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# The evaluation of stability of Czech and Slovak banks

**JEL Classification:** *G21; C61*

**Keywords:** *commercial banks; stability; banking stability index; Z-score; Czech Republic; Slovakia*

**Abstract**
**Research background:** Commercial banks could affect the stability of the whole banking system due to the way they carry out their business activities. The supervision authorities play a key role in protecting banking stability by ensuring banks´ resilience to shocks, ability to recover their position in response to crisis and ultimately the supervision authorities help prevent failure of these banks. Therefore, in recent years' researchers have been trying to define conditions that could guarantee stability of banks.
**Purpose of the article:** This paper aims to describe the methodology used to measure banking stability, namely banking stability index (BSI) and Z-score. In the first part, we present the literature review, then we try to assess the stability in the condition of the Czech Republic and Slovakia during the period 2006–2016.
**Methods:** The BSI is constructed according to the methodology presented by Ghosh (2011), taking into account the main components, which are described by the set of financial indicators of banks.

**Findings & Value added:** Results showed that the average BSI in the whole sample moved from 0.20454 (in 2015) to 0.2486 (in 2007). The results according to countries have showed that the tendency of development in the Czech and Slovak banking sector was the same. At the beginning of the analyzed period, the Slovak banks were more stable compared to Czech ones. Since 2009 the situation has been different, where the Czech banks could be considered as more stable compared to Slovak ones. The tendency of development of Z-score in both countries could be considered as the same, without the 2009 year, when the Czech banks significantly strengthened their capitalization, which influenced the development of Z-score. The results of correlation analysis between Z-score and BSI pointed to the fact that there was no high correlation between these two measures, therefore it is appropriate to use both methodologies for stability evaluation.

## Introduction

Over the last decades, banking systems in all countries within the European Union (EU) have gone through significant changes that had an impact on the banking stability (Belas & Polach, 2011). One of the most important changes that had impact on the stability during the last years was the deterioration in the quality of the loan portfolio, which led to a rise in credit risk (Sipko, 2014). When we use the non-performing loans to total loans ratio (NPL ratio) as the main indicator of credit risk, we can see that the average NPL ratio in the EU countries rose from 1.8% in 2006 to a high level to 7.8% in 2014. The topic of quality of the loan portfolio has attracted more attention in recent years. Several authors, like Barr and Siems (1994), Männasoo and Mayes (2009), or Jin *et al.* (2011), assessed bank failures and tried to find out if the quality of assets was an indicator of insolvency as banks still had a high NPL value before their bankruptcy. They pointed to the fact that with increasing NPL the ability of banks to increase their performance continued to decline. In addition to credit risk, another important factor in assessing the stability of banks is performance (Cipovova & Belas, 2012; Gavurova *et al.*, 2017). The performance of banks in the EU countries during the last years has also declined, which is evident from the performance ratios. Based on the statistics of European central bank, the average Return on assets in the EU countries declined from 0.52% in 2007 to 0.13% in 2013, and Return on equity decreased from 10.58% in 2007 to 2.24% in 2013.

In the EU countries the banks are business entities, which have a special meaning and role in national economies (Balcerzak *et al.*, 2017; Meluzin *et al*., 2017, 2018a, 2018b). They represent primary financial intermediation, which creates the main channel for mobilization of domestic savings and their transformation into the main source of external capital for firms (Belas *et al.*, 2016; Kljucnikov & Belas, 2016; Toth & Mura, 2014). The logical

consequence of the fact that the banks have an important role in national economies in all EU countries, is the interest of researchers in the issue of performance measurement, which has been presented in many studies (Balcerzak *et al*., 2017, Kljucnikov *et al.*, 2017; Rahman *et al.*, 2017; Kozubikova *et al.*, 2017; Maci *et al*., 2017, Benda-Prokeinová *et al*., 2017). Banks could affect the stability of the whole system due to the way they carry out their business activities. The supervision authorities play a key role in protecting banking stability by ensuring banks´ resilience to shocks, ability to recover their position in response to the crisis, and ultimately the supervision authorities help prevent failure of these banks.

Beside credit risk and performance, other parameters that could affect the stability are liquidity, capital adequacy, currency and interest rate risk, and so on. Therefore, the objective of the current research is to evaluate the banking stability index based on methodology presented by Ghosh (2011). The results of stability index are compared with the standard methodology used to measure the bank´s stability, namely the Z-score. We try to construct a banking stability index (BSI), taking into account the financial strength of banks and the major risks affecting them in the Czech Republic and Slovakia during the period 2006–2016. Compilation of stability index allows to follow the development within the banking system during the specified period but also to compare the stability of banks within the specified banking system. Both methodologies, Z-score and stability index, may allow policy makers and participants in the financial system to better monitor the level of stability.

The recent financial crisis affected the economies of both countries, as well as other countries worldwide, and revealed the problem of the absence of clear banking stability measures. The construction of banking stability index is highly desirable to track the stability level over time and diminish the probability of banking instability through the recognition of its sources. The novelty of the current research is that such an index is being built for both countries at the same time and the quantitative measures (BSI and Z-score) are being compared to select the appropriate model.

