EFFICIENCY OF BANKS IN NORTHERN CROATIA

EFIKASNOST BANAKA U SJEVERNOJ HRVATSKOJ

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Primljeno / Received: 16. 9. 2021.
Prihvaćeno / Accepted: 3. 11. 2021.
Izvorni znanstveni rad
Original scientific paper
UDK / UDC: 336.712(497.523:497.525)
[658:330.322] (497.5-17)

ABSTRACT

Banks are important financial intermediaries of any national economy and especially vital in bank-based systems as the one in the Republic of Croatia, where banks hold a crucial role in the financial system, with a share of almost 70% of the total assets of the financial sector in 2018.

This paper aims to evaluate and discuss the relative efficiencies of three small-sized commercial banks operating and headquartered in Northern Croatia by implementing the output-oriented DEA (Data Envelopment Analysis) methodology. The model uses two input and two output variables, following Banker et al. (2010), Cvetkoska et al. (2021a) and Cvetkoska et al. (2021b). Even though the sample consists of 20 banks operating in Croatia at the end of 2019, only three of them are headquartered in Northern Croatia (Banka Kovanica d.d., Varaždin; J&T banka d.d. Varaždin and Podravska banka d.d. Koprivnica). They are the main focus of this research. The time frame is from 2015 to 2019.

The findings show that J&T Banka d.d. Varaždin noted 86.8% efficiency, Podravska Banka d.d. Koprivnica 78.7% and the most efficient of these small-sized banks is Banka Kovanica d.d. Varaždin with an efficiency score of 100% in the whole observed period. The total average efficiency score for the whole Croatian sector is 90.9%.

The findings of this study will provide valuable insights and feedback for the analyzed bank's management as well as for the bank's stakeholders, which would ultimately lead to an improvement of efficiency of the analysed banks, and eventually, the whole banking system. Notwithstanding, the findings could bring light to the fact that small-sized banks operating in rural counties could be neglected by researchers in Croatia, but also globally. The results are somewhat in line with many previous studies that found large banks to be more efficient than small banks.

Keywords: banks, commercial bank, small-sized banks, efficiency, DEA, data envelopment analysis, Northern Croatia

Ključne riječi: banke, komercijalne banke, male banke, učinkovitost, efikasnost, DEA, Analiza omeđivanja podataka, Sjeverna Hrvatska

INTRODUCTION

Banks are one of the most researched institutions worldwide. They are vital financial intermediaries of any national economy and especially important in bank-based systems since their management and efficiency has an important role in the banking sector, especially due to the processes of globalization and internationalization, as well as due to the sensitivity of the activities between the interest groups (Tomičić et al., 2012). Namely, one of the main specifics of banks is a large number of stakeholders with diverse interests, such as shareholders and managers (whose relations and communication are crucial for "good" corporate governance), deponents and bank creditors (as the most specific stakeholders), as well as employees, the country and the broader community, whose interests are being represented by various supervisory and regulatory bodies and judicial authorities (Trifunović, 2009). The banking industry in every economy enjoys great visibility and attention from the public, scholars and the government. The banking sector is held to be the "nerve system of a country's economy". In this sense, if there are malfunctions of the nervous system, the whole body is of no use. In the context of banking, malfunction or failure of the banking system leads to a disastrous situation for the entire financial and economic system (Khan and Khattak, 2016). In developing countries, the importance of the banking industry is even greater. Namely, it is often the most vibrant industry in the developing economies and it "serves as a catalyst for growth and development" (Emori et al., 2014). Furthermore, the banking industry has a major impact on financial stability and economic growth. Because of this, banks have to operate efficiently and at their optimum level so that they could support the stability and growth of the financial sector as a whole. This is the reason why efficiency evaluation studies regarding the banking sectors have become so popular in the past few decades.

The relative efficiency of commercial banks is a very important issue for research, due to banks' vital intermediating role in each economy. However, the question of their performance and efficiency is even more important in developing countries such as Croatia. The reason behind this is simple: the financial markets in Croatia are still underdeveloped, there are not enough diverse tradable financial instruments on the market and the Croatian financial system is a bank-based system, which means that commercial banks play the vital intermediating role of financing, through collecting deposits and transferring them as loans (Kordić & Visković, 2018; Gulin et al., 2012). Furthermore, Croatian banks in 2018 hold a share of almost 70% of the total assets of the financial sector (Cvetkoska et al., 2021a).

