SERVICE-ORIENTED EFFICIENCY OF SLOVAK BANKS

Martin Boďa – Emília Zimková

Abstract

The paper investigates into the efficiency of the Slovak banking industry over the period of 2000 – 2011 through the prism of the service-oriented approach to the perception of efficiency of commercial banks. The aim of the paper is to benchmark individual Slovak commercial banks with respect to their efficiency status that they exhibit in their operations. To this end, the non-parametric method of evaluation is employed based on the slack-based measure (SBM) model of data envelopment analysis under the assumption of variable returns to scale in the operations of Slovak commercial banks. The methodological procedure is based on dividing the entire period of 2000 – 2011 under the evaluation into three sub-periods identified in the development of the Slovak banking sector, represented by time spans 2000 – 2003, 2004 – 2008 and 2009 – 2011. For each sub-period it is assumed that the production function remains the same which permits pooling individual commercial banks for years covered by the three sub-periods for their joint efficiency assessment. Most commercial banks were found highly technically efficient in providing their services and that they are comparatively efficient in receiving deposits and granting loans

Key words: efficiency, the Slovak banking industry, SBM model, the profit approach.

JEL Code: C44, G21.

Introduction

Over recent years, the topic of measuring efficiency of commercial banks has acquired wide attention. Three leading approaches, viz. the service-oriented approach, the intermediation approach and the profit approach, have been developed and are used intensively in evaluating efficiency of commercial banks. It seems that that the intermediation approach is pre-dominant in empirical studies and that other approaches are not given sufficient attention. Having this in mind, this paper focuses on the service-oriented approach which is taken as the underlying standpoint under which Slovak banks are evaluated with respect to their technical efficiency. As such, the paper is a natural continuation of the research conducted by the

authors who in a previous article of theirs (Boďa & Zimková, 2013) evaluated Slovak banks from the perspective of the profit approach.

Similarly as in the previous paper, the non-parametric slack-based measure (SBM) model is applied here with the service-oriented approach of interpreting bank's efficiency to a data set of eleven organisational units of the Slovak banking industry for the period of the years 2000 – 2011. During this period, the Slovak banking sector has gone through some changes as to its structure, competitiveness and regulation. Nonetheless, three periodization landmarks were identified and reasoned out, inside which it is assumed that the production function did not change and the production frontier remained invariant to a time shift. These landmarks divided the entire period of twelve years into three sub-periods, over which the data on individual organizational units of the Slovak banking industry were pooled for their joint evaluation. In each sub-period, individual organisational units were evaluated and their efficiency was determined by the slack-based measure.

The paper is organized in 5 sections, the first of which is introductory and the last is concluding. The second section explains the service-oriented approach for measuring efficiency of commercial banks, the third section is methodological and is followed by the fourth section which presents the results and includes their interpretation.

1   Conceptual issues and an overview of the literature

Conceptual views of efficiency of commercial banks differ. Individual theoretical concepts concur that commercial banks are agents of a transformation process and that during this process they transmute a set of inputs into a set of outputs. These inputs and outputs are linked in operations of commercial banks through a production function, which specifies the maximum attainable outputs at the given level of inputs. On the one hand, there is an explicit or implicit agreement that such a functional relationship exists; on the other hand, there is no general agreement on the production function of commercial banks which would reflect the aims that commercial banks seek to pursue.

So far three main approaches have been developed and used both in theory and practice, and these are the intermediation approach, the service-oriented approach and the profit approach. The primary source of difference between them is the treatment of deposits, which have both input and output characteristics. Only the service-oriented approach is of import to the paper.

The service-oriented approach views deposits as outputs. It assumes that the aim of commercial banks is to produce deposits (liabilities) as well as loans (assets) and other services. One of the first studies under this approach was Benston (1965). The data used by him contain operating costs of six types of services (demand deposits, time deposits, mortgage loans, instalment loans, business loans, and securities) and the average number of deposit or loan accounts. The service-oriented approach to efficiency of commercial banks both promoted and investigated by Benston (1965) has two main disadvantages. The first drawback is that it requires a detailed database which is not disclosed to the public. It contains information about the number of deposit accounts and loan accounts and their operational cost allocation. Therefore the production approach by Benston (1965) is usually used within the bank for comparing bank branches in terms of their efficiency. The second disadvantage of the service-oriented approach is that it does not take into consideration interest costs. Kamecka (2010) in her research proposed to consider deposits to be an output together with loans and the interest income.

There also were some other investigations into the efficiency of the banking industry in the area of the Visegrad Group, such as Kenjegalieva, Simper & Weyman-Jones (2009), Řepková (2012a, 2012b), Stavárek & Řepková (2012) or Stavárek (2006). A valuable source of information were the articles by Andries (2011) and Pastor, Perez & Quesada (1997).