In this background, an attempt has been made, in this article, to develop a banking stability index for Slovak and Czech banks by way of combining some of the indicators which are important in gauging the stability of the banking sector. The paper is covered in five sections. In Section 2 we provide a brief of papers trying to measure the banking stability. In Section 3 we provide methodological aspects of constructing banking stability index and Z-score measure, and also data used in the analysis are presented. Section 4 analyses the stability in the condition of the Slovak and the Czech banking market. This section is followed by the conclusion and summary of

the study in Section 5. References used in the study are given at the end of the paper.

## Theoretical framework

In the condition of EU countries, the prosperous development of the national economy is based on the stable development of banks which involves a large number of multi-dimensional criteria. The choice of rating techniques applicable to the relevant banking sector is very important (Kočišová & Stavárek, 2018). Each method has its own specific features, which results in the existence of discrepancies in the results of their evaluation. For this reason, as well as due to the elimination of model risk, numerous methods are recommended in practice to evaluate the bank stability and to create a comparator base (Gavurová *et al*., 2017). In general, most of the studies used two ways of bank stability measures: the first one is Z-score, while the second one is an attempt to construct the banking stability index. In some papers, the specific stability index measured through the Bankometer model is used. Most of the studies dealing with this methodology are located in the condition of Asian countries, but also some studies on the condition of European banking can be seen.

Table 1 provides an overview of indicators used in these studies. In most studies dealing with bank stability assessment, the attention is concentrated on four main areas: capital adequacy, quality of assets, profitability, and liquidity. These areas are in line with so-called CAMELS methodology which is normally used for the assessment of the financial institutions´ soundness. The letters of mentioned methodology indicate five main areas: capital adequacy (C), quality of assets (A), management (M), earnings and profitability (E), liquidity (L), and sensitivity to market risk (S). Therefore, in the assessment of stability, we try to take into account indicators of their financial strength and the major risks affecting them in the Czech Republic and Slovakia during the period 2006-2016.

## Methodology and data description

In this section, we try to describe the methodological process of construction of banking stability index (BSI) based on methodology presented by Ghosh (2011). Based on the literature review in Table 1 we select four main dimensions of operations realised by the bank: capitalization, credit

risk, profitability, and liquidity. Table 2 presents four main dimensions, specified indicators and their expected impact on the BSI.

Before compiling the BSI, the data must go through a process of adjustment and normalization. In the first step, indicators must be adjusted in order to lead to an increase in stability. This ensures that higher value of all individual indicators leads to improvement in bank operations in that dimension which should lead to improvement of stability. On the other hand, the decline means deterioration of bank operations and therefore the decline of bank stability. The process of adjustment is necessary in case of indicators where the negative impact is expected (Table 2). In case of these indicators, the reciprocal values must be taken.

As individual indicators show varying variability, they must be normalized in the second step. The normalization ensures that their values are placed on the same scale in the interval from zero to one [0; 1]. This standardization is referred to as empirical normalization. According to this normalization, each value of the indicator is compared to its limit values (minimum and maximum) during the whole analysed period, where the normalized values represent the deviation from the limit values. The main advantage of empirical normalization is that normalized values of indicators lie within a small interval which increases the effect of the indicator on the composite index. The formula that represents this method is as follows (Petrovska & Mihajlovska, 2013):

$$I_{i,k,t}^{n} = \frac{I_{i,k,t} - Min(I_i)}{Max(I_i) - Min(I_i)} \tag{1}$$

where:
$I_{i,k,t}^{n}$ is a normalized value of indicator *i* for *k*-th bank in period *t*;
$I_{i,k,t}$ is a value of indicator *i* for *k*-th bank in period *t*;
$Min(I_i)$ and $Max(I_i)$ are the minimum and maximum of the indicator *i* in the analysed period.

In case of dimensions where only one indicator is used the index for *j*-th dimension for *k*-th bank in period *t* is calculated as the normalized value of indicator *i* in specified dimension ($d_{j,k,t} = I_{i,k,t}^{n}$). In case of dimensions where *m* indicators are used the index for *j*-th dimension for *k*-th bank in period *t* is calculated as the average of normalized values of all indicators in specified dimension ($d_{j,k,t} = \sum_{i=1}^{m} I_{i,k,t}^{n}/m$). As the result of this part of procedure, four indexes for four main dimensions ($d_{j,k,t}$, where $j = 1, 2, 3, 4$) are set up for each *k*-th bank in period *t*. Based on methodology presented

by Ghosh (2011) in *j*-dimension space, the BSI for *k*-th bank in period *t* is given by equation (2) according to:

$$BSI_{k,t} = 1 - \frac{\sqrt{\sum_{j=1}^{4}(1 - d_{j,k,t})^2}}{\sqrt{j}} \tag{2}$$

In other words, according to Ghosh (2011), the BSI is the normalized Euclidean distance of the actual point from the ideal point (which is 1 that represents the higher achievement in all four dimensions). Given that the minimum and maximum values are likely to be time-varying in nature, the BSI has the flexibility to appropriately take this aspect into account. It, therefore, allows for comparing the extent of stability of a bank over the time as also relative to other banks. Taking that into account, the BSI is both dynamic and flexible.