The purpose of this article is to evaluate and comment on the efficiencies of three small-sized banks whose headquarters and basis are in the region of Northern Croatia. These are three commercial banks: Podravska Banka d.d. with headquarters in Koprivnica (Koprivničko-križevačka county), Banka Kovanica d.d. and J&T banka d.d. (both with headquarters in Varaždin – Varaždin County).

Banks, like any other business, need to be efficient and profitable. Efficiency is a concept that has been first developed by Farell (1957), but has been further reworked and introduced as the DEA (Data Envelopment Analysis) model in 1978. In this paper, we have followed previous studies of Banker et al. (2010), Cvetkoska et al. (2021a) and Cvetkoska et al. (2021b) and have applied the output-oriented DEA model with two input and two output variables in order to assess and comment on the relative efficiency of each of the three analysed banks based in Northern Croatia.

Our research findings reveal rather interesting facts regarding the position and efficiency of small-sized banks in Croatia. They also represent results that are exclusive for banks in Northern Croatia. This is why this research would bring a significant contribution to the existing literature.

The remainder of this paper is structured as follows. Following the Introduction, in Section 2 the Croatian banking sector has been presented, with all of its characteristics and specifics. In Section 3 (Literature review), the relevant literature of DEA in the Croatian banking sector is given, and their findings have been elaborated. Section 4 describes the selected methodology and data. Section 5 presents the results of the research, supported by the analysis and opens up a discussion, while Section 6 concludes the paper and gives guidance for future research.

THE BANKING SECTOR IN CROATIA

In the early 1990s, when the inception of the Croatian banking system occurred, it had faced many inherited problems from the socialist legacy in Croatia, but most of them have been resolved over the years and most of the bank's assets in the early 2000s were already foreign-owned (Galac & Kraft, 2001). The Croatian banking sector has also undergone substantial changes over the last three decades, becoming "a more propulsive and competitive sector with a significant contribution to social stability and economic development" (Pervan et al., 2015). However, the process leading up to this market-based banking practice was not smooth. The Croatian banking market was not isolated from "tectonic" structural changes (Davidović et al., 2019), and in order to get there, Croatia was obliged to transform and restructure its banking system (Jemrić & Vujčić, 2002). In 1990, the Croatian banking sector consisted of 26 state-owned banks. This number has risen to 60 banks in 1997, but ultimately the transactions of M&As, the entrance of foreign ownership and the intense competition in the market led to a decrease in the number of operating commercial banks in Croatia (Tipurić, Kolaković & Dumičić, 2002).

The Croatian financial system nowadays is a bank-centric continental system where banks play the crucial intermediation role of transferring funds to the economy. It represents a "pillar for the national economy and its stability, because of the important role in the financing of economic activity" (CBA, 2020; Kordić & Visković, 2017). The banking sector in 2019 consisted of 20 commercial banks, which operate in a highly concentrated market, where the leading five banks control over 80% of the total assets in the whole banking sector. The Croatian banking sector is mostly foreign-owned (with 90.2%), with mostly Italian (48,9%) and Austrian shareholders (29,9%) (Banks bulletin, 2019; Peša et al., 2021; Cvetkoska et al., 2021a). Furthermore, the banking system notes quite high capital adequacy ratios in the past few years, and a capital adequacy ratio of 22.9% at the end of 2018 (Cvetkoska et al., 2021b). With such a high total capital ratio, the Croatian banking system is among the ten best-capitalized banking systems in the world (CBA, 2020). According to the abovementioned, the efficiency of banks is vital because it affects the soundness of the financial sector and the viability of the whole monetary system. Furthermore, the soundness and efficiency of small-sized banks operating and headquartered in small Croatian counties are even more appealing.

In 2021, the NUTS-2 (Nomenclature of Territorial Units for Statistics) in Croatia have been revised and there are currently four statistical regions in Croatia, which are: City of Zagreb, Northern Croatia, Adriatic Croatia and Pannonian Croatia. This paper analyses the efficiency of commercial banks based in the region of Northern Croatia.

