic demand during the 2008 post-crisis period. Its share in total investment in the EU grew from 7.0% in 2006–2007 to 9.2% in 2010. In 2014–2015 it stabilized at a relatively high level of 8.3%. Statistics for 2011–2015 are presented in Fig. 1.

The unchanged revenue base combined with increased investment efforts resulted in a durable adverse impact on the finances of LGs across the EU. Their average debt/GDP ratio grew significantly, from less than 5% in 2007 to 7.5% in 2015. In many countries the crisis also limited the financial resources transferred to LGs. This negatively influenced their financial standing and ability to provide public services as described in Vammalle and Hulbert (2013).

The financial soundness of the LG sector may be an important factor facilitating economic growth. Several studies deliver arguments for the high effectiveness of LG spending, showing that fiscal decentralization increases GDP per capita, productivity, human capital, and the share of public funds directed to capital expenditures (see Blöchliger and Égert 2013). However, there is also evidence of politically driven transfers to local governments, targeted at securing support for elections, which causes inefficiencies (see Veiga and Veiga 2013; de Haan and Klomp 2013).

The growing indebtedness of the public sector triggered a debate on how to implement fiscal consolidation and what choice of consolidation instruments favours long-term growth. The impact of fiscal policy tightening on growth is analyzed in Barrell et al. (2012). It shows the possible adverse impact of fiscal

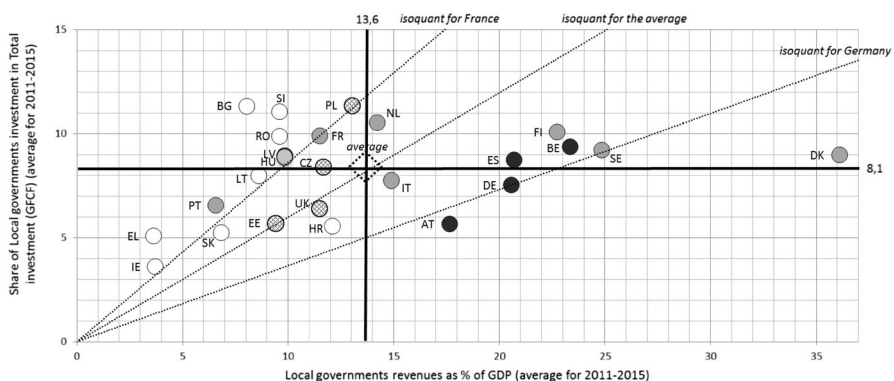


Fig. 1 Significance of the LG sector in the EU countries from the perspective of revenues, investment and debt. *Note 1* The color of the circles reflects the debt/GDP ratio of the LG sector in each country. White color ratio below 2.5%; checkered pattern ratio from 2.5 to 5.0%; grey color ratio from 5.0 to 10.0%; black color ratio above 10.0%. *Note 2* The smallest countries such as Cyprus, Luxembourg and Malta are not included in the analysis Source: Eurostat online database, Author's own calculation

consolidation on growth in the short-term horizon. As described in Sutherland et al. (2012), the focus should be on finding policies with low multipliers in the short-term (e.g. related to pension systems) and undertaking reforms of budgetary institutions. In OECD reports devoted to Denmark (OECD 2012) and Finland (OECD 2014) policy recommendations point to merging LGs into bigger entities and implementing legal rules restricting growth of expenditure.

Despite the worsening financial profile of LGs across the EU, there is little research devoted to the assessment of LG credit risk and debt repayment capacity. Research literature refers mainly to risk assessment of private sector entities and banking institutions. For example, a popular handbook on financial management and accounting in the public sector by Bandy (2011) devotes only a few pages to the issue of financial risk management. That there is less literature devoted to the risk of public sector entities is understandable, taking into account the considerably lower risk of this sector. However, after the 2008 crisis the developed economies experienced a few cases of restructuring of public sector debt, with such remarkable examples as the city of Detroit (USD 18 billion of debt) and Jefferson County, AL (USD 4 billion of debt). In 2014, the city of Rome (EUR 14 billion of debt) was on the brink of bankruptcy, but ultimately it was saved by the urgently passed legislation by the Italian government, which secured additional funds for Rome. Even if the final responsibility for the liabilities of LGs is transferred to central government, it does not eliminate their negative impact on the stability of the public sector and the whole economy.

The financial distress of the LG sector is also noticeable in Poland. Although only 2% of LGs do not comply with the statutory debt limits, around 10% of LGs temporarily lose their ability to fulfill their financial obligations in the course of a fiscal year, and half of the entities in this group experience overdue liabilities unsettled at the end of the fiscal year according to research by Filipiak (2014, p. 30). In Poland, one LG (Ostrowice borough) is already facing a liquidation procedure.

A vastly popular approach to risk assessment was proposed by E. Altman (see the revised concept in Altman 2000). Although this method is applicable to the evaluation of private and public companies, its application to the risk assessment of LGs is very limited. There are several financial measures which are critical for the Altman model (such as market value of equity, common equity, retained earnings etc.) that cannot be used to characterise LGs, as they are public governance bodies. Moreover, the notion of ‘revenue’ has a completely different dimension than in the corporate sector. Similarly, working capital, which is one of the critical factors in the Altman model, is not relevantly reflected in the LGs’ financial reports. Thus, interpretation of the liquidity ratios may be misleading—they are typically very high in LGs (see Galiński 2015, p. 26), as they are distorted by funds dedicated solely to specific commissioned activities or particular investment projects. They cannot be disbursed for any other operating expenses or for servicing the debt. As a result, traditional risk evaluation methods cannot be directly employed for the LG sector, and non-financial indicators should also be considered.

Research on specific factors which influence the financial stability of large municipalities in Spain (148 entities) was conducted by Rodríguez-Bolívar et al. (2016). LGs in Spain experienced similar processes as in many EU countries—their

revenues and expenditures have increased very significantly as a result of the growing number of functions undertaken, and this process has resulted in high levels of public debt. The authors tested the impact on the LG financial stability and net debt of the following socio-demographic and economic parameters: population, population density, dependent population below 16 years and over 65 years, unemployment rate, immigrant population, level of education, budget results per capita, GDP, touristic activity and concentration of firms. The research identified unemployment, population aged under 16 years and budget surplus/deficit per capita as the most important factors in the assessment of LG financial sustainability. However, the coefficients of determination were low in all models (between 0.009 and 0.274), which shows that the omission of financial indicators results in insufficient characterisation of the LG risk profile.