The second methodology used to evaluate the bank stability is the standard methodology of Z-score calculation. To approximate the stability of banks, the Z-score can be used (as, for instance in Berger *et al.*, 2009; Fiordelisi & Mare, 2014; Capraru *et al.*, 2016). The indicator is estimated as follows:

$$Z - score_{k,t} = \frac{ROA_{k,t} + E_{k,t}/TA_{k,t}}{\sigma_{ROA_T}} \tag{3}$$

where:
$ROA_{k,t}$ is the return on assets for *k*-th bank in period *t*,
$E_{k,t}/TA_{k,t}$ denotes the equity to total assets ratio for *k*-th bank in period *t*,
$\sigma_{ROA_T}$ is the standard deviation of return on assets over the full sample period (*T* years).

According to the Fiordelisi & Mare (2014), the Z-score provides a measure of bank soundness as it indicates the number of standard deviations by which returns have to diminish in order to deplete the equity of a bank. A higher Z-score implies a higher degree of solvency and, therefore, it gives a direct measure of bank stability.

The stability of individual banks in the Czech and Slovak banking sector for the period since 2006 to 2016. The analysis is based on the data of domestic banks, which comprises more than 75% of total assets in 2016 in their country. The number of analysed banks from both countries in each year move from 22 to 26. In our analysis, we calculate the stability of each

from analysed banks and we compare the average stability of banks in two banking sectors separately according to bank headquarters to one of the countries.

The data were collected from banks´ annual reports, where unconsolidated statements were used. The data were used to calculate financial ratios. Descriptive statistic and development of average values of all variables used in the evaluation of stability is given in Table 3 and Figure 1.

Capitalization measures banks´ solvency and refers to the ability of a bank to meet all its debt immediately. Too low levels of this ratio point to potential failures and may indicate future banking crisis. Regulatory pressure and increased demand for higher levels of core capital, as well as the expectation of the effects of new Basel III accords, have led to the increase in quality and quantity of equity capital since 2008 (Figure 1). This significant increase in 2009 is more evident in the case of CR, which was followed by decrease till 2013. The level of capitalization was lower in a case of Slovak banks at the beginning of the analysed period. Since 2008 gradual increase in capitalization can be seen and since 2013 the level of capitalization is approximately the same in both countries.

The NPL ratio captures the value of loans for which the bank expects that it will have difficulty to collect. The ratio has risen significantly since 2007 in both countries, but a longer increase can be seen in the case of Czech banks. The credit risk significantly decreased during the period from 2007 to 2013 in case of Czech bank, when reached its minimum. In the case of SR, the increase is evident only till 2009, later the development can be considered as stable.

Return on equity and Return on assets are a bank profitability indicator designed to measure the efficiency in using the capital of shareholders and total assets. The decrease in return on equity and return on assets in 2009 and 2011 could be influenced by the formation of provision for non-performing loans. In 2009, the low profitability was influenced by the global financial crisis and in the case of Slovak banks by the adoption of the euro. In 2010, the Slovak banking sector recorded a significant growth in profitability, which was influenced by the retail sector, decline in provisioning for loans and increase of interest margin from transactions with businesses. Since 2011 the development can be considered positive in both countries.

The liquidity of bank influences the bank´s ability to withstand financial shocks. It is most often assessed by the share of LATA. This indicator reflects the maturity structure of assets, and may point to excessive maturity mismatch and a need for more careful liquidity management. TLTA is also sometimes used to detect problems — a high ratio indicating potential li-

quidity stress within the bank. This ratio may also reflect the loss of depositor and investor confidence in the long-term viability of the institution (Sundararajan *et al*., 2002). The liquidity measured by the share of LATA significantly decreased since 2008 in the case of Slovak banks and since 2010 since Czech banks. The reason for this decrease was primarily the reduction in the volume of liquid assets, which was the result of several movements (e.g. decrease in interbank assets and a decrease in short-term loans). The ratio of TLTA indicates that the liquidity slightly decreased in case of Slovak banks. The opposite situation can be seen in the case of Czech banks, where the share of illiquid loans on the total assets slightly decrease, which increase the level of liquidity within the group of analysed banks from CR.

## Results and discussion

Following the methodology described in the previous section, we evaluated the stability of all banks in the estimation set and calculated Z-score and BSI for each bank during the period 2006–2016. We pooled the cross-country data, which allowed us to focus on determining relative differences in stability across banks. The stability was evaluated separately on the "national" and "international" level. Under the "national" approach the average Z-score and BSI for each country in the specified year were calculated as the average of estimated Z-scores and BSIs of Czech banks and Slovak banks separately. In the case of "international" approach, the average Z-scores and BSIs were calculated from data of all banks in a specified year. The results are recorded in the following figures. The increase in the Z-score and BSI means an improvement of stability while the decrease denotes stability worsening.

Based on the results of Z-score the stability of whole banking sector (Average SR+ CR) decreased since 2006 to their minimum values in 2008 (Figure 2). In this year, the level of banks´ capitalization and profitability was very low, and also the differences between analysed banks were very high. This led to the lowest values of Z-score in 2008. We can suppose that the lowest values in this year mirrored the negative effects of the financial crisis which hit the banking sectors in all EU countries. In next year the level of stability significantly increased, which was due to the increase in bank capitalization, mainly influenced by the Czech banks. This increase was followed by a decrease till 2011. Then, the development could be considered stable.