LITERATURE REVIEW

There are a couple of commonly used approaches for measuring the efficiency of financial institutions in the existing literature. These are the parametric and the non-parametric approaches (Tuškan & Stojanović, 2016; Cvetkoska et al., 2021). Non-parametric approaches can handle multiple outputs, which is not the case with the parametric approaches. According to Jemrić et al. (2002), DEA could be perceived as an alternative to regression analysis. While regression analysis relies on central tendencies, DEA is based on extreme observations. In the regression approach, a single estimated regression equation is assumed to apply to each observation vector, whereas DEA analyzes each vector (DMU) separately, producing individual efficiency measures relative to the entire set under evaluation. This is one of the main reasons why the Data Envelopment Analysis (DEA) has received so much praise, application and popularity in the past four decades since its introduction in 1978.

However, studies regarding the efficiency of the Croatian banking sector with the application of the DEA methodology are relatively scarce. Namely, the authors have browsed the Croatian Scientific Bibliography Database (also known as CROSBI) using the keywords "DEA" and "banking" combined, and this resulted in only 15 papers, of which only 6 regarded the Croatian commercial banks, while the other papers discussed and investigated foreign banking sectors or are cross-country studies. And even though the banking industry in Croatia is sufficiently explored and investigated with 2081 studies on CROSBI (using the keywords "bank" or "banking"), it is safe to assume that the DEA methodology still struggles to find its way to the Croatian researchers and academics and its application is modest, to say the least

(Fotova Čiković et al., 2021). Hunjak and Jakovčević (2001) claim that this is due to some "subjective reasons", such as the required supplementary education of management for DEA to be utilized to the full extent, but also several objective reasons resulting from its main limitations. Jemrić & Vujčić (2002) state that the main limitation of DEA is that the "frontier is sensitive to extreme observations and measurement errors since the basic assumption is that random errors do not exist and that all deviations from the frontier indicate inefficiency". However, Gardener et al. (2011) note that the possibility to be adapted and used for small samples is what makes DEA so popular.

In this paper we focus on assessing and analysing the relative efficiency of three commercial banks from Northern Croatia, hence we have surveyed all of the applications of DEA solely in banking in Croatia (i.e. cross-country studies were not taken into consideration). Accordingly, a total of 8 studies were found (Jemrić & Vujčić, 2002; Jurčević & Mihelja Žaja, 2013; Tuškan & Stojanović, 2016; Kordić & Višković, 2018; Pavković et al., 2018; Davidović et al., 2019; Novak & Hsu, 2020; and Peša, Mate and Prvonožec (2021). Their findings are presented in Table 1. These studies have been published in the period from 2002 to 2021, but there is a huge gap in the literature from 2002 to 2013. The analysed period is diverse. Jemrić & Vujčić (2002) were amongst the first researchers to have dealt with DEA problematics in the early 2000s and are the only researchers referring to pre-2000s, analysing the period from 1995 to 2000. Most of these studies analyse the period between 2005 and 2016. Both CCR and BCC models have been applied, however, it seems that Croatian scientists are keener on using the BCC DEA model with VRS (variable returns to scale).

Table 1: Studies assessing the efficiency of the Croatian banking sector with the implementation of the DEA methodology

