

THE ROLE OF THE Z-SCORE MODEL IN ASSESSING FINANCIAL STABILITY. EVIDENCE FROM THE COMMERCIAL BANKS LISTED ON BUCHAREST STOCK EXCHANGE

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Abstract:

This paper represents a theoretical and practical approach regarding one of the alternatives to measure financial stability, namely the Z-score model. It is well known that the Z-score model was firstly developed for manufacturing firms, but the initial model was revised in order to become operational for banks as well. Therefore, the main goal of the paper is using Z-score for the banks listed on Bucharest Stock Exchange in order to determine their stability or instability. The Z-score method allows comparison among different institutions' stability in a simple and elegant way and proves to have more advantages than disadvantages in practice.

Keywords: *financial stability, Z-score, ROA, Bucharest Stock Exchange*

JEL: *D81, E58, G21.*

1. Introduction.

The aftermath of the global financial crisis has accentuated the discrepancy between theory and practice and the fact that worst economic scenario can trigger huge losses for the financial system, if the financial institutions do not take precaution against the impairment of their soundness. Now it is clear that every participant at the financial system has its own contribution to the systemic risk as well and, in case of a downturn, generalized effects will occur as in a chain reaction. Therefore, it is of great importance to assess the financial health of the banks, especially the large

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banks and the systemically important institutions, in order to prevent or diminish systemic risk.

This paper aims at presenting a popular method to measure financial stability for individual credit institutions, but also outlines the fact that this method is not thoroughgoing and does not take into account all the indicators that define a bank's activity. The paper is divided in sections regarding Methodology used to process and present data, another section entitled "The use of Z-score in assessing financial stability for firms and banks", which is considered to be a literature review of the Z-score application by different authors on different companies that operate in various industries, including the banking industry, and the last section entitled "Z-score estimation for the banks listed on Bucharest Stock Exchange(BVB)" focused on the application of the Z-score method on the four Romanian banks listed on Bucharest Stock Exchange(BVB), Transilvania Bank, BRD, BCR(ERSTE), Carpatica Commercial Bank, for the last three years with available data, namely 2012, 2013 and 2014.

After computing the Z-scores for the sample banks, we can see that the Z-score outlines at some extent the periods with potential downturn for the banking system, but this is not a sufficient method to assess the financial condition of a credit institution.

2. Methodology

On the one hand, the aim of this paper is to highlight the role of the Z-score in measuring the financial stability of individual institutions as depicted in other research papers, differentiated on the industry in which the sample companies operate (manufacturing industry and banking industry). On the other hand, I chose the simplest formula for the Z-score and applied it on the four Romanian banks listed on Bucharest Stock Exchange(BVB), with data collected for the years 2012-2014. Therefore, I computed the Z-scores for each bank every year, using the Ms Excel functions such as Average and Standard Deviation and generated graphic representations in order to highlight the evolution of these indicators over time. To put it in a nutshell, the main method used in my research is Z-score, one of the most popular models to assess the financial soundness of the credit institutions. Moreover, it was required a comparison analysis among the Z-score of each credit institution listed on BVB, the Z-score components and their evolution over time. In order

to compute the Z-score of every bank I collected the financial data provided by the banks' annual reports, which I synthesized and processed.

3. The Use of Z-Score in Assessing Financial Stability for Firms and Banks

First of all, financial stability is a highly debated subject amongst policy makers, economists, central banks and also researchers due to the systemic risk that links every market actor. Accordingly, measuring financial stability and enhancing the methods to diminish systemic risk have been of great importance in the post-crisis context.

Along with the Financial Soundness Indicators provided by the International Monetary Fund as a guide for quantifying financial stability at the banking system level, the early warning systems and the stress-tests that project scenarios so as to anticipate the banking system's reaction to specific downturn conditions, there are several quantitative methods to measure financial stability. The quantitative methods to diagnose financial stability or instability, which include the discriminant analysis and Z-scores, represent a significant tool for risk management, given the fact that allows individual banks to determine the probability of default with a model that correlates the main causes of the downturn with macroeconomic factors. (Cihák, 2005)

Altman (1968) conducted the first study to examine the use of financial ratio analysis as a tool to predict corporate bankruptcy by using discriminant analysis.

However, the use of Z-score models in banking had shown inaccuracies up to 70% or in other words the model Z-score early it is not accurate in predicting the likelihood of financial distress in the banking industry. Therefore Altman then revised the initial model and introduce Altman's four-variance model (Altman, 2000). First, the Z-score was created as a model to determine the bankruptcy risk of companies from the manufacturing industry and not to assess the financial performance of banks. The banking system manages the risks which it is exposed to differently than other companies, so the studies revealed that the Altman model has a high accuracy of the model of 90% in correctly classifying the bankrupt firms and 80% accurate in predicting the next financial difficulties. However, the use of Z-score models in banking had shown inaccuracies up to 70% or in other

words the model Z-score early it is not accurate in predicting the likelihood of financial distress in the banking industry.(Erari et al., 2013).