Based on the BSI slightly decrease in stability of whole banking sector (Average SR+ CR) till 2011 can be seen and then the development could be considered as stable. During the 2006–2011 period, the average value of BSI decreased. This period was characterized by a high credit risk, low profitability, and decreasing liquidity. The lowest values of indexes in this year mirrored the negative effects of the financial crisis and debt crisis which hit the banking sectors in all EU countries. During the 2011–2016 period, the development could be monitored as stable. A positive development in stability during this period was influenced mainly by the growing profitability. The stable development was also influenced by the demand for raising capital adequacy, which was related to the gradual implementation of Basel III. Another factor with the positive impact on the stability especially in a case of CR was the growth of liquidity component, which was positively affected by the development of TLTA.

In the analysis, the Z-score and BSI were calculated also separately for Czech and Slovak banking sectors for the period since 2006 to 2016, on a yearly basis. We observed no dramatic changes in the average stability according to Z-score for Slovakia during the analysed period. The results show that average Z-score in the case of Slovak banks moved from 7.07 (in 2008) to 9.04 (in 2014). In the case of CR, the maximal value (14.92) was reached in 2009, and the minimal value in 2013 (9.05). According to Z-score, we can say that the Czech banks were more stable compared to Slovak ones till 2013, then the development could be considered as comparable. According to BSI, the tendency of development could be considered as comparable during the whole analysed period. We can see a decline till 2013, when the Czech banks reached their minimum (0.2074). After that year, in the case of Czech banks, the stability started to increase, which is not evident in the case of Slovak banks. The Slovak banks reached their minimum at the end of analysed period (0.198). The maximum was reached in the case of both countries in 2007.

Figure 3 displays the contributions of individual components to the BSI in the Czech and Slovak banking sector during the analysed period. The individual components in both countries showed approximately the same trajectories. Regulatory pressure, and increased demand for higher levels of core capital, as well as the expectation of the effects of new Basel III accords, have led to the increase in quality and quantity of equity capital. The significant impact of capitalization in recent years positively affected the growth of BSI mainly in the case of the Czech Republic.

The credit risk was the minor component of BSI, therefore there is no significant impact of asset quality on stability. The quality of asset positively influenced the BSI of both countries, mainly at the beginning of the ana-

lysed period. After the crisis years, when the NPL ratio significantly increased, the positive impact of quality of asset was no more observed.

The major component which positively affected the stability of banks was profitability component. The share of this component on the whole index was by more than 60%. The share of profitability component on the BSI in CR during the whole analysed period was relatively stable. In the case of Slovak banks, a gradual increase of influences of the profitability component on the BSI can be seen since 2009. The reason why the profitability components had the highest impact on BSI was that the values of ROA and ROE had lower volatility (was more concentrated around the median value), and values of both indicators were skewed towards higher values. As the difference between indicators values and maximum values was not high, in the process of empirical normalization the normalized values become very high, close to one.

The final aspect of the stability is liquidity, which significantly affected the stability in both countries. The impact is more evident in the case of Slovak banks at the beginning of the analysed period and in the case of Czech banks in 2016. The reason for liquidity increase in case of Slovakia at the beginning of the analysed period was the balanced structure of liquid assets and long-term assets, and a relatively high share of LATA of analysed banks. In the case of Czech banks, the increasing importance of liquidity component in last year was positively influenced by the decreasing share of illiquid loans on total assets.

In last part of our paper, we try to compare the results of both stability measures by correlation analysis (Figure 4). The results pointed to the fact that the correlation between these two measures is not high, as the correlation coefficient takes the value 0.2349 in case of Slovakia and 0.5892 in the case of the Czech Republic. This supports our choice of considering two alternatives measures of bank stability.

## Conclusions

In the last decade there have been a number of studies which have attempted to answer the question what influence the stability of banks and thus the stability of the whole banking system. However, the results are far from being conclusive, since they depend on the period, countries analysed and methodology used. Therefore, the aim of this paper was to assess the main parameters affecting the stability of banks and we tried to construct a BSI based on methodology presented by Ghosh (2011). The results of BSI were compared with the Z-score. We tried to construct a BSI, taking into account

the financial strength of banks and the major risks in line with CAMEL methodology. The stability was evaluated for the sample of banks in the Czech Republic and Slovakia during the period 2006–2016. The individual components of the BSI in both countries showed approximately the same trajectories. As can be seen, individual components of BSI didn't have the same importance on the aggregate value of index. During the whole analysed period, the profitability component had the highest positive impact on BSI. The second component with a high impact on stability was the liquidity component. In parallel, the quality of asset and capitalization remained stable and had a relatively low stable effect on the BSI. The second presented methodology was calculation of Z-score. Based on the results of Z-score, the average stability for both countries decreased since 2006 to their minimal values in 2008. In the next year the level of stability significantly increased, which was due to significant increase in capitalization, mainly influenced by the Czech banks. This increase was followed by a decrease till 2011. Then, the development could be considered as stable. After the estimation of both stability measures, we compared the results by correlation analysis. The results support our choice of considering two alternatives measures of stability, as the correlation between them was not high.