Author/s and year of publication	Time frame	Findings
Jemrić & Vujčić (2002)	1995-2000	In the six-year transition period, the Croatian financial system has moved towards the equalization of the banks regarding their technical efficiency, and after 1999 there was a rapid catch-up towards the „normal" levels of efficiency. Foreign-owned banks are on average more efficient compared with domestic banks and that new banks are more efficient than old ones.
Jurčević & Mihelja Žaja (2012)	2005-2010	Lowest efficiency scores in 2008, but with visible lower values of efficiency already in 2007.
Tuškan & Stojanović	2008-2012	CCR-model (output-oriented, CRS): the worst average relative efficiency was recorded in 2012 and the highest in 2008. BCC-model (output-oriented, VRS), the lowest average efficiency was recorded in 2009. DEA window analysis had their lowest values in 2008.
Kordić & Visković (2018)	2016	11 of 24 banks are overall technically efficient in 2016. According to BCC model, 12 banks are pure technically efficient. Inefficient domestic banks were forced to exit from the market and the remaining domestic banks have improved their efficiency over time. The group of large banks is more efficient than medium and small-sized banks. They found statistically no significant difference regarding bank ownership. In their study, they identified the top performers on the market in 2016 are Banka Kovanica d.d. and Zagrebačka Banka d.d.
Pavković, Cesarec & Stojanović (2018)	2004-2016	Results indicate that large banks are the most profitable and most efficient banks' group using variable returns to scale (BCC model), while the medium-sized banks appear most efficient using constant returns to scale (CCR model).
Davidovic, Uzelac & Zelenovic (2019)	2006-2015	Croatian banks have largely benefited from the EU membership, and the efficiency score after the EU association increased by about 45%. Contrary to the agency theory hypothesis, state-owned banks are permanently more efficient than private banks.

Author/s and year of publication	Time frame	Findings
Novak & Hsu (2020)	2014- 2018	Large- and medium-sized banks were not very efficient in the year 2014 and 2015 but they note higher efficiency every consecutive year from 2014 to 2018. The average efficiency scores in the Croatian banks from the years 2014 to 2018 were on the scale of 0.5 to 1. The final results showed that from 2014 to 2018, five to eight banks had perfect efficiency scores of 1. Their study concludes that banking efficiency in Croatia increased after Croatia joined the EU.
Peša, Mate & Prvonožec (2021)	2019	The group of large banks has noted the highest efficiency results. They tried to proved that deposits and loans should be used as key variables in DEA model to measure the efficiency of Croatian banks, but their hypothesis could not be confirmed.

Source: Authors' construction

METHODOLOGY AND DATA

After its introduction in 1978 in the groundbreaking paper *Measuring the efficiency of decision-making units* by Charnes, A., Cooper, W. W. and Rhodes E, Data Envelopment Analysis (DEA) has instantly been recognized as a useful methodology for measuring the relative efficiency of different entities, called Decision Making Units (DMUs), given multiple criteria. However, many scholars argue that Farell (1957) is the father of the efficiency concept and that "in his seminal paper, he has graphically presented the three efficiency measures in a single output case" (Cvetkoska et al., 2021b).

Nevertheless, in the last four decades, the popularity of DEA has expanded and the literature shows that the performance measurement in economics and business has remained the main applicative area of DEA (Neralić & Gardijan Kedžo, 2019). DEA has become increasingly accepted and widely used in measuring efficiency in different national banking industries since it allows comparison of the relative efficiency of banks by determining the efficient banks as benchmarks and by measuring the inefficiencies in input combinations (slack variables) in other banks relative to the benchmark (Jemrić & Vujčić, 2002). Interestingly, according to Emrouznejad & Yang (2018), the majority of DEA studies have been conducted in the following areas: agriculture, banking, supply chain, transportation, and public policy, whereas Emrouznejad & Cabanda (2015) found "banking and finance, education, health care and hospital efficiency, energy and utilities, and transportation" to be the most popular application areas of DEA.

Data Envelopment Analysis (DEA) is currently the leading non-parametric technique for measuring the efficiency of homogeneous units called Decision-Making Units (DMSs). It can be considered as a "useful alternative or complementary analytical tool for detecting early signs of inadequate business strategies" (Tuškan & Stojanović, 2016).

DEA as a linear mathematical programming approach and as one of the most used frontier methods assigns a score of 1 to a DMU only when the comparisons with other relevant DMUs don't prove its inefficiency in the use of any input or output, and assigns an efficiency score less than 1 to relative inefficient units. However, researchers should bear in mind that when using DEA, we always think of relative efficiency because its measurement by DEA is regarding to some set of units we are comparing with each other. The efficiency score is usually expressed as either a number between 0-1 and a percentage 0-100%. A DMU with a score below 100% is deemed inefficient relative to other units (Gökşen et al., 2015; Cvetkoska, 2011). That being said, DEA gives benchmarking feedback regarding the reference set for each relative inefficient DMU (Decision Making Unit). As Maletić et al. (2013) state, DEA lets researchers observe a set of points and construct the line that wraps them (envelope), which represents the limit of efficiency. The main purpose of DEA is to identify the best practice units (DMUs), i.e. the units that are relative efficient and have a score of 1 (or 100%), so that the best practice frontier is constructed and all analysed DMUs are related to the frontier (Hartwich et al., 1999).