Extensive research on the systematic and unsystematic factors which have an influence on the probability of default of the large municipalities was presented by Lara-Rubio et al. (2017). The authors analyze 23 dependent variables ranging from demographic measures to political criteria (such as the number of parties represented in a city council). The financial indicators reflecting debt repayment capacity were not included. The analysis showed that the probability of default rises in response to a fall in such factors as population density, dependent population, municipal income per capita and GDP growth and with the ideological alignment of the LG with the national government. It also rises with an increase in short-term borrowing and the market risk premium. The model results in very high probabilities of default—over 50%. This is a result of the definition of a default event as a lack of cash surplus for overheads or debt exceeding 110% of revenues or current revenue smaller than current expenditure or current assets smaller than current liabilities. In practice, these are not default events nor even payment incidents; they just reflect certain aspects of the deterioration of the risk profile of LGs based on the changes of the above demographic and economic indicators. As such, they require enhancement by financial measures.

Given that the Altman model cannot be applied directly, because only a limited set of financial indicators is qualified to the risk analysis of LGs, and that numerous non-financial factors cannot sufficiently explain the changes in an LG's risk profile, the practical challenge is to propose a methodology based on a set of qualified and relatively easily available indicators, preferably reported quarterly to allow more accurate risk monitoring. This research develops a risk assessment methodology with the use of selected applicable financial indicators based on free operating cash flow and net debt as an alternative to the statutory limits on LG debt. Next, it combines these indicators with efficiency indicators for LGs using the Data Envelopment Analysis (DEA) method. Such an approach allows the risk of individual LGs to be ranked according to both their debt service capacity and their long-term ability to manage costs and carry out rational investment policy.

The quantitative analysis is conducted for the LG sector in Poland for the 2008–2015 period. The analysis provides guidance about which LG categories are more vulnerable to problems with servicing their financial liabilities in the future due to their cost management and investment policies, and which may suffer structural problems. As in the above-mentioned research, the focus in this analysis is

on large municipalities (towns with county rights), which play a central role in the LG sector in Poland.

2 Risk assessment of local governments

2.1 Corporate finance approach in evaluating LG financial standing

LGs have to comply with several statutory debt limits and related regulations implemented by national legislators. Typically, such regulations focus on maximum debt to revenue measures and are loosely related to LG debt repayment capacity. Examples of such statutory limits for Poland and a brief discussion of their flaws are presented in Sect. 4.1. From a risk assessment perspective, statutory ratios have a limited application, so this paper proposes alternative indicators for assessing LGs' financial standing. Classic literature on corporate finance and financial analysis delivers several useful indicators (see Palepu et al. 2004; Crouhy et al. 2000; Altman 2000). The basic approach to measure and manage LG credit risk is presented in Peterson (1998). Specific risk assessment methodologies for the LG sector are also derived by credit rating agencies (see FITCH 2012, 2014; S&P 2013, 2014). Based on them and the format of statutory reports of LGs, as well as over 10 years of professional experience of the author in the LG sector financing, the following indicators are proposed. Detailed definitions and the rationale of the indicators described below are presented in Kluza (2014). All the ratios can be calculated with annual or quarterly frequency, which enables more precise risk monitoring.

2.1.1 Net debt/revenues (ND/R ratio)

Debt is netted of cash and cash equivalents, but not receivables (mainly tax receivables). In the denominator, there are total revenues. This is more appropriate than taking current (operating) revenues since other revenues usually contain subsidies directly linked to investments for which the debt is acquired. The debt related to the EU funds is not excluded.

2.1.2 EBITDA/gross interest (EBITDA/GI ratio)

Note that in the case of LGs, EBIT (Earnings before Interest and Taxes) is equal to EBITDA (Earnings before Interest, Taxes, Depreciation and Amortization) as LG reporting in Poland is based on a cash basis. The negative warning sign is generated if this indicator is below the value of 2.0 for a given entity.

2.1.3 Free operating cash flow/net debt (FOCF/ND ratio)

In this indicator, debt should include only interest bearing liabilities. In the case of Polish LGs, there is no need to make adjustments, since approx. 99% of their liabilities are due to the financial sector. Free Operating Cash Flow (FOCF) is the equivalent of operating surplus from the statutory limits, but is more accurate

because it does not include the sale of fixed assets and interest paid. The typical form of this indicator is *net debt/FOCF*. However, for the DEA method its inversed form must be used in order to keep ‘the higher the better’ logic. For financially sound entities this indicator should amount to at least 20%.

The above ratios are useful in describing the financial standing of individual LGs. However, they do not differentiate between well- and poorly managed entities, implicitly treating the debt as something bad and undesirable. In reality, the picture is not so simple. Debt may (and should) be spent on investments which create cash inflows or efficiencies in the future. Thus, an entity with a lower debt level does not necessarily have a better risk profile than a more indebted one. An identification of entities based on their ‘productivity’ of debt usage is an important supplement in risk assessment analysis. For this part of the analysis DEA is used.

2.2 Risk assessment with the data envelopment analysis

An important question to answer is whether the changes of risk profile in some LG categories are the result of system changes, such as the relative limitation of their revenues in relation to their commissioned tasks during the period of economic slowdown, or whether they are the result of individual cost management and development policies performed by LGs. In particular, this last issue—the size of undertaken investments by a given LG—may be a factor which influenced to the greatest extent their current financial standing and ability to service existing debt and raise new debt.

For an assessment of these issues, the DEA method is used. The method was originally developed by Charnes et al. (1978). It has numerous developments for specific implementations (see Cooper et al. 2011). It is also used for assessment of public sector entities and their policies. For example, in Wang and Alvi (2011) the DEA method is used for the assessment of efficiency of government spending in various countries. An evaluation of public policies in the health care sector using the DEA method is presented in Yeh et al. (2014). This method may also be a useful tool for creating the relative risk rankings of LGs.

The method is widely described in the literature. Below is a short description based on Kucharski (2011). In the DEA method, a best practice frontier is estimated based on the empirical data of inputs and effects for the analyzed decision making units (DMUs), in this case individual LGs. DMUs which are located on the frontier are efficient. For them, the efficiency measure θ is equal to 1, where θ is a standardized measure from 0 to 1.