The most commonly used approach in the banking industry is probably the intermediation approach but this approach cannot account for all aspects that are present and perceptible in commercial operations of the Slovak banking sector. The negligence of other approaches in empirical research leaves some room for a further investigation.

2 Methodology

In order to determine the technical efficiency of organizational units of the Slovak banking sector under the service-oriented approach, the SBM analysis was applied on the panel data of eleven organizational units of the Slovak banking sector during the period from 2000 to 2011. The methodological procedure stands on several assumptions that underlie and shape the line of research and they are summarized and explained in brief in the following text.

The assumption of the production frontier time invariance during three identified phases of the Slovak banking sector development.

Every sensible and interpretable application of the DEA rests on the explicit assumption of the existence of a production frontier that delimits the set of all disposable

inputs and attainable outputs. The optimization task of a chosen DEA model then constructs in a non-parametric fashion the production frontier and measures in an appropriate way the distance of individual production units from the production frontier and captures it in the form of a score (used in assessing the relative efficiency of a given production unit and in the benchmarking). However, it often happens that the production frontier changes over time (even this change is required for the theory of economic growth to be valid and hold). However, in some consecutive periods the production frontier due to the inertia of the economic environment may remain invariant with respect to a time shift. This view is applied in the paper and it is believed that there are some phases in the evolution of the Slovak banking sector during which its production frontier remained intact and free of shift. During the period from 2000 to 2011, three sub-periods can be identified and justified: 2000 – 2003, 2004 – 2008, 2009 – 2011. The justification is given in the previous paper by the authors (Boďa & Zimková, 2013).

The selection of organizational units of the Slovak banking sector and the selection of a particular set of inputs and outputs with each approach.

The dataset comprises the data on 11 organizational units (commercial banks) operating in the Slovak Republic and it covers the great majority of Slovak banking structures (as the total of included banks exceeds 90 % of the Slovak banking assets). The organizational units considered in the paper are listed in Table 1. In order to assure consistency of the analysis, building societies and special financial institutions are subject to exclusion. The source of the data is TREND Holding, s.r.o., Bratislava.

Tab. 1: Organizational units of the Slovak banking sector subjected to the analysis

Organizational unit	
Citibank Europe plc, foreign bank subsidiary (before 2009 Citibank (Slovakia), a. s.)	
Československá obchodná banka, a. s. (in 2009 merged with Istrobanka, a. s.)	
Prima banka Slovensko, a. s. (before 2011: Dexia banka Slovensko, a. s.)	
Privatbanka, a.s. (before 2005 Banka Slovakia, a. s.)	
OTP Banka Slovensko, a. s.	Poštová banka, a.s.
Slovenská sporiteľňa, a. s.	Tatra banka, a.s.
VOLKSBANK Slovensko, a. s. (since 2013 Sberbank Slovensko, a. s.)	
Všeobecná úverová banka, a. s.	
UniCredit Bank Slovakia, a. s. (a 2007 merger of UniBanka, a. s. & HVB Bank Slovakia, a. s.)	

Source: the authors.

The data used in the empirical analysis are the yearly data of balance-sheet items disclosed by the eleven organizational units of the Slovak banking sector during the period

2000 – 2011. During the period some of the organizational units underwent a merger or a takeover, it was therefore necessary to operate with totals on the banks which changed its legal and economic status. The data on these banks were aggregated as a total and only the merger or the acquisitor is considered. The hypothesis on the time-invariance of the production function permitted the pooling of individual organizational units in the identified phases and resulted in "bank-years". Only the data for 4 bank-years were not complete (ČSOB / Istrobanka 2007 & Citibank 2009, 2010, 2011). In consequence, the first phase was represented by $11 \times 4 = 44$ bank-years, the second phase included $11 \times 5 - 1 = 54$ bank-years, and finally, the third phase was formed by $11 \times 4 - 3 = 41$ available bank-years. The data are evaluated within the framework of the DEA separately; in other words, the DEA was conducted for each of the three phases independently.

Two inputs and three outputs were recognized in the study. The selected inputs were bank capital and total operating expense and they were compared with total deposits, total loans and net interest income as the outputs. The pooling of the data from different years necessitated their deflation for a proper analysis. Individual data were deflated to the prices of 2000 by the GDP deflator provided by Eurostat.

The employment of the SBM model

In this paper, the assumption of variable returns to scale is formed (which, of course includes a specific case of constant returns to scale) and combined with a non-oriented SBM model in evaluating the organizational units of the Slovak banking sector on a comparative basis. Most empirical studies use in their analysis the rudimentary CCR or BCC model. This study thus goes farther.