In this study, we follow Banker et al. (2010), Cvetkoska et al. (2021a) and Cvetkoska et al. (2021b) in the selection of the used inputs and outputs under the income-based approach, together with the output-oriented BCC DEA model. This BCC DEA model is "one of the most used models in the DEA literature, as well as in analyzing the banking efficiency in Croatia" (Cvetkoska et al., 2021b). The time frame is from 2015 to 2019, a total of 5 years and the year 2020 has not been taken into consideration due to the unavailability of financial reports and publications. Furthermore, the year 2020 was a rather untypical year, because of the unfavourable economic trends caused by the coronavirus pandemic. In 2020, most of the systemic and credit risks for the banking sector have increased. This has affected the trend of significant improvement in the quality of banks' loan portfolios. The deteriorating macroeconomic environment has caused an increase in credit risk, which has adversely affected the profitability of banks, and there has been a noticeable increase in the risk of concentration of exposure due to the rapid growth of government lending. However, current high levels of capital and liquidity provide ample room for amortization of expected shocks. In conditions of impaired profitability, the continuation of structural changes in the direction of digitalization of operations will be challenging, but also necessary for the sustainable operations of the banks after the pandemic (Financial stability report, 2021). This can be subject to future research, to assess the extent to which the COVID-19 has affected bank efficiency in the Republic of Croatia, and small-sized banks in particular.

The envelopment form of the model used is given in (1) - (5), [Cooper et al. (2007)]:

$$\text{(BCC - Oo)} \quad \max_{\eta_B, \lambda} \eta_B \tag{1}$$

$$\text{subject to} \quad X\lambda \leq x_o \tag{2}$$

$$\eta_B y_o - Y\lambda \leq 0 \tag{3}$$

$$e\lambda = 1 \tag{4}$$

$$\lambda \geq 0 \tag{5}$$

where η_B is a scalar. The input data for DMUj (j=1,…,n) are $\left(x_{1j}, x_{2j}, \ldots, x_{m_j}\right)$, and the output data are $\left(y_{1j}, y_{2j}, \ldots, y_{sj}\right)$; the data set is given by two matrices *X* and *Y*, where *X* is the input data matrix, and *Y* is the output data matrix, λ is a column vector and all its elements are non-negative, while is a row vector and all its elements are equal to 1 [Cooper et al. (2007), pp. 22, pp. 91-92, Cvetkoska & Barišić (2017), pp. 33-34]. The DMU is BCC efficient if the efficiency score is equal to 1 (100%) and its slacks are equal to 0. See more about the BCC DEA model in Banker et al. (1984) and Cooper et al. (2007, pp. 90-94).

Collection of deposits and lending transactions are assumed to be banks' core business. The main groups of income and expenses arise from those activities (Jurčević & Mihelja Žaja, 2013). Following Banker et al. (2010), Cvetkoska et al. (2021a) and Cvetkoska et al. (2021b), the selected input and output variables are interest and non-interest income (income from operating activities) as well as interest and non-interest expenses (such as expenses on fees and commissions, general administrative expenses and depreciation, expenses on value adjustments and provisions and other operating expenses) (Table 2).

In this paper, the authors investigate the efficiency of the three small-sized banks in the period from 2015 – 2019. The data for the banks are extracted from the profit and loss account of banks published in the Banks bulletin, a regular publication of Croatian National Bank (CNB) until 2020 and their official financial reports published on their websites.