What can be considered as the limitation of our study is that data for all banks were not available during the whole analysed period. As the bank branches are not obliged to publish unconsolidated information about their businesses in the country, we could not involve those branches into the analysis. We can suppose that the stability of these banks should not have a significant impact on the stability of whole banking sector, but on the other hand, we cannot neglect some influence of these banks. As the discussion for next research can be considered how to involve all banks in the analysis and evaluate if the outlier values of individual indicators can affect negatively the value of banking stability index and Z-score.

## References

Balcerzak, A. P., Kliestik, T., Streimikiene, D., & Smrčka, L. (2017). Nonparametric approach to measuring efficiency of banking sectors in European Union countries. *Acta Polytechnica Hungarica*, *14*(7). doi: 10.12700/APH.14.7.2017.7.4.

Bank of Albania (2010). Financial stability report. Retrieved from: http://www.bankofalbania.org/web/Financial_Stability_Report_2010_H1_5948_2.php (26.06.2015).

Barr, R., & Siems, T. (1994). Predicting bank failure using DEA to quantify management quality. *Federal Reserve Bank of Dallas, Financial Industry Studies. Working Papers, 94*.

Belas, J., Vojtovic, S., & Kljucnikov, A. (2016). Microenterprises and significant risk factors in loan process. *Economics and Sociology*, *9*(1). doi: 10.14254/2071-789X.2016/9-1/3.

Belas, J., & Polach, J. (2011). Economic imbalance and regulatory traps in banking sector. In E. Jircikova, E. Pastuszkova & J. Svoboda (Eds.). *Finance and the performance of firms in science, education, and practice*. Zlín.

Benda-Prokeinová, R., Dobeš, K., Mura, L., & Buleca, J. (2017). Engel's Approach as a tool for estimating consumer behaviour. *E & M Ekonomie a Management*, *20*(2). doi: 10.15240/tul/001/2017-2-002.

Berger, A. N., Klapper, L. F., & Turk-Ariss, R. (2009). Bank competition and financial stability. *Journal of Financial Services Research*, *35*(2). doi: 10.1007/s10693-008-0050-7.

Budiman, T., Aldrin, H., & Farida T. K. (2017). An evaluation of financial stress for Islamic banks in Indonesia using a bankometer model. *Journal of Finance and Banking Review*, *2*(3).

Capraru, B., Moise, N. I., Nistor Mutu, S., & Petria, N. (2016). Financial stability and concentration: evidence from emerging Europe. *SSRN*. Retrieved form: https://ssrn.com/abstract=2898033.

Central Bank of the Republic of Turkey (2008). Financial stability report. Retrieved from: http://www.tcmb.gov.tr/ wps/wcm/connect/28a21c82-97f2-4155-b096-df7983662b4b/fulltext6.pdf?MOD=AJPERES&CACHEID=28a21c 82-97f2-4155-b096-df7983662b4b (26.03.2015).

Cipovova, E., & Belas, J. (2012). Assessment of credit risk approaches in relation with competitiveness increase of the banking sector. *Journal of Competitiveness*, *4*(2). doi: 10.7441/joc.2012.02.05.

Da Silva, T. P., Leite, M., Guse, J. C., & Gollo, V. (2017). Financial and economic performance of major Brazilian credit cooperatives. *Contaduría y Administración*, *62*(5). doi: 10.1016/j.cya.2017.05.006.

Fiordelisi, F., & Mare, D. S. (2014). Competition and financial stability in European cooperative banks. *Journal of International Money and Finance*, *45*. doi: 10.1016/j.jimonfin.2014.02.008.

Gavurova, B., Belas, J., Kocisova, K., Kliestik, T. (2017). Comparison of selected methods for performance evaluation of Czech and Slovak commercial banks. *Journal of Business Economics and Management*, *18*(5). doi: 10.3846/16111699.2017.1371637.

Gersl, A., & Hermanek, J. (2007). Financial stability indicators: advantages and disadvantages of their use in the assessment of financial system stability. *Occasional Publications-Chapters in Edited Volumes.*

Gersl, A., & Hermanek, J. (2008). Indicators of financial system stability: towards an aggregate financial stability indicators? *Prague Economic Papers*, *2*.

Ghosh, S. (2011). A simple index of banking fragility: application to Indian data. *Journal of Risk Finance*, *12*(2). doi: 10.1108/15265941111112839.

Ginevičius, R., & Podviezko, A. (2013). The evaluation of financial stability and soundness of Lithuanian banks. *Ekonomska Istraživanja*, *26*(2). doi: 10.1080/1331677x.2013.11517616.

Jin, J. Y., Kanagaretnam, K., & Lobo, G. J. (2011). Ability of accounting and audit quality variables to predict bank failure during the financial crisis. *Journal of Banking & Finance*, *35*(11). doi: 10.1016/j.jbankfin.2011.03.005.

Kljucnikov, A., Kozubikova, L., & Sopkova, G. (2017). The payment discipline of small and medium-sized enterprises. *Journal of Competitiveness*, *9*(2). doi: 10.7441/joc.2017.02.04.