For each commercial bank it is necessary to solve a task of linear programming of the non-oriented SBM model under the assumption of variable returns to scale, which produces – amongst other – the coefficient of efficiency (so-called SBM technical efficiency scores). This coefficient takes values at interval [0, 1] and if it for some commercial unit it attains the value 1, this commercial bank is called SBM efficient, which means that it is technically efficient in the sample of commercial banks under the evaluation.

In the paper, three runs of the SBM analysis were made with 2 inputs and 3 outputs, one for each phase. In the first phase, the number of commercial banks was 44, in the second phase, 54, whilst in the third phase, 30.

3   Results and interpretation

All computations were performed in program R (R Development Core Team, 2013) by means of functionalities included in package nonparaeff (Oh & Suh, 2013). The results are displayed compactly in Table 3; which presents the information on the achieved SBM score for each organizational unit of the Slovak banking sector in each phase. The (simplifying if understandable) designations of individual organizational units indicated in the table are also used in the interpretations.

Tab. 3: Results of the application of the SBM model in the individual phases

FIRST PHASE		SECOND PHASE		THIRD PHASE		FIRST PHASE		SECOND PHASE		THIRD PHASE	
YEAR	SCORE	YEAR	SCORE	YEAR	SCORE	YEAR	SCORE	YEAR	SCORE	YEAR	SCORE
Citibank						ČSOB / Istrobanka					
2000	0.648	2004	1	2009	NA	2000	1	2004	0.735	2009	0.712
2001	0.741	2005	0.528	2010	NA	2001	1	2005	1	2010	0.672
2002	1	2006	1	2011	NA	2002	0.756	2006	0.891	2011	0.652
2003	1	2007	0.606	---	---	2003	1	2007	0.618	---	---
---	---	2008	0.645	---	---	---	---	2008	NA	---	---
OTP Banka Slovensko						Poštová banka					
2000	1	2004	0.584	2009	0.751	2000	0.439	2004	0.338	2009	1
2001	0.524	2005	0.667	2010	0.793	2001	0.501	2005	0.285	2010	1
2002	0.425	2006	0.660	2011	0.742	2002	0.502	2006	0.356	2011	1
2003	0.557	2007	0.657	---	---	2003	0.487	2007	0.398	---	---
---	---	2008	0.735	---	---	---	---	2008	0.542	---	---
Prima banka						Privat banka					
2000	0.722	2004	0.815	2009	1	2000	0.691	2004	1	2009	1
2001	0.838	2005	0.779	2010	1	2001	0.858	2005	0.638	2010	0.933
2002	1	2006	1	2011	0.873	2002	1	2006	1	2011	1
2003	0.881	2007	1	---	---	2003	1	2007	1	---	---
---	---	2008	1	---	---	---	---	2008	1	---	---
Slovenská sporiteľňa						Tatra banka					
2000	1	2004	0.626	2009	1	2000	1	2004	0.782	2009	1
2001	1	2005	0.764	2010	1	2001	0.883	2005	0.813	2010	0.839
2002	1	2006	1	2011	1	2002	1	2006	0.895	2011	0.820
2003	1	2007	1	---	---	2003	0.799	2007	0.932	---	---
---	---	2008	1	---	---	---	---	2008	1	---	---
UniCredit Bank						VOLKSBANK Slovensko					
2000	0.654	2004	0.673	2009	0.688	2000	0.651	2004	0.473	2009	0.574
2001	0.671	2005	0.641	2010	1	2001	0.624	2005	0.496	2010	0.645
2002	1	2006	0.775	2011	1	2002	0.561	2006	0.556	2011	0.673
2003	1	2007	1	---	---	2003	0.552	2007	0.552	---	---
---	---	2008	0.804	---	---	---	---	2008	0.597	---	---
Všeobecná úverová banka											
		2000	1	2004	0.718	2009	1				
		2001	0.635	2005	0.723	2010	1				
		2002	0.595	2006	0.774	2011	1				
		2003	0.664	2007	0.873	---	---				
		---	---	2008	1	---	---				

Source: the authors.

The results indicate that, during the investigated period of 12 years, most banks manifested technical efficiency in terms of their provision of services on a comparative basis, and were capable of a relatively efficient transformation of bank capital and total operating

expense into total deposits, total loans and net interest income. The value 1 of the efficiency score does not imply that a given commercial bank cannot perform better and operate under a more convenient relationship of inputs and outputs. However, it rather means that it represents a certain technological benchmark for the other commercial banks and that it appears efficient in the group of commercial banks under the investigation. In the first sub-period of 2000 – 2003, only two commercial banks did not attain in any year of this 4-year sub-period the efficiency score 1, in the second sub-period of 2004 – 2008, there were three such banks and the same number was found in the third sub-period of 2009 – 2011. This is suggestive that Slovak banks during the investigated period of 12 years were successful in providing their services and efficiently meet the economic definition of a commercial bank, according to which a commercial bank is the subject that receives deposits and grants loans.