Table 2: Selected variables for the DEA analysis of efficiency of the Croatian banks

Character of variable	*Variables*	*Elements of the variables*
INPUT	interest expenses (I1)	
	non-interest expenses (I2)	Expenses on fees and commissions
		General administrative expenses and depreciation
		Expenses on value adjustments and provisions
		Other operating expenses
OUTPUT	interest revenues (O1)	
	non-interest revenues (O2)	Income from fees and commissions
		Other operating income

SOURCE: Authors' construction

Namely, many scholars and researchers have covered the topic of banking efficiency in Croatia (Cvetskoska et al., 2021a, 2021b; Jemrić & Vujčić, 2002; Kordić & Visković, 2018; Pavković et al., 2018; Jurčević & Mihelja Žaja, 2013). However, none of them has ever covered the region of Northern Croatia exclusively (covering Međimursku, Varaždinsku, Koprivničko-križevačku i Krapinsko-zagorsku counties).

In the next few passages, a short overview and introduction to the three analyzed banks is given.

J&T Banka d.d. Varaždin has expanded its business in the Republic of Croatia through the acquisition and recapitalization of then-called Vaba Bank d.d. in June 2014. The greatest shareholder (with 82.55%) is the Czech leading bank – J&T bank. In 2020, the Bank operated through two branches and employed a total of 67 full-time workers (Annual report for 2020, 2021).

Podravska Banka d.d. Koprivnica is one of the oldest banks in the Republic of Croatia and its roots go back to Koprivnička dionička štedionica (Equity Savings Bank of Koprivnica), established in 1872. It has been operating under the name Podravska Banka for the last three decades. Based on centuries-old traditions, the Bank profiles itself as a modern financial institution of a universal type. It is in 80% Italian ownership (several small individual shareholders). In 2020, the Bank operated through 22 branches in whole Croatia, but most of these branches (a total number of 13) are located in the region of Northern Croatia.

Banka Kovanica d.d. has been founded in 1997 under the name Štedionica Kovanica d.d. and it has been renamed in Banka Kovanica d.d. in 2002. Since May 2007, Banka Kovanica d.d. is owned by Cassa di Risparmio della Repubblica di San Marino (100% Italian ownership). Banka Kovanica is specialized in retail banking, focusing on consumer lending and working capital financing (factoring). It currently has a business network of 12 branches in 10 major cities throughout the Republic of Croatia.

Commercial banks in Croatia are classified by the Croatian National Bank (HNB), according to their market share. Namely, banks with a market share of less than 1% are considered small-sized banks, banks with a market share between 1 and 5% are considered middle-sized banks and banks with a market share above 5% as large or big banks (Croatian National Bank Home Page, 2021). The three commercial banks that are the core of this research belong to the small banks' group. According to The Banks (2020), J&T Banka d.d. has a 0.26% market share in 2020, Podravska Banka d.d. has a 0.99% and Banka Kovanica d.d. has a market share of 0.34%.

RESULTS AND DISCUSSION

This paper attempts to measure the intermediation efficiency of three small-sized commercial banks operating in the Republic of Croatia and located in the region of Northern Croatia in the period from 2015 to 2019 by employing the DEA BCC output-oriented model. Interestingly, this observed time frame is after the Croatian banking sector had faced many challenging macroeconomic developments, including the aftermath of the global financial crisis, whose impact together with the local economy weaknesses have led to the six years of recession thereafter. This, of course, led to lower banks' performance and efficiency (Pavković et al, 2018).

According to the obtained results of average efficiency in separate years, a slow and continuous increase of efficiency occurred in this sample, starting from 80.7% in 2015, to 91.04% in 2017 and to the highest efficiency noted in 2019: 93.04%. Furthermore, this average efficiency seems to get better every year. Unfortunately, the challenging year 2020 does not leave us much hope for better efficiency results. The coronavirus pandemic has caused unfavourable economic trends and a significant materialization of credit risk. The negative effect due to lower revenues and impairment on financial assets due to the expected losses will significantly affect bank profitability. Although the current trends are unfavourable, high capitalization and liquidity remain the basic features of the banking system of the Republic of Croatia, which will give ample room for amortization of the expected shocks. In conditions of impaired profitability, continuation of structural changes in the direction of further business digitalization will be troblesome, but they are vital for the sustainable operation of banks after a pandemic (Croatian National Bank, 2020).