In general, there is n entities (DMUs). Each of them uses P input categories in order to obtain R specific effects. The entity h_i employs x_{pi} amount of p input and delivers y_{ri} of effect r . The inputs and effects must be non-negative with at least one input and one effect greater than zero. The efficiency of each entity is calculated by solving i following programming problems.

$$\begin{aligned}\theta_i &= h_i(\mu, v) = \frac{\sum_{r=1}^R \mu_r y_{ri}}{\sum_{p=1}^P v_p x_{pi}} \rightarrow \max \\ \text{s.t.} \quad &\frac{\sum_{r=1}^R \mu_r y_{ri}}{\sum_{p=1}^P v_p x_{pi}} \leq 1 \\ &\mu_r \geq 0, \quad v_p \geq 0\end{aligned}$$

where h_i —efficiency of entity i ($i = 1, \dots, n$), μ_r —weights assigned to respective effects ($r = 1, \dots, R$), v_p —weights assigned to respective inputs ($p = 1, \dots, P$)

The weight vectors μ and v exhibit a combination of inputs and effects for a given entity in the form of one ‘virtual’ input and one ‘virtual’ effect, so that a given entity was as close as possible to the best practice frontier. The vectors may be different for each DMU.

The above problem is transformed to linear programming form with a Charnes–Cooper transformation:

$$\begin{aligned}g_i &= \sum_{r=1}^R \mu_r y_{ri} \rightarrow \max \\ \text{s.t.} \quad &\sum_{p=1}^P v_p x_{pi} = 1 \\ &\sum_{r=1}^R \mu_r y_{ri} - \sum_{p=1}^P v_p x_{pi} \leq 0 \\ &\mu_r \geq 0, \quad v_p \geq 0,\end{aligned}$$

DEA can be a tool employed to measure the individual performance of entities, so from a risk perspective, the ranking that DEA produces reflects the measure of their unsystematic risk. For each year it allows a frontier of LGs to be identified with either strong debt service indicators along with an active development policy or with modest debt service indicators accompanied by moderate investment needs and operational surpluses. From a risk perspective, both profiles are sound. From the perspective of this research, the particular advantage of the DEA method is that it does not impose a uniform distribution of θ in the range 0–1 for DMUs. For example it is theoretically possible that all DMUs will be located on the frontier. Such a situation would indicate that there is no unsystematic risk.

Observations on the frontier, with $\theta = 1$, are compared to observations with an inferior risk profile. For each LG, this distance to the frontier is equal to $1 - \theta$ and represents an individual unsystematic risk measure (URM). The URM does not quantify unsystematic risk in absolute terms, but allows comparisons to be made between categories or individual LGs as well as an assessment of changes between

years. From a risk assessment perspective (e.g. in the credit process in a bank), this is a useful tool.

3 Methodological notes

The further analysis is devoted to the application of the methods described in Sect. 2 to risk assessment of LGs in Poland. In Poland, there are 2808 LG entities as of 2015. They form a three tier system which consists of boroughs, counties and provinces. The largest towns (66 entities at the end of 2015) perform both the functions of boroughs and counties, and they form a separate category called ‘towns with county rights’ (TWCR). Boroughs are split into three categories: municipal boroughs (MB), municipal-rural boroughs (MRB) and rural boroughs (RB).

Note that the debt of LGs does not include the liabilities of public health care entities owned by LGs, which amounted to PLN 4.2 bn at the end of 2015, or the liabilities of cultural entities and similar units (PLN 0.5 bn of debt). These are owned mainly by counties, towns with county rights and provinces. These liabilities are usually undue and served directly by these entities. Including fully these contingent liabilities in LG debt would raise the *D/R* ratio in 2015 from 36.0 to 38.4% (without increasing the denominator by the revenues of these entities). The debt ratios also do not include the debt of municipal companies, which are separate legal entities.

In Poland, the assessment of LGs’ risk is also hindered by the development of new financial instruments such as the sale and leaseback of property and reversed tenancy, which are not reported as financial liabilities and thus bypass statutory debt limits. The design and implications for LGs’ financial standing of these instruments are widely described in Kluza (2016a). At the end of 2015, these new instruments accounted for less than 1% of LG sector debt. However, their importance will grow unless the legislators take them into account in the formulas of statutory debt limits.

All data regarding local governments used in this research comes from system BESTI@ run by the Ministry of Finance of Poland. Data about the population is from the Central Statistical Office (GUS). Calculations for the DEA method were done with Microsoft Excel (small data sets) and Efficiency Measurement System ver. 1.3.0 software (all data sets). Control calculations for the same data sets with different programs delivered exactly the same results.

4 Financial standing of local governments in Poland

In their financial policies, LGs in Poland have to comply with several statutory limits and related regulations implemented by Public Finance Law (PFL), and they are also controlled by Regional Comptroller Offices (RIOs). For each new financing, the LG has to obtain a positive formal recommendation from the RIO.

4.1 Statutory limits versus corporate finance approach

Until the end of 2013, there were two statutory limits (plus some auxiliary rules for situations when the general government debt exceeds precautionary thresholds from PFL). The first one set the maximum debt level (D) for each LG at 60% of its current year total annual revenues (R), i.e. D/R ratio. The second ratio limited the financial outflows (FO) for each LG to a maximum of 15% of its current year total annual revenues, i.e. FO/R ratio. The debt and interest payments which are related to projects co-financed with EU funds are excluded from all statutory limits.

Since the beginning of 2014, the above limits were replaced by the individual debt limit from par. 243 of the Public Finance Law (PFL 2009). It states that for an n -th year the relationship of financial outflows to total revenues (Left Hand Side of equation, LHS) cannot exceed the average relationship for the previous 3 years of current revenues (CR) plus sales of fixed assets (SFA) minus current expenses (CE) to total revenues (Right Hand Side of equation, RHS). In PFL it is defined as:

$$\left(\frac{FO}{R}\right)_n \leq \frac{1}{3} \times \left(\frac{CR_{n-1} + SFA_{n-1} - CE_{n-1}}{R_{n-1}} + \frac{CR_{n-2} + SFA_{n-2} - CE_{n-2}}{R_{n-2}} + \frac{CR_{n-3} + SFA_{n-3} - CE_{n-3}}{R_{n-3}} \right)$$

Since 2011 there is also a requirement for LGs to have an operational surplus, calculated as operating revenues plus unused cash and cash equivalents from the previous year minus operating expenses. The definition of this rule is provided in par. 242 of PFL.