Kljucnikov, A., & Belas, J. (2016). Approaches of Czech entrepreneurs to debt financing and management of credit risk. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *11*(2). doi: 10.12775/ EQUIL.2016.016.

Kočišová, K., & Stavárek, D. (2018). The evaluation of banking stability in the European Union countries. *International Journal of Monetary Economics and Finance*, *11*(1). doi: 10.1504/IJMEF.2018.090566.

Kozubikova, L., Homolka, L., & Kristalas, D. (2017). The effect of business environment and entrepreneurs' gender on perception of financial risk in the SMEs sector. *Journal of Competitiveness. 9*(1). doi: 10.7441/joc.2017.01.03.

Laila, N., & Widihadnanto, F. (2017). Financial distress prediction using bankometer model on islamic and conventional banks: evidence from Indonesia. *Journal of Economics and Management*, *11*(S1).

Laznia, M. (2013). Where can we find the most stable banks? Slovenská banková asociácia. Retrieved from: http://www.sbaonline.sk/sk/presscentrum/aktuality/tema-kde-najdeme-najstabilnejsie-banky.html (27.03.2015).

Maci, J., & Hovorkova, V. (2017). Loan versus bond financing of Czech companies and the influence of the global recession. *Journal of Competitiveness*, *9*(1). doi: 10.7441/joc.2017.01.05.

Maudos, J. (2012). Financial soundness indicators for the Spanish banking sector: an international comparison. *SEFO-Spanish Economic and Financial Outlook*, *1*(4).

Männasoo, K., & Mayes, D. G. (2009). Explaining bank distress in Eastern European transition economies. *Journal of Banking & Finance*, *33*(2). doi: 10.1016/j.jbankfin.2008.07.016.

Meluzín, T., Balcerzak, A. P., Pietrzak, M. B., Zinecker, M., & Doubravský, K. (2018a). The impact of rumours related to political and macroeconomic uncertainty on IPO success: evidence from a qualitative model. *Transformations in Business & Economics*, *17*(2), 148-169.

Meluzín, T., Pietrzak, M. B., Balcerzak, A. P., Zinecker, M., Doubravský, K., & Dohnal, M. (2017). Rumours related to political instability and their impact on IPOs: the use of qualitative modeling with incomplete knowledge. *Polish Journal of Management Studies*, *16*(2). doi: 10.17512/pjms.2017.16.2.15.

Meluzín, T., Zinecker, M., Balcerzak, A. P., Doubravský, K., Pietrzak, M. B., & Dohnal, M. (2018b). The timing of initial public offerings – non-numerical model based on qualitative trends. *Journal of Business Economics and Management*, *19*(1). doi: 10.3846/jbem.2018.1539.

Miklaszewska, E., & Kil, K. (2015). The impact of the 2008 crisis on the banking sectors of the CEE-11 countries: multi level performance (MLP) score as a synthetic measure of bank risk adjusted performance. *Ekonometria*, *4*.

Petrovska, M., & Mihajlovska, E. M. (2013). Measures of financial stability in macedonia. *Journal of Central Banking Theory and Practice*, *2*(3).

Rahman, A., Belas, J., Kliestik, T., Tyll, L. (2017). Collateral requirements for SME loans: empirical evidence from the Visegrad countries. *Journal of Business Economics and Management*, *18*(4). doi: 10.3846/16111699. 2017.1357050.

Sipko, J. (2014). Imbalances and debt crisis in the Euro area. *Ekonomický časopis*, *62*(3).

Sundararajan, V., Enoch, C., San José, A., Hilbers, P., Krueger, R., Moretti, M., & Slack, G. (2002). *Financial soundness indicators: analytical aspects and country practices* (Vol. 212). Washington, DC: International Monetary Fund.

Tóth, Z., & Mura, L. (2014). Support for small and medium enterprises in the economic crisis in selected EU countries. In *Hradec Economic Days 2014: Economic Development and Management of Regions, PT V*. Hradec.