In Table 3, the efficiency scores per years are presented, together with the mean efficiency scores for the whole analysed period for the sample as well as for each individual bank. Among these three banks, Banka Kovanica d.d. has been most efficient (and relative efficient in tho whole observed period) with 100%, Podravska Banka d.d. has been least efficient bank with an efficiency score of 78.7%, whereas J&T Banka d.d. is somewhere in the middle of these two, with an efficiency of 86.8% for the whole observed period from 2015 to 2019.

As seen in Figure 1, it is obvious that Podravska Banka d.d. has experienced a dramatic fall in efficiency in 2017, whereas J&T Banka d.d. has increased its efficiency in 2017 and has been thereafter relative efficient (with a 100% efficiency score).

Table 3: Mean efficiency scores for Northern Croatia banks in the observed period of 2015-2019

Bank	*2015*	*2016*	*2017*	*2018*	*2019*	*Total average efficiency*
Banka Kovanica d.d., Varaždin	1	1	1	1	1	**1**
J&T Banka d.d., Varaždin	0,6592	0,682	1	1	1	**0,868**
Podravska Banka d.d., Koprivnica	0,7626	0,8735	0,7312	0,7766	0,7912	**0,787**
Average	**0,807**	**0,852**	**0,9104**	**0,925**	**0,9304**	**0,885**

When compared to the average efficiency of the whole Croatian sector (which is 90.9%), it is clear that the findings from this research are somewhat in line with previous studies who claim small-sized banks to be less efficient than medium and large-sized banks (Pavković, Cesarec & Stojanović, 2018; Kordić & Visković, 2018; Davidović et al., 2019; Cvetskoska et al., 2021; Peša, Mate & Prvonožec, 2021) and somewhat in line with the study of Novak & Hsu (2020). Because of this notion, many researchers and scholars today question the sustainability of small banks and propose potential benefits from the further consolidation processes in the banking sector. These results could also be interpreted in the sense of the many articles suggesting consolidation of the banking sector, which could bring business sustainability, enhanced financial stability and profitability growth (Fotova Čiković et al.,

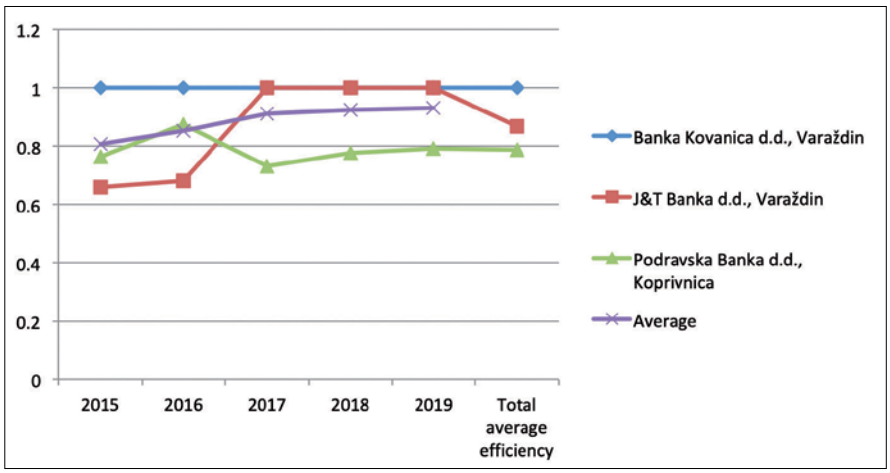

Figure 1: Efficiency results for the sample of three small-sized banks (2015-2019)

Source: Authors' construction

2015; Emeri et al., 2014). Notwithstanding, Šverko et al. (2012) claim that the consolidation of small-sized banks has long been cited as "an inevitable scenario for the development of the banking sector".

However, one of these small-sized banks is an exception to this rule. Namely, Banka Kovanica d.d., Varaždin has noted an average efficiency score of 100% in the whole observed period, which makes it a relatively efficient bank. These results of relative efficiency for five consecutive years can be explained through their increasing business results (Return On Equity was 13.4% in 2019), relatively high capital adequacy ratio (18.0% in 2019) and Banka Kovanica's "prudent investment policy and effective uncollected debt recovery policy as well as the further automation of company processes to optimize the back and middle-office functions" (Annual report for 2019, 2020). The other two banks' inefficiency results (J&T Banka d.d., Varaždin with an average efficiency result of 86.80% and Podravska Banka d.d., Koprivnica with an average efficiency result of 78.70%) could be further interpreted with an in-depth analysis of the macroeconomic environment and their operations in the observed period.