The limits on LG financing imposed by the Public Finance Law were undoubtedly very important in preventing Polish LGs from over-borrowing. However, their usefulness in assessing the financial standing of LGs is limited. For example, they exclude from statutory limits debt collected for co-financing EU projects. From a political perspective this is plausible since such regulation helps to absorb EU funds. However, from a risk assessment perspective this is not correct as this debt includes financing of LGs' own contributions in projects, which must be repaid. In addition, it covers bridge financing, which not only involves the necessity of bearing interest payments, but also carries the risk of returning the EU aid (e.g. in the case of Kosakowo airport project in Gdynia).

Moreover, the rule in par. 243 as well as the previous FO/R ratio are inflated by refinancing activities as they also include a rollover of debt. Thus, even such reasonable activity as substituting more expensive debt with cheaper debt can be prohibited when this operation results in exceeding these statutory limits. Thirdly, the new par. 243 rule, which refers itself as being based on operating surplus, is in fact loosely connected to such an approach. On the RHS, the 'operating surplus' in the numerator is diminished by financial expenses and increased by sales of fixed assets. Additionally, the denominator for RHS and LHS includes current revenues, sales of fixed assets and project subsidies. That makes this debt indicator a partial function of investment policy instead of operating free cash flow.

The above flaws prompt the design of alternative, more relevant indicators for assessing LG's financial standing, which are described in Sect. 2.1.1–2.1.3. These are based on operating cash flows and net debt. The comparison of results for different ratios for LGs in Poland is presented in Table 1.

The data in Table 1 shows that the worst financial situation of LGs was in Poland in 2011–2013. Although in 2013 there was some improvement of indicators based on operating surpluses, the free resources of LGs were further reduced as the net debt grew, and in 2013 for the first time it exceeded 30% of their revenue.

From the statutory limits perspective, the financial situation of LGs in 2012 and 2013 could be perceived as relatively unfavorable when taking into consideration how many entities did not comply with the statutory requirements. Although debt growth slowed down, the number of LGs not fulfilling the 60% limit (after excluding debt for EU projects) grew to 37 entities in 2013. The financial outflows indicator also reached its historical maximum of 8% and 326 entities crossed the 15% ceiling for this ratio. However, this negative picture is partly misleading. The high *FO/R* ratio was largely a result of the refinancing of historical debt with new, cheaper debt, and this kind of operation was accepted by RIOs despite the fact that technically it violated the 15% limit.

In 2014–2015, the situation of LGs worsened further from the statutory limit perspective. Despite diminished debt levels, 108 and 67 entities, respectively, did not comply with the new statutory limits from par. 243 of PFL—more than in previous years, under the 'old' statutory limits. However, the statutory limits do not reflect exactly the risk of the LG sector. This can be assessed by alternative financial

Table 1 Statutory limits and alternative financial ratios for LGs in Poland Source: Ministry of Finance data, (KRRIO 2016), Author's own calculation

	2008	2009	2010	2011	2012	2013	2014	2015
D/R ratio	20.2%	26.0%	33.8%	38.4%	38.2%	37.7%	37.1%	36.0%
LGs with D/R ratio above 60%*	3	17	70	135	95	89	107	105
FO/R ratio	5.5%	4.9%	5.6%	7.2%	7.7%	8.0%	5.4%	5.2%
LGs with FO/R ratio above 15%*	46	21	48	220	331	326	58	99
LGs not complying with debt limit in par. 243 of PFL	–	–	–	–	–	–	108	67
ND/R ratio	7.7%	15.4%	24.7%	29.3%	29.6%	30.3%	29.8%	27.8%
EBITDA/GI	1376%	911%	579%	494%	427%	596%	756%	974%
% of LGs with EBITDA/GI above 2.0	95%	90%	78%	84%	88%	95%	96%	97%
FOCF/ND	175%	56%	28%	27%	29%	31%	32%	37%
% of LGs with FOCF/ND above 0.2	93%	83%	61%	64%	73%	79%	79%	81%

* Without excluding debt and interest payments associated with EU projects, which would be an exact calculation of the statutory limit

measures presented in Table 1. From this perspective, one may notice a strong improvement in the ability of LGs to service their debt. The average *EBITDA/GI* ratio grew from its lowest value of 427% in 2012 to 974% in 2015. The average *FOCF/ND* ratio did not improve as much—from 27% in 2011 (which was a really alarming level) to 37% in 2015. The different magnitude of change of both ratios indicates that part of the improvement in the *EBITDA/GI* ratio was due to the decrease of interest rates in Poland. Indeed, average WIBOR 1 M (interbank rate) in 2011 amounted to 4.37% compared to 3.04% in 2013 and 1.51% in 2015. Thus, the sector gained an additional cushion for debt service, but it became vulnerable to future interest rate increases. This risk is analyzed in Kluza (2016b) with the application of Monte Carlo simulations. They show that even an increase of market interest rates back to the level of 2013, combined with a certain increase of operating expenses, may cause financial strains for over 300 LGs.

A further assessment of the financial conditions of LGs requires an analysis of separate LG categories. The differentiation between categories is very large and is related to both revenue and expenditure. For example, boroughs have a substantial tax base, i.e. PIT, CIT, local taxes (property tax, agriculture tax), compared to counties. Similarly, different sets of tasks are performed by each LG category, especially in the fields of education, health care, transport services, road and railway infrastructure, and water and sewage services. As a result, a debt level which is safe for a municipal borough might be dangerously high for a county, which typically has a very small operating surplus. Selected indicators for LG categories are presented in Table 4 in Appendix 1.

Analysis of data by LG categories confirms large differentiation of LG categories in terms of both their current financial condition and historical trends. With the exception of provinces, all LG categories have visibly improved their risk profile since 2011–2012. The best risk profile is in the rural boroughs, which have both relatively low debt and adequately large operating surpluses to service it. The *ND/R* ratio amounted to only 17% in 2015. The municipal boroughs and municipal-rural boroughs have improved their financial standing the most since 2011–2012. Their net indebtedness is around 25% of total revenues and is accompanied by growing operating surpluses with an average *EBITDA/GI* ratio of around 10.

An interesting LG category from a financial perspective is the counties. These entities have relatively low debt—*ND/R* amounted to 17.4% in 2015. However, their average *EBITDA/GI* and *FOCF/ND* ratios are on the level of more indebted entities, which indicates relatively weak operating surpluses of the counties. Their situation is opposite to the provinces, which are the only LG category that increased their *ND/R* ratio—to the level of 35%—but have strong operational surpluses to service their debt.