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## Annex

**Table 1.** The review of studies

| Author (Year) | Country | Methodology | Indicators |
|---|---|---|---|
| Miklaszewska & Kil (2005) | CEE countries | Z-score | Return on assets (ROA), Total equity to total assets (ETA) |
| | | Bankometer | ETA, Tier 1 to total asset (T1TA), Capital adequacy ratio (CAR), Non-performing loans to total loans (NPL ratio), Cost to income ratio (CI), Total loans to total assets (TLTA) |
| Gersl & Hermanek (2007, 2008) | Czech Republic | Stability index | CAR, NPL ratio, ROA, Return on equity (ROE), Liquid assets to total assets (LATA), Liquid assets to total deposits, Cumulative net balance sheet position to 3 month to total assets, Absolute value of open total position in foreign exchange to Tier 1 capital, Absolute value of open balance sheet position in foreign exchange to Tier 1 capital |
| Central Bank of the Republic of Turkey (2008) | Turkey | Stability index | NPL ratio, Non-performing loans to total equity, Fixed assets to total assets, LATA, Absolute value of open total position in foreign exchange to Tier 1 capital, Absolute value of open balance sheet position in foreign exchange to Tier 1 capital, ROA, ROE, CAR, Free capital to total assets, Cumulative net balance sheet position to 1 month to total equity |
| Berger et al. (2009) | 23 developed nations | Z-score | ROA, ETA |
| Bank of Albania (2010) | Albania | Stability index | NPL ratio, Non-performing loans to total equity, Fixed assets to total assets, LATA, Assets with a maturity up to 3 months to liabilities with a maturity up to 3 months, Absolute value of open total position in foreign exchange to Tier 1 capital, Absolute value of open balance sheet position in foreign exchange to Tier 1 capital, ROA, ROE, CAR, Free capital to total assets, Cumulative net balance sheet position to 1 month to total equity |
| Shar et al. (2010) | Pakistan | Bankometer | ETA, T1TA, CAR, NPL ratio, CI, TLTA |
| Ghosh (2011) | India | Stability index | Loan-loss provisions to total assets, CAR, ROA |
| Maudos (2012) | Spain | Stability index | ROA, CAR, CI, NPL ratio |
| Ginevičius & Podviezko (2013) | Lithuania | Stability index | CAR, Net interest income to risk weighted assets, TLTA, Non-performing loans to total assets, Loan value decrease to total assets, Non-interest expenses to gross income, Pre-provision profit to risk weighted assets, Net income to risk weighted assets, Total deposits to total loans, Regulatory liquid ratio |
| Laznia (2013) | Slovakia | Stability index | ROA, Total deposits to total loans, CAR, NPL ratio |

**Table 1.** Continued

| Author (Year) | Country | Methodology | Indicators |
|---|---|---|---|
| Petrovska & Mihajlovska (2013) | Macedonia | Stability index | CAR, NPL ratio, Annual growth rate of non-performing loans, ROE, Non-interest expenses to gross income, LATA, Liquid assets to total deposits, Net open position in foreign exchange to total equity |
| Fiordelisi & Mare (2014) | Austria, France, Germany, Italy, Spain | Z-score | ROA, ETA |
| Capraru et al. (2016) | Central and Eastern Europe | Z-score | ROA, ETA |
| Budiman et al. (2017) | Indonesia | Bankometer | ETA, T1TA, CAR, NPL ratio, CI, TLTA |
| Da Silva et al. (2017) | Brazilia | Stability index | ETA, Total loans to total equity, TLTA, Operating expenses to total assets, Total revenue to total assets, ROA, ROE, Total deposit to total assets, Total deposit to total equity |
| Laila & Widihadnanto (2017) | Indonesia | Bankometer | ETA, T1TA, CAR; NPL ratio, CI, TLTA |
| Keffala (2018) | 24 emerging countries | Stability index | Loan-loss provisions to total assets, CAR, ROA |

**Table 2.** Review of selected indicators

| Dimension | Adjustments | Indicators | Impact |
|---|---|---|---|
| Capitalization | Normalization | Total equity to total assets (ETA) | + |
| Credit risk | Adjustment and normalization | Non-performing loans to total loans (NPL ratio) | - |
| Profitability | Normalization | Return on assets (ROA) | + |
| | Normalization | Return on equity (ROE) | + |
| Liquidity | Normalization | Liquid assets to total assets (LATA) | + |
| | Adjustment and normalization | Total loans to total assets (TLTA) | - |

**Table 3.** Descriptive statistics of variables; 2006–2016

| | | ETA | NPL ratio | ROA | ROE | LATA | TLTA |
|---|---|---|---|---|---|---|---|
| **CR** | Minimum | 0.0155 | 0.0004 | -0.0577 | -0.2768 | 0.0537 | 0.1742 |
| | Maximum | 0.8234 | 0.3443 | 0.0419 | 0.5413 | 0.7495 | 0.9213 |
| | Average | 0.1205 | 0.0727 | 0.0088 | 0.0963 | 0.2650 | 0.5642 |
| | St. deviation | 0.1014 | 0.0538 | 0.0121 | 0.0990 | 0.1614 | 0.1879 |
| **SR** | Minimum | 0.0285 | 0.0010 | -0.0693 | -1.0431 | 0.0815 | 0.3027 |
| | Maximum | 0.1589 | 0.2538 | 0.0217 | 0.2778 | 0.7937 | 0.9651 |
| | Average | 0.0941 | 0.0471 | 0.0061 | 0.0574 | 0.3430 | 0.6651 |
| | St. deviation | 0.0252 | 0.0368 | 0.0116 | 0.1474 | 0.1560 | 0.1359 |
| **CR+ SR** | Minimum | 0.0155 | 0.0004 | -0.0693 | -1.0431 | 0.0537 | 0.1742 |
| | Maximum | 0.8234 | 0.3443 | 0.0419 | 0.5413 | 0.7937 | 0.9651 |
| | Average | 0.1072 | 0.0598 | 0.0074 | 0.0767 | 0.3043 | 0.6150 |
| | St. deviation | 0.0747 | 0.0477 | 0.0119 | 0.1270 | 0.1632 | 0.1711 |