J&T Banka d.d. has started this research with an efficiency score of 0.6592 in 2015 and 0.6820 in 2016, which is quite a low efficiency. However, it has suddenly increased its efficiency in 2017 to 100% and stayed relative efficient till 2019. This "sudden" increase in efficiency could be a result of the strategy alteration in 2017 and the Bank's shift to large corporate clients. This strategy change had also optimized the business processes, organizational structure and impacted the decrease of the number of employees.

Podravska Banka d.d. Koprivnica notes the lowest efficiency results from all of the three analysed banks in Northern Croatia. It has started with an efficiency score of 0.7626 in 2015, increased its efficiency to 87.35% in 2016, only to experience a sharp fall in efficiency in 2017 (73.12%), and started increasing its relative efficiency in 2018 and 2019 (77.66% and 79.12%). The sharp fall of efficiency in 2017 could be explained through the prism of one of the toughest years in Croatian banking when the final fall of the Agrokor Group occurred. This has left the economy and a large portion of entrepreneurs shattered and this could be one logical explanation for this decline in efficiency. Its efficiency in the future could be improved through the implementation of their "digital strategy in the following years, which would bring today's consumers simple and modern interaction with the bank, an improvement of their customer experience, as well as an optimization of the business processes." (Annual report for 2020, 2021).

The ownership of the bank could be an interesting argument for further analysis by researchers and scholars, but it cannot be an argument for this study. Namely, in this case, both Podravska Banka d.d. (with 80% Italian ownership) and Banka Kovanica d.d. (in 100% Italian ownership) are in mostly Italian ownership, and one of them (Banka Kovanica d.d.) is relatively efficient, while the other one (Podravska Banka d.d.) is relative inefficient and noting worst efficiency results from these three banks. J&T Banka d.d., on the other hand, is in 100% Czech ownership (the J&T Finance Group in particular). Bank

ownership of these small-sized banks shows that small North Croatian commercial banks are an interesting investment opportunity for shareholders from the European Union. However, it would be interesting to see how the banks' ownership impacts its efficiency on the sample of the whole Croatian banking system, which is our plan for the next research.

The DEA model used in this study, as any model, presents results influenced by the selected inputs and outputs. The use of different DEA approach (production or profitable) or even a different selection of analyzed variables could result in different efficiency levels and results (Pavković et al., 2018). This should be taken into consideration by future researchers.

CONCLUSION

The efficiency of commercial banks is globally very important, but even more in developing countries, due to its impact both on the stability of the financial system and on the economy's well-being. As Pavković et al. (2018) state, both "profitability and efficiency of the banking sector significantly contribute to the economic growth and stability". This is why the research on banking efficiency is always praised by both the public and the banks' management.

In this paper, we measure the efficiency of three small-sized commercial banks based in the region of Northern Croatia in a period of 5 years (2015-2019) by using the leading non-parametric methodology DEA. We follow Banker et al. (2010), Cvetkoska et al., (2021a) and Cvetkoska et al., (2021b) in the selection of the variables and the DEA model. Based on the obtained results, the average efficiency of the Croatian banking system is 90.9%, and the average efficiency of the three Northern Croatia banks is 88.5%. One of the analysed small-sized banks (Banka Kovanica d.d., Varaždin) has been relative efficient in the whole observed period and has thus debunked the myth that small-sized banks are less efficient than large and medium-sized banks.

This research represents an essential contribution to the previous research papers regarding the efficiency of the Croatian banking sector and has a great scientific value. The important input of the paper is the fact that for the first time in history, three individual banks from Northern Croatia have been screened, thus enabling specialization of the results and findings for their future use and further analysis from the bank management and the interested public. In our further research, we plan to investigate the impact of the COVID-19 pandemic and bank ownership on the efficiency of the Croatian banking sector.

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SAŽETAK

Banke su važni financijski posrednici bilo koje nacionalne ekonomije. Poglavito su značajne u bankovnim sustavima poput onih u