TWCRs are presumably the most important category for the LG sector. Although there are only 66 TWCRs out of 2808 LGs, they represent 33% of Poland's population, 35% of all LG revenue and generate 46% of LG sector debt as of December 2015. Data shows that TWCRs have the worst financial standing among LGs from the perspective of debt service capacity. Their *ND/R* ratio reached 40% in 2013 and since then improved only moderately to the level of 37%. The average *FOCF/ND* ratio for TWCRs is dangerously low—for the last 5 years it has

fluctuated around 20%, reaching 26% in 2015. As a result, almost half of TWCRs do not reach the 20% threshold regarded as a safe level for this indicator. In addition, due to the size of each TWCR, they also generate a large concentration risk for the financial sector.

4.2 Unsystematic risk of local governments

The second part of the analysis is devoted to measuring the risk ranking of LGs with the use of the DEA method as described in Sect. 2.2. In this analysis, the following categories are used as inputs:

1. operating revenues to operating expenses (net of interest payments) ratio.¹
2. investments per capita (2-year average).²

The data for inputs is taken from system BESTI@ run by the Ministry of Finance of Poland. The following ratios, defined in Sect. 2.1, are used as effects:

1. *EBITDA/gross interest*.
2. *FOCF/net debt*.

Due to the requirements of the DEA method, the data regarding the effects needed some calibration, i.e. transforming negative values, adjusting outlayers etc. First of all, observations for LGs without net debt (and as a result with a negative *FOCF/ND* ratio) were substituted with the maximum positive value of this ratio for other LGs. Secondly, observations for LGs with an operating deficit received minimum positive values. Thirdly, the LGs with very high *EBITDA/GI* and *FOCF/ND* ratios (the outlayers) were downsized to values of 20 and 2, respectively. Proportional downsizing of the ratios was also done for the observations in a range of 10–20 and 1.05–2.0, respectively.³

The calculations were performed for each LG (2809 entities) for 4 years: 2008 (pre-crisis year), 2011 (crisis year, the first one with the statutory requirement of operating surplus for each LG), 2013 (the last year with the ‘old’ statutory limits) and 2015 (the last year available). The DEA calculations were performed with the following approach: input oriented, constant returns to scale, distance radial, convex structure. The results are presented in Table 2 and Fig. 2.

The analysis of LG categories with the DEA method delivered several observations for risk assessment of the categories as well as the individual entities. The diverse changes of risk profile within categories may be observed in Fig. 2. The crisis caused the largest differentiation within the LG categories in 2011, despite

¹ Operating revenues and expenses are defined in the report *RbNDS*, which is the income statement report for LGs, as position no. *A1* and *B1*. These categories do not include funds and operations related to investments (such as project subsidies, sale of fixed assets and investment expenditures).

² Investments are defined as item *B2* in the *RbNDS* report. Data on the population is taken from the Central Statistical Office (GUS).

³ From a risk assessment perspective it is irrelevant whether in a given year the *EBITDA/GI* ratio was 50 or 500. Both values indicate enormously strong capacity to service existing debt. However such outlayers have an impact on DEA results and therefore require calibration.

Table 2 Unsystematic risk measure (URM) for LG categories—selected statistics
Source: Author's own calculation

	2008	2011	2013	2015
TWCR				
Average URM	0.43	0.73	0.60	0.59
Median URM	0.47	0.80	0.66	0.64
Coefficient of variation	63.2%	30.8%	47.2%	39.5%
Counties				
Average URM	0.44	0.60	0.58	0.48
Median URM	0.35	0.71	0.67	0.51
Coefficient of variation	76.2%	50.4%	49.0%	52.7%
MB				
Average URM	0.44	0.73	0.67	0.52
Median URM	0.45	0.80	0.73	0.54
Coefficient of variation	59.9%	31.9%	32.5%	42.7%
MRB				
Average URM	0.39	0.70	0.63	0.52
Median URM	0.36	0.78	0.70	0.53
Coefficient of variation	71.4%	34.0%	36.5%	45.7%
RB:				
Average URM	0.37	0.61	0.53	0.51
Median URM	0.27	0.69	0.57	0.55
Coefficient of variation	62.3%	47.1%	48.2%	48.8%
Provinces				
Average URM	0.22	0.48	0.45	0.26
Median URM	0.14	0.55	0.51	0.28
Coefficient of variation	85.4%	59.7%	42.8%	93.3%

their uniform revenue base and commissioned tasks within each category. The impact was the strongest in TWCRs and municipal boroughs. In 2013, it declined moderately in all categories, and this process continued until 2015. However, the URM measures remained at a high level for TWCRs, municipal boroughs and municipal-rural boroughs, which indicates that unsystematic risk is an important factor in the assessment of the risk profile for these entities.

Towns with county rights is the category with the highest risk level among all LGs. Their average URM of 0.59 (and median value of 0.64) indicates that they have a relatively high level of both systematic and unsystematic risk components. This result confirms intuition, because TWCRs perform both the functions of counties (higher systematic risk) and municipal boroughs (higher unsystematic risk). The coefficient of variation (CV) for TWCRs decreased significantly to 39.5%, indicating that currently the whole of this LG category has a relatively inferior risk profile. Since the TWCR category, consisting of only 66 entities, represents 46% of LG sector debt, its financial soundness is critical for the whole public sector. The average debt of an individual TWCRs amounted to PLN 503 million (approx. USD 135 million) in 2015, without including the debt of its municipal companies and