**Figure 1.** Development of variables (in %)

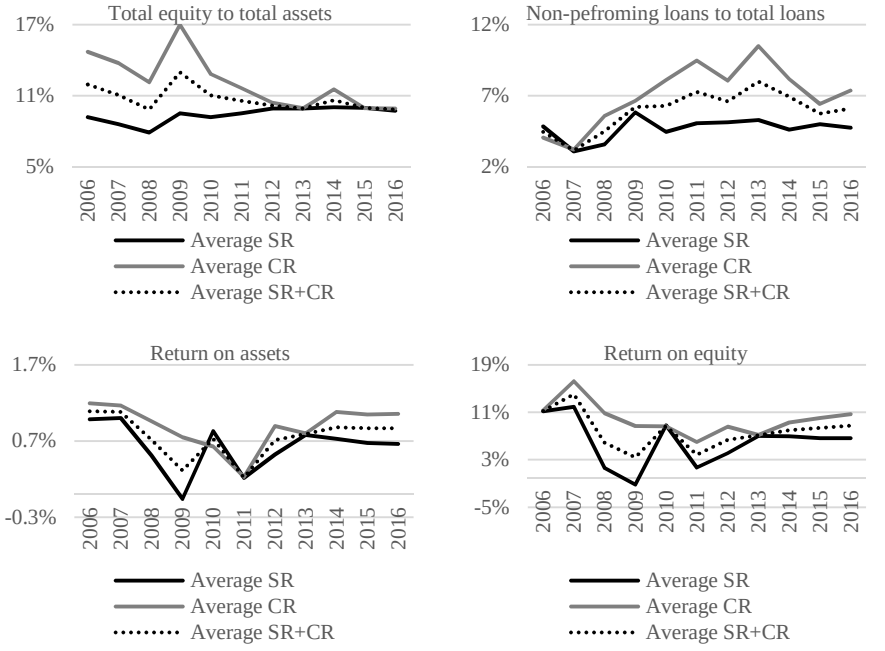
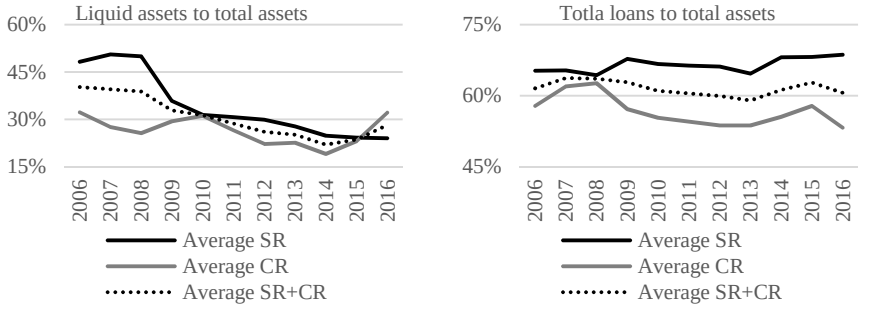


**Figure 1.** Continued




Source: Prepared by authors

**Figure 2.** Development of stability measures in individual countries

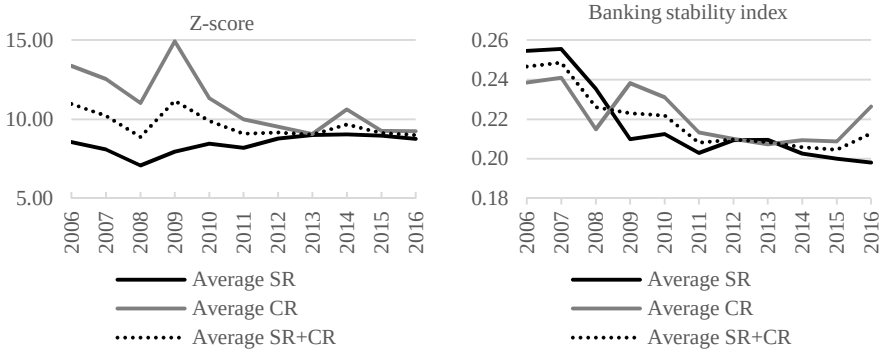


**Figure 3.** Contributions of individual components in the banking stability index in individual countries

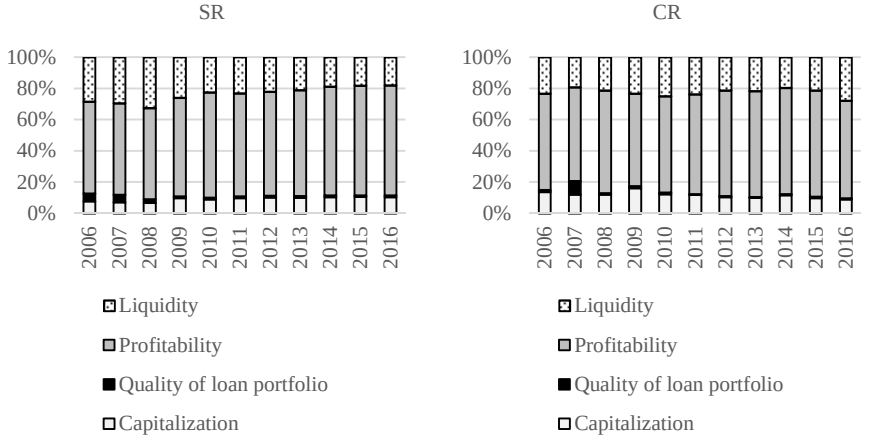



**Figure 4.** Correlation between Z-score and banking stability index in individual countries