This inaccuracy and the decision of the Basel Committee to adopt CAMEL as the standard model of bank rating contributed to the main use of CAMEL as primary tool to quantify the performance of a bank. Moreover, there are other several limitations to take into account when using the Z-score model to measure financial stability and the most important is the fact that the Z-score components are based purely on accounting data. This means that financial institutions are able to 'make up' data and provide an overly positive assessment of the financial institution's stability.(World Bank, 2013)

Moreover, given the necessity to assess the financial condition of individual banks in comparison to other banks' financial health and the peculiar risk management of the credit institutions, Altman adjusted the Z-score formula for nonproductive companies with the formula $Z = 6.56 X_1 + 3.26 X_2 + 6.72 X_3 + 1.05 X_4$, where (1)

X_1 = Net Working Capital to Total Assets

X_2 = Retained Earnings to Total Assets

X_3 = Earnings before Interest and Tax to Total Assets

X_4 = Market Value of Equity to Book Value of Debt.

This condition can be seen from the Z-Score value. If:

a) The Z-score which is less than or equal to 1.23 means that the company is experiencing financial difficulties and high risk.

b) The score of $1.23 < Z < 2.90$ then the company is considered to be in the grey area.

c) With the score of $Z > 2.90$, it provides an assessment that the company is in a very healthy condition. (Altman, 2000)

Even though Altman proposed different formulas to calculate the Z-score, some revised as a result of determining the influence each variable has on the overall score, there are several papers in the economic literature that utilize a simplified formula in order to measure the risks that individual banks are exposed to. The author who proposed a simpler method to quantify financial stability is Mercieca et al(2007), who relatively recent developed this method that became the tool used by many researchers afterwards. Groeneveld and De Vries used this formula in their research paper in order to measure the impact of the financial crisis on co-operative banks compared to commercial banks on a sample of 45 large European banks, mostly commercial, taking

into consideration the 2002-2007 period. A similar study was carried by Diaconu and Oanea(2014), for a sample of 13 commercial banks in Romania and a co-operative one and had the same goal of highlighting the main determinants of a bank's stability.

Cihák and Hesse (2008) use such a method to assess the robustness of Islamic banks and find out that the largest international commercial banks are more solid than the large Islamic banks; on the contrary, the small Islamic banks are stronger than the large banks in this category. Moreover, the authors also found out that the market share of the Islamic banks does not influence the soundness of other banks in the system.

A similar study was conducted by Fungáčová and Solanko (2008), who used quarterly data for the period 1999-2007 for Russian banks in order to test the relationship between the features and the risks of these banks. Besides the classic indicators for credit risk, the authors have used Z-scores to assess insolvency risk or probability of default. The study concludes that the provincial banks are exposed to slightly higher risks than those located in Moscow, and the banks with foreign major shareholders are less risky than those with local shareholders.

The wide range of models available for a Z-score assessment reveal the fact that there is no standard formula, because there are many differences among companies and their fields of activity and balance sheets. Accordingly, every model should be considered as complementary to other methods of measuring financial stability, in order to have the most realistic overview of a bank's financial health.

In my opinion, this method is more operational to use for the financial institutions because they can compute it more easily and the number of variables processed and estimated is smaller than any other rating model.

The Z-score is determined by three factors (2), as it follows: the return on assets (ROA), equity to assets ratio (E/A) and the standard deviation of ROA, used as a proxy for volatility. The Z score indicates by how many standard deviations the return on assets has to change to cause the bank's assets to fall below the value of its debts. (Groeneveld and De Vries) .

$$Z\text{-score} = \frac{ROA+E/A}{\sigma(ROA)} (2)$$

The Z-score value is in inverse proportion with the insolvency risk of a bank; therefore, the higher the level of this indicator is, the lower the insolvency risk is.