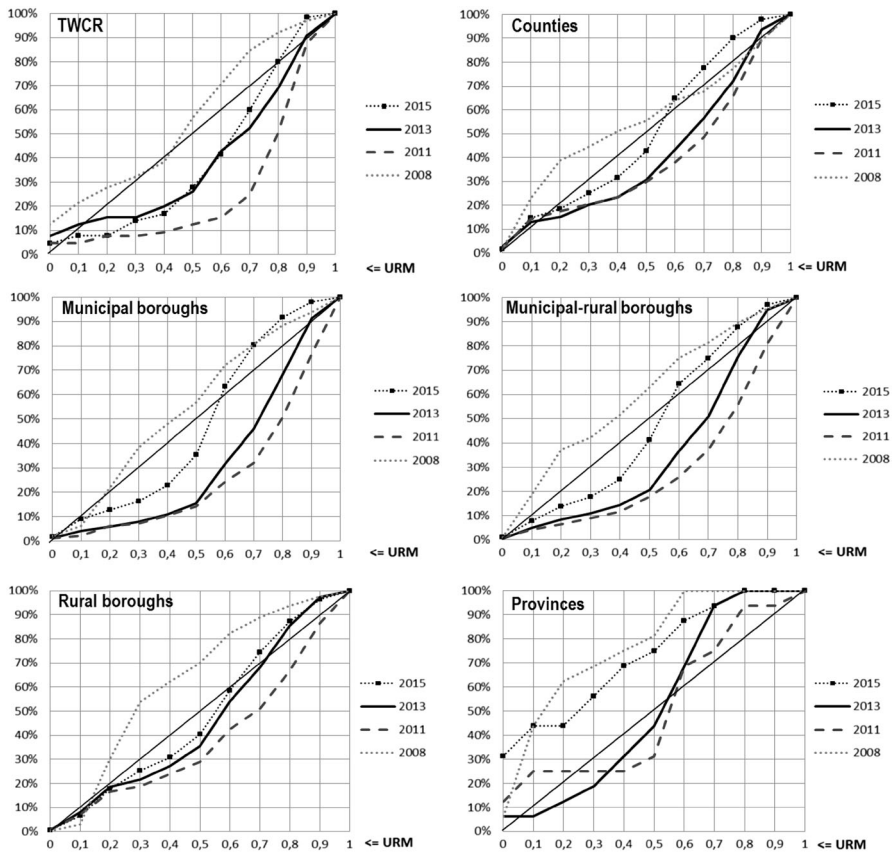


Fig. 2 Distributions of unsystematic risk measure (URM) in 2008–2013 for LGs categories. *Note* The larger convexity of the distribution function indicates that there are more LGs with high unsystematic risk
Source: Author's own calculation

health sector entities. Thus, the persistence of the inferior risk profile of TWCRs creates a significant risk for the whole public sector and implies designing additional regulations for these entities to limit their indebtedness (Table 2 and Table 4).

The relatively high unsystematic risk measures for municipal boroughs and municipal-rural boroughs, along with the high CV ratios, indicate that individual entities from this group significantly overinvested in recent years and are highly risky despite the general stability of this LG category. 20% of municipal-rural boroughs have a URM ratio above 0.75.

In the case of the counties, the results showed that this category bears mainly systematic risk. This is further evidence that this LG category undergoes deep systemic problems (inadequate tax revenues for the tasks commissioned to them) which may lead to solvency problems and structural changes resulting in the elimination of this category. Additionally, despite the low URM, this category has

Table 3 Evolution of the *D/R* ratio for LGs with the worst and the best value of URM in 2015; all data in % Source: Author's own calculation

	TWCR			Municipal boroughs			Counties		
	2011	2013	2015	2011	2013	2015	2011	2013	2015
Average <i>D/R</i> ratio for the category	49.4	48.0	46.7	36.0	34.2	29.9	26.0	25.5	24.7
Average URM ratio for the entities* with the highest URM ratio as of 2015	84.8	84.3	85.2	88.0	83.8	86.4	85.4	86.3	88.7
Average <i>D/R</i> ratio for the entities* with the highest URM ratio as of 2015	44.5	50.8	54.8	45.1	46.8	46.6	39.3	43.1	44.5
Average URM ratio for the entities* with the lowest URM ratio as of 2015	51.4	20.9	14.6	47.7	27.9	4.9	18.6	19.3	2.1
Average <i>D/R</i> ratio for the entities* with the lowest URM ratio as of 2015	31.3	27.0	24.1	18.8	14.2	10.0	9.7	7.1	6.7

* For TWCRs, which account for only 66 LGs, the top ten and the bottom ten entities are considered; for MBs (240 entities) and counties (313 entities) the top twenty and the bottom twenty entities are considered

the highest *CV*, which correctly reflects the large diversity between individual counties. Counties with the highest unsystematic risk are usually, or used to be, owners of public hospitals, which are typically permanently unprofitable.

The URM ratio, which implicitly reflects the efficiency of revenue-cost management and investment activities, shows promising properties in identifying individual LGs with the most inferior risk profile. Despite the gradually improving *D/R* ratios in the LG sector, the LGs with permanently high URM experience gradually growing debt levels (see Table 3). This property of URM may be particularly valuable for a credit risk assessment process, as this process aims to select a few of the riskiest entities out of the whole population, which generally has a healthy risk profile, or find such entities whose profile may noticeably deteriorate over time compared to their peers.

The evolution of the *D/R* ratio for the TWCRs with the highest URM in 2015 (i.e. the higher unsystematic risk) is presented in Fig. 3 below. The enduringly high URM ratios are associated with growing *D/R* ratios for these TWCRs despite the overall deleveraging process in this LG category. The figures for the municipal boroughs and counties are presented in Appendix 2.

URM also exhibits useful features in modelling future changes of an LG's financial situation. The exemplary models explaining the *D/R* ratio and *EBITDA/GI* ratio with URM for TWCR are presented in Appendix 3. The past values of URM are not only a valuable extension for auto-regression models describing the above ratios, but may also be used as the only independent variable as well. The strong relationship between the URM and *D/R* ratios in the models 1a and 2a is particularly noteworthy because gross debt and total revenues are not used in the DEA method, either as inputs or as outputs for the calculation of URM. All models presented in

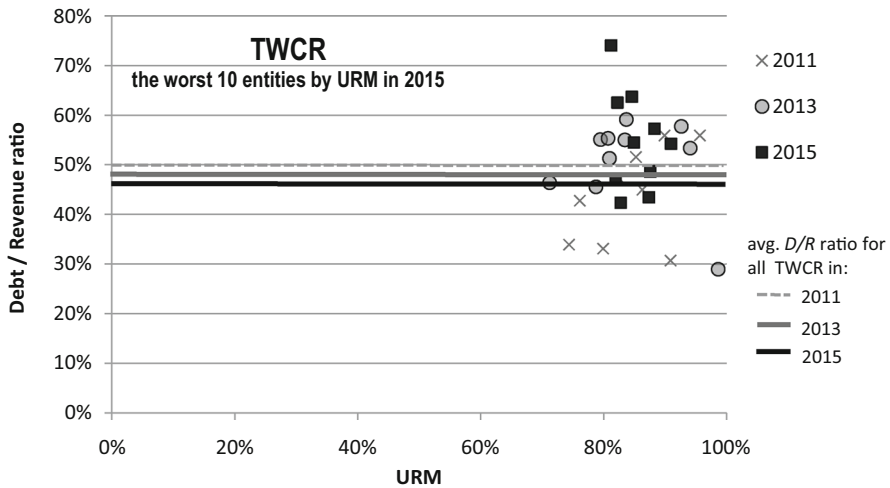


Fig. 3 The relationship between the debt ratio and the URM ratio for TWCR with the highest URM ratio in 2015 Source: Author's own calculation

Appendix 3 are statistically significant. This creates a promising opportunity for further research on forecasting the financial standing of LGs with the use of the DEA method.