From the perspective of the service-oriented approach, only 3 banks were found comparatively technically efficient during some entire sub-period: Slovenská sporiteľňa in the first sub-period and the third sub-period, Všeobecná úverová banka in the third sub-period and Poštová banka in the third sub-period as well. There also were some shifts in comparative efficiency of some banks. Out of the largest Slovak banks, whilst Všeobecná úverová banka during the three sub-periods tended to improve in its relative efficiency, both Slovenská sporiteľňa and Tatra banka may be said to oscillate around the same level of comparative technical efficiency. In the first sub-period, two commercial banks were found uniformly least technically efficient when compared to the other 9 commercial banks, and they are Poštová banka and OTP banka. Poštová banka exhibited the lowest scores of technical efficiency also in the second sub-period, but in the third sub-period it showed a considerable improvement in the level of comparative technical efficiency. In the third sub-period, the worst comparative technical efficiency was uncovered with VOLKSBANK Slovensko and ČSOB / Istrobanka.

Conclusion

In this paper, 11 organizational units of the Slovak banking sector over the years 2000 – 2011 were evaluated in terms of technical efficiency from the perspective of the service-oriented approach. In the evaluation, a non-parametric SBM model was applied under two crucial assumptions: the assumption of variable returns to scale and the condition that the production frontier remained constant in three identified sub-periods marked in the development of the Slovak banking sector: 2000 – 2003, 2004 – 2008 and 2009 – 2011. In each of these sub-periods, organizational units of the Slovak banking sector were pooled in one data frame,

from which the information on the shape of the production frontier (constant in individual sub-periods and common to all organizational units in the given sub-period) was extracted by in the form of SBM technical efficiency scores. Most organizational units were ascertained highly technically efficient in providing their services and that they are comparatively efficient in receiving deposits and granting loans

Acknowledgment

References

Andries, A. M. (2011). The Determinants of Bank Efficiency and Productivity Growth in the Central and Eastern European Banking Systems. *Eastern European Economics*, 49(6), pp. 38-59.

Benston, G. (1965). Branch banking and economies of scale. *Journal of Finance*, *20*(2), 312-331.

Boďa, M., & Zimková, E. (2013). *Efficiency in the Slovak banking industry: a DEA application of the profit approach*. European financial systems 2013, Telč, the Czech Republic. Submitted for proceedings.

Kamecka, M. (2010). *Bank efficiency in CEE*. (Doctoral dissertation).

Kenjegalieva, K. A., Simper, R., & Weyman-Jones, T. G. (2009). Efficiency in transition banks: inter-country banking industry trends. *Applied Financial Economics*, 19, 1531-1546.

Oh, D.-H., & Suh, D. (2011). *nonparaeff: Nonparametric methods for measuring efficiency and productivity*. R package version 0.5-3. http://CRAN.R-project.org/package=nonparaeff

Pastor, J. M., Perez, F., & Quesada, J. (1997). Efficiency analysis in banking firms: An international comparison. *European Journal of Operational Research*, 98(2), pp. 395-407.

R Development Core Team (2011). *R: a language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

Řepková, I. (2012a). *Measuring the efficiency in the czech banking industry: Data envelopment analysis and malmquist index*. In Ramik J., Stavarek D. (Eds.), *PROCEEDINGS OF 30TH INTERNATIONAL CONFERENCE MATHEMATICAL METHODS IN ECONOMICS, PTS I AND II* (pp. 781-786). Karviná.

Řepková, I. (2012b). *Cost Efficiency of the Czech Commercial Banks*. In Stavarek D., Vodova, P. (Eds.), PROCEEDINGS OF THE 13TH INTERNATIONAL CONFERENCE ON FINANCE AND BANKING (pp. 321-329). Ostrava.

Stavárek, D., & Řepková, I. (2012). Efficiency in the Czech banking industry: a non-parametric approach. *Acta Universitatis Agriculturae et Silviculturae Mendeleianae Brunensis*, LX(2), 357-366.

Stavárek, D. (2006). Banking efficiency in the context of European integration. *Eastern European Economics*, 44(4), pp. 5-31.

Contact

Ing. Martin Boďa, PhD.

Univerzita Mateja Bela v Banskej Bystrici, Ekonomická fakulta

Tajovského 10, 975 90 Banská Bystrica

martin.boda@umb.sk

doc. Ing. Emília Zimková, PhD.

Univerzita Mateja Bela v Banskej Bystrici, Ekonomická fakulta

Tajovského 10, 975 90 Banská Bystrica

emilia.zimkova@umb.sk