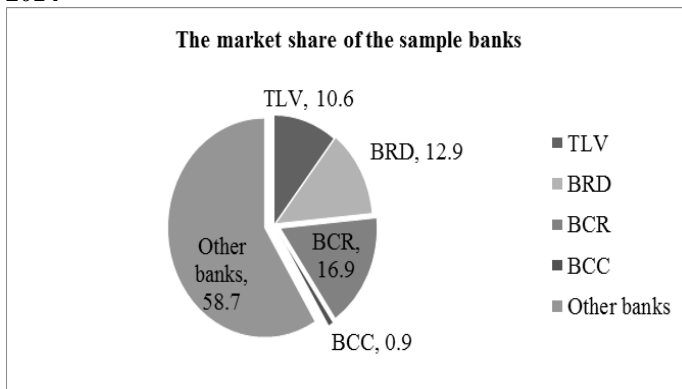
4. Z-score estimation for the banks listed on Bucharest Stock Exchange(BVB)

In the previous section, I put an emphasis on the contribution of the Z-score to the quantitative analysis of financial stability as stated in the economic literature, with various applications of the model for firms or banks. In this section, I calculated the Z-scores of the banks listed on Bucharest Stock Exchange for three consecutive years, from 2012 to 2014. I consider the selected period of time for the calculation to be relevant for the post-crisis context and it conveys banks' performance evolution during the years considered crucial for the post-crisis recovery.

Hence, the banks listed on BVB are Transilvania Bank (TLV), BRD - Groupe Société Générale(BRD), BCR – ERSTE Group Bank AG(BCR) and Carpatica Commercial Bank(BCC). The components of the Z-score used in my study required financial data which I collected from the annual reports of each bank and which I processed using the formulas available in Excel 2010.

The sample of banks represent 41,3% market share of the Romanian banking system, as presented in Figure 1 and three of them, namely BCR, BRD and TLV are the top three banks in Romania due to total assets.

Figure 1 The market share of the Romanian banks listed on BVB in 2014



Source: author's presentation based on the annual reports of the banks in 2014

The return on assets(ROA) and equity to assets ratio(E/A) are presented in Table 1, as calculated based on the data collected from the annual reports of each bank regarding the net profit , total assets and equity:

Table 1 The indicators of the Romanian banks listed on BVB according to banks' annual reports

		2012	2013	2014
TLV	Net Profit	320,431,880.00	374,898,104.00	434,329,895.00
	Total Assets	29,572,044,797.00	32,065,865,467.000	35,619,511,820.00
	ROA(Net Profit/Total Assets)	0.0108	0.0117	0.0122
	Equity	2,694,937,962.00	3,082,493,781.000	3,701,961,760.000
	E/A(Equity/Assets)	0.0911	0.0961	0.1039
BRD	Net Profit	-331,176,000.00	335,527,000.00	43,240,000.00
	Total Assets	47,924,059,000.00	47,079,103,000.00	45,179,978,000.00
	ROA(Net Profit/Total Assets)	-0.0069	0.0071	0.0010
	Equity	5,523,521,000.00	5,160,979,000.000	5,492,417,000.000
	E/A(Equity/Assets)	0.1153	0.1096	0.1216
BCR	Net Profit	-1,214,833,000.00	335,527,000.00	-2,629,568,000.00
	Total Assets	70,531,183,000.00	63,509,963,000.00	59,037,134,000.00
	ROA(Net Profit/Total Assets)	-0.0172	0.0053	-0.0445
	Equity	7,123,305,000.00	7,479,850,000.000	5,110,897,000.000
	E/A(Equity/Assets)	0.1010	0.1178	0.0866
BCC	Net Profit	21,666,531.00	38,405,249.000	-169,504,965.000
	Total Assets	4,725,920,079.00	4,063,065,992.000	3,250,453,950.000
	ROA(Net Profit/Total Assets)	0.0046	0.0095	-0.0521
	Equity	364,191,442.00	396,323,888.000	223,617,288.000
	E/A(Equity/Assets)	0.0771	0.0975	0.0688

Source: author's calculation based on the annual reports of the banks for the period 2012-2014

Table 2 presents the values of the standard deviation of the return on total assets ($\sigma(ROA)$) and the Z-score for the four banks, separately for every year, along with the average of the Z-score computed for every year from the individual Z-scores of each bank.

Table 2 The Z-score of the Romanian banks listed on BVB in the period 2012-2014

	2012				2013				2014			
$\sigma(ROA)$	TLV	BRD	BCR	BCC	TLV	BRD	BCR	BCC	TLV	BRD	BCR	BCC
	0.0124				0.0028				0.03219			
Z-score	8.20	8.71	6.74	6.57	38.71	41.91	44.18	38.41	3.61	3.81	1.31	0.52
Mean	7.55				40.8				2.31			

Source: author's processing of the data provided by the banks' annual reports in MS Excel

As it is presented in Table 2, the mean Z-score calculated for every year of the period analyzed in this paper, we can notice that the year 2013 was the peak for the period taking into account for every bank of the sample. Even though the mean value does is not representative for the minimum and maximum value of the indicator, in this case the Z-scores of the banks have close values, meaning that their operational and financial activities were influenced in a similar way by the national or global financial condition of the banking system.

Hence, it is a recommended approach to analyze the components of the Z-score of the sample banks in order to highlight the factors that led to the high upswing from 2012 to 2013 and then its severe decline in 2014.

According to the formula used to compute the Z-score(2), the lower the volatility of the return on assets is, the higher the Z-score and, consequently, the more stable the bank is.

A notable feature in the development of the Z-scores analyzed for the last three years when banks published their annual reports (2012,2013,2014) is that the level of the Z-score declined significantly from 2013 to 2014.

In order to reveal the causes of the significant favourable evolution of the Z-scores for every bank involved in the study, it is important to mention that the return on assets (ROA), calculated as Net Profit/Total Assets was positive for every bank only in 2013, whereas in 2012 BRD and BCR recorded losses and in 2014 BCR and BCC 'contributed' with their loss to the average return on assets of the four banks. The stability of the return on total

assets ($\sigma(ROA)$) was computed for every year based on the individual return on assets ratio of every bank recorded in that year, so the loss of a bank systemically changed the average return on assets of the whole sample for the year in question.

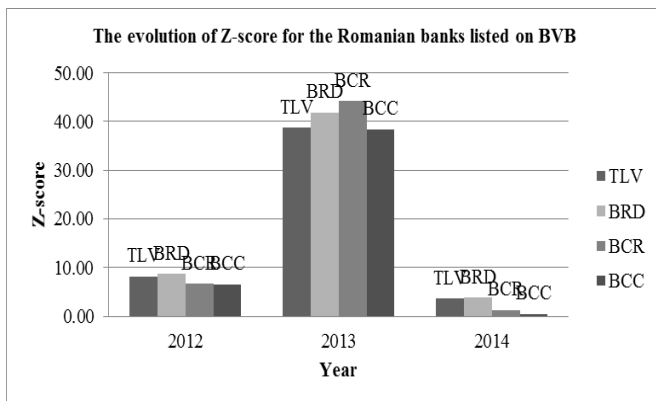
The balance sheet of the Romanian banking system at the end of the year 2014 reveals the largest loss in history, i.e. 1 billion euros, exactly the profit it recorded in 2008, during the economic boost and before the global financial crisis outburst. From 39 commercial banks and a single co-operative bank, 23 credit institutions recorded cumulative losses of 1,4 billion euros, whilst the other 17 credit institutions gained 0,4 billion euros. Mainly, the causes of this colossal loss are: the NBR requests to reevaluate loan guarantees, especially real estate mortgage-backed securities, to set up provisions up to 90% of the financing granted to companies entered into insolvency proceedings, to clear portfolios from bad and doubtful loans, which happened at a small extent, since the NPL(non-performing loans to total loans) ratio decreased from 20% to 14% at the end of 2014. (NBR Annual Report, 2014).

In Figure 2 there is represented the evolution of the Z-scores in the three years chosen for the study, where we can clearly see the gaps among the three sets of values corresponding to the years 2012, 2013, 2014, with maximum values recorded in 2013.

On the one hand, the Romanian banking system ended the year 2013 with a cumulative profit of 110 million euros, recorded by 23 banks, whereas 17 banks ended the year on loss, caused by the the weight of the non-performing loans in banks' portfolio.

To put it differently, even though the Z-scores computed for the listed banks on BVB are the highest in our sample in 2013, this is not a sufficient criterion to measure the banking system stability, given the fact that 17 banks out of 40 still recorded losses.

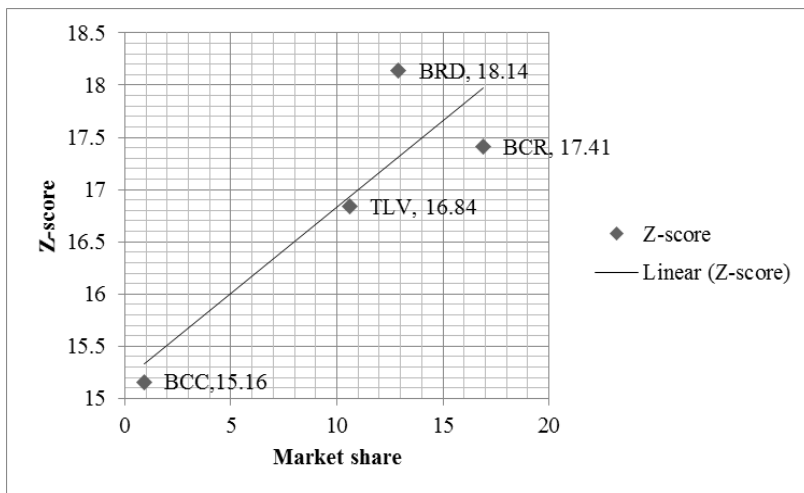
Figure 2 The evolution of Z-score for the Romanian banks listed on BVB in the period 2012-2014



Source: author's calculation based on the data provided by the banks' annual reports in 2012-2014

In Figure 3 we can see represented the average Z-score obtained for every bank in the study during the analyzed period of time in relation with the bank's market share. The overview of this representation may admit a positive relationship between the market share and the Z-score of each bank, but we cannot conclude this is a rule, since this analysis requires to expand the time horizon and the sample of banks to assess. Nevertheless, this can be a relevant subject for further research, as a part of a more elaborate study on the factors that influence the Z-score and their quantitative impact.

Figure 3 The relationship between the market share of the banks and their Z-scores



Source: author's representation based on the data provided by the banks' annual reports and author's own calculations of banks' Z-score

5. Conclusions

This paper's main objective was highlighting the role of a popular and simple method of financial assessment at the level of individual banks, taking into consideration that each bank contributes to the aggregate profit of the banking system and to its cumulative risk as well. The Z-score is an elegant method to determine the vulnerable periods of time which an institution undergoes and to compare the financial stability of a bank to that of other banks. However, given the few variables that the Z-score encompasses, such as return on assets, equity to assets ratio and the volatility of the return on total assets, this method gives useful information regarding potential threats to a bank's stability. The initial Altman model, compiled for manufacturing firms and several revised versions of it allow situating a firm in a dangerous or safe area due to a preset range of values that diagnose a firm as being stable or unstable. In the case of the Z-score for banks, we do not have a range of values to give a precise verdict in terms of financial health, but it is well known that the higher the Z-score is, the more stable the bank is considered.

To conclude, the analysis of the financial health of the Romanian banking system represents a permanent challenge, that requires a complex sets of indicators and models in order to asses financial stability accurately. Given the changes which have been occurring in the banking system in the last years after the global financial crisis and the huge losses the Romanian banks recorded in the sample period of time(2012-2014), financial stability remains an important objective at the micro and macro level.

References

- Al-Laham, Al-Tarawneh, Abdallat (2009). "Development of Electronic Money and Its Impact on the Central Bank Role and Monetary Policy"
- Brito, J. and Castillo, A. (2013). "Bitcoin: A Primer for Policymakers", Mercatus Center. George Mason University. Retrieved 22 October 2013.
- Fântână, R.S., 2010, Expertiza mărfurilor de import – export, Editura ProUniversitaria, București, 2010, p.43, ISBN 978-973-129-614-2
- FINCEN, "Statement of Jennifer Shasky Calvery, Director Financial Crimes Enforcement Network United States Department of the Treasury Before the United States Senate Committee on Banking, Housing, and Urban Affairs Subcommittee on National Security and International Trade and Finance Subcommittee on Economic Policy", Financial Crimes Enforcement Network. 19 November 2013. Retrieved 1 June 2014.
- Goswami, A., Quantum Economics: Unleashing the Power of an Economics of Consciousness Paperback, May 11, 2015
- Kondratenko A., Physical Modeling Of Economic Systems. Classical and Quantum Economies, Novosibirsk "Nauka", 2005
- Marx, K. (1973), Grundrisse, The Pelican Marx Library: Harmondsworth.
- O'Sullivan, Arthur; Steven M. Sheffrin (2003). Economics: Principles in action. Upper Saddle River, New Jersey 07458: Pearson Prentice Hall. p. 261. ISBN 0-13-063085-3.
- Ricardo, D. (1817), On the Principles of Political Economy and Taxation, J. Murray: London; reprinted Cambridge University Press: Cambridge, 1951.

- Russell, J., (2016), Microsoft will continue to support bitcoin after 'inaccurate information' was posted online, TechCrunch, 14.03.2016, <http://techcrunch.com/2016/03/14/microsoft-quietly-drops-bitcoin-support-from-the-windows-store/>
- Schmitt, B. (1984): Inflation, chômage et malformations du capital. Macroéconomie quantique, Paris and Albeuve: Economica and Castella.
- Schneider, Gary (2010). Electronic Commerce. Cambridge: Course Technology. p. 497. ISBN 0-538-46924-2.
- Smith, A. (1978), The Wealth of Nations, Pelican Classics: Harmondsworth (first published 1776).
- Vukotić, Veselin, Quantum Economics, PANOECOMICUS, 2011, 2, pp. 267-276
- https://en.wikipedia.org/wiki/Quantum_economics