5 Conclusions

The LG sector performs an important function in the EU economies, accounting for over 8% of all their investments. In particular, it played a significant role in stabilizing domestic demand after the 2008 crisis. However, the crisis had an adverse impact on the finances and credit risk profile of LGs across the EU. Their debt/GDP ratio grew from less than 5% in 2007 to 7.5% in 2015. On the one hand, this negatively influenced the extent of development policies conducted by LGs. On the other hand, this caused a deterioration in their debt repayment capacity and constitutes an additional risk factor should the current low interest rate environment come to an end. Although local governments and other public entities typically have very low risk compared to private sector entities, the developed economies have already experienced cases of LG debt restructuring after 2008.

Despite these recent economic developments, there is little research on designing effective risk measures of LGs, which will be more relevant and informative than statutory debt limits. This paper proposes an alternative methodology of risk assessment of LGs to statutory debt limits and the Altman model approach, which cannot be applied due to data differences and incompatibility, especially in the area of equity and working capital measures. It also does not extensively use demographic and macroeconomic measures, which as past research has shown, only slightly explain the LG risk profile. This research employs measures based on free operating cash flow and net debt to evaluate the financial standing of individual entities as well as LG

categories. Then, with the use of Data Envelopment Analysis, the relative performance of LGs in debt productivity and management is calculated, reflecting the risk ranking of individual LGs. The indicators used are easily available from the LG financial reports and also allow for quarterly monitoring of risk.

The proposed approach is applied to the risk assessment of the LG sector in Poland for the period 2008–2015. The research shows that the risk profile of Polish local governments has gradually improved since 2011, but it is still inferior compared to the pre-crisis year of 2008. Although several dozen local governments do not comply with the statutory debt limits from the Public Finance Law, overall the financial position of the sector was remarkably stronger in 2015 than in the middle of the economic slowdown period. The much bigger improvement of *EBITDA/GI* ratios than *FOCF/ND* ratios indicates, however, that part of the improvement was due to the lower market interest rates in Poland over the last 3 years, which is a systematic risk factor.

The analysis of LG categories with the DEA method identified riskier areas in the local government sector and the nature of this risk. Firstly, it showed that the category of the counties bears mainly systematic risk due to its modest tax base and ownership of local hospitals. Despite the relatively low debt levels, approx. 25% of counties may have problems performing the tasks commissioned to them or servicing their debt in the medium term. Secondly, it revealed that towns with county rights are characterized by high unsystematic risk. This category consists of only 66 entities, but it represents 33% of Poland's population and 46% of LG sector debt, so it has vast importance from the perspective of public sector stability as a whole. Several towns with county rights raised too much debt due to a defect in the formula for statutory debt limits which treats the historical sale of assets as a factor improving future lending capacity. As several LGs may encounter problems servicing their debt and performing their statutory activities in the future, there is a need for research on redesigning the existing statutory debt limits from par. 243 of the Public Finance Law.

The URM ratio shows promising properties in identifying individual LGs with the most inferior risk profile. Despite the gradually improving *D/R* ratios in the LG sector, the LGs with permanently high URM experience steady growth in debt levels. This property of URM may be particularly valuable for the credit risk assessment process, as this process aims to select the riskiest entities out of the whole population. URM also exhibits useful features in modelling future changes in the financial condition of LGs. The past values of URM may be used as the only independent variable in explaining future values of *D/R* ratios for TWCRs. This creates a promising opportunity for further research on forecasting the financial standing of LGs with the use of the DEA method.

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Appendix 1

See Table 4.

Table 4 LG financial ratios—breakdown by LG categories; all data in % Source: Author's own calculation

	2008	2009	2010	2011	2012	2013	2014	2015
TWCR (65/66 entities)								
D/R ratio	25.8	37.2	43.5	49.4	48.3	48.0	47.2	46.7
Par. 243 rule: ratio of RHS to LHS; median value			207.4	120.4	92.8	90.5	149.8	167.7
ND/R ratio	14.3	25.5	33.9	38.4	39.4	40.2	39.5	37.2
EBITDA/gross interest	1039	561	400	342	273	433	572	743
% of LGs with EBITDA/GI above 2.0	97	85	71	78	75	83	92	97
FOCF/net debt	90	28	18	18	17	21	23	26
% of LGs with FOCF/net debt above 20%	95	65	37	38	45	43	52	54
MB (240 entities)								
D/R ratio	19.4	26.4	32.9	36.0	35.7	34.2	32.2	29.9
Par. 243 rule: ratio of RHS to LHS; median value			237.6	152.7	99.6	102.4	181.3	194.3
ND/R ratio	6.1	17.0	24.7	28.6	28.5	27.8	25.5	23.3
EBITDA/gross interest	1410	715	440	446	395	557	800	1019
% of LGs with EBITDA/GI above 2.0	92	77	65	78	76	90	97	98
FOCF/net debt	215	42	21	25	27	30	36	40
% of LGs with FOCF/net debt above 20%	92	69	47	56	58	69	75	80
MRB (602 entities)								
D/R ratio	19.2	25.2	33.2	37.4	36.4	35.4	34.4	32.3
Par. 243 rule: ratio of RHS to LHS; median value			217.5	132.3	90.8	90.0	156.7	165.1
ND/R ratio	8.2	15.9	25.7	30.7	29.5	29.3	28.5	25.7
EBITDA/gross interest	1433	1072	586	505	470	650	828	1092
% of LGs with EBITDA/GI above 2.0	96	90	72	80	87	95	95	97
FOCF/net debt	154	60	25	27	32	34	36	42
% of LGs with FOCF/net debt above 20%	92	81	52	56	66	74	75	79
RB (1570/1571 entities)								
D/R ratio	14.5	18.3	26.6	30.8	29.5	28.7	28.4	26.0
Par. 243 rule: ratio of RHS to LHS; median value			292.9	143.3	100.8	106.4	160.5	166.6
ND/R ratio	1.3	6.8	17.5	22.2	20.5	20.3	20.4	17.1
EBITDA/gross interest	2406	2072	1208	784	720	1005	1206	1463

Table 4 continued

	2008	2009	2010	2011	2012	2013	2014	2015
% of LGs with EBITDA/GI above 2.0	97	94	83	86	92	98	97	97
FOCF/Net Debt	1158	188	54	44	54	59	58	68
% of LGs with FOCF/net debt above 20%	95	89	68	68	79	85	82	84
Counties (313 entities)								
D/R ratio	15.8	19.4	24.1	26.0	26.5	25.5	25.0	24.7
Par. 243 rule: ratio of RHS to LHS; median value			152.4	106.5	88.3	93.6	181.6	187.5
ND/R ratio	4.5	9.2	14.9	17.2	16.7	18.8	18.5	17.4
EBITDA/gross interest	669	576	433	523	408	571	790	1001
% of LGs with EBITDA/GI above 2.0	85	79	73	88	81	91	95	97
FOCF/net debt	158	58	30	39	38	35	39	44
% of LGs with FOCF/net debt above 20%	87	77	62	75	72	74	79	79

Notes: Debt related to the EU projects is not excluded from the above ratios

Appendix 2

See Fig. 4.

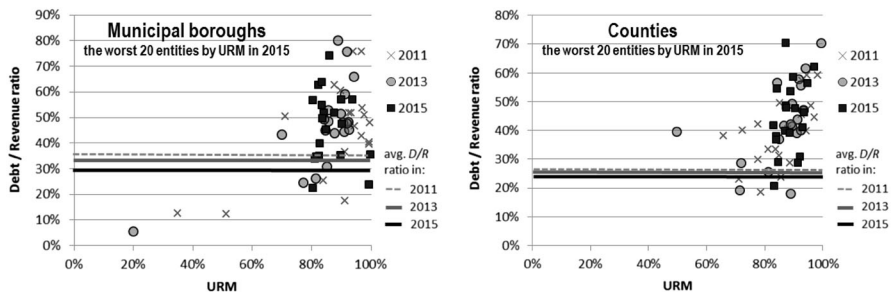


Fig. 4 The relationship between the debt ratio and the URM ratio for the municipal boroughs and counties with the highest URM ratio in 2015 Source: Author's own calculation

Appendix 3: Models describing the relationships between URM and financial ratios for TWCRs

All models calculated with the least squares method; sample size: 65; selected statistics presented

Model 1a. D/R ratio for 2015 modelled by URM for 2013; dependent variable (Y): D/R2015

	Coefficient	Standard error	t-stat.	p value
Const	0.195448	0.0345213	5.6617	<0.00001***
URM2013	0.383736	0.0520767	7.3687	<0.00001***
<hr/>				
R-square	0.462903	Adjusted R-square	0.454378	
F(1, 63)	54.29730	Significance F	4.54e−10	
Normal distr. of residuals	$\chi^2 = 0.211879$ with p = 0.899479			

Model 1b. D/R ratio for 2015 modelled by URM for 2013 and D/R ratio for 2013; (Y): D/R2015

	Coefficient	Standard error	t-stat.	p-value
D/R2013	0.812659	0.0718352	11.3128	<0.00001***
URM2013	0.127089	0.0488415	2.6021	0.01154**
<hr/>				
R-square	0.967076	Adjusted R-square	0.966553	
F(1, 63)	925.2454	Significance F	2.00e−47	
Normal distr. of residuals	$\chi^2 = 2.22791$ with p = 0.328259			

Model 2a. D/R ratio for 2013 modelled by URM for 2011; (Y): D/R2013

	Coefficient	Standard error	t-stat.	p-value
Const	0.103248	0.0518631	1.9908	0.05085*
URM2011	0.439676	0.0681938	6.4474	<0.00001***
<hr/>				
R-Square	0.397530	Adjusted R-square	0.387967	
F(1, 63)	41.56957	Significance F	1.82e−08	
Normal distr. of residuals	$\chi^2 = 3.27773$ with p = 0.1942			

Model 2b. D/R ratio for 2013 modelled by URM for 2011 and D/R for 2011; (Y): D/R2013

	Coefficient	Standard error	t-stat.	p-value
URM2011	0.129403	0.0501581	2.5799	0.01223**
D/R2011	0.77126	0.0846291	9.1134	<0.00001***
R-square	0.966885		Adjusted R-square	0.966360
F(1, 63)	919.7344		Significance F	2.40e-47
Normal distr. of residuals	$\chi^2 = 4.08719$ with $p = 0.129562$			

Model 3a. EBITDA/GI ratio for 2015 modelled by URM for 2013; (Y): EBITDA/GI2015

	Coefficient	Standard error	t-stat.	p-value
Const	14.5335	0.826033	17.5944	<0.00001***
URM2013	−11.4274	1.2461	−9.1705	<0.00001***
R-square	0.571713		Adjusted R-square	0.564915
F(1, 63)	84.09763		Significance F	3.29e−13
Normal distr. of residuals	$\chi^2 = 1.39304$ with $p = 0.498315$			

Model 3b. EBITDA/GI ratio for 2015 modelled by URM for 2013 and EBITDA/GI for 2013; (Y): EBITDA/GI2015

	Coefficient	Standard error	t-stat.	p-value
Const	7.40042	1.4321	5.1675	<0.00001***
URM 2013	−4.74352	1.56216	−3.0365	0.00350***
EBITDA/GI2013	0.627328	0.11101	5.6511	<0.00001***
R-square	0.717316		Adjusted R-square	0.708197
F(1, 63)	78.66315		Significance F	9.78e−18
Normal distr. of residuals	$\chi^2 = 0.0232555$ with $p = 0.98844$			

Model 4a. EBITDA/GI ratio for 2013 modelled by URM for 2011; (Y): EBITDA/GI2013

	Coefficient	Standard error	t-stat.	p-value
Const	15.7314	0.945906	16.6311	<0.00001***
URM2011	−14.7881	1.24375	−11.8899	<0.00001***
R-square	0.691736		Adjusted R-square	0.686842
F(1, 63)	141.3700		Significance F	9.52e−18
Normal distr. of residuals	$\chi^2 = 0.527845$ with $p = 0.768033$			

Model 4b. EBITDA/GI ratio for 2013 modelled by URM for 2011 and EBITDA/GI for 2011; (Y): EBITDA/GI2013

	Coefficient	Standard error	t-stat.	p-value
EBITDA/GI2011	0.951071	0.0478914	19.8589	<0.00001***
URM2011	0.770414	0.380003	2.0274	0.04686**
R-square	0.910875		Adjusted R-square	0.909460
F(1, 63)	321.9345		Significance F	8.41e−34
Normal distr. of residuals	$\chi^2 = 1.12651$ with $p = 0.569352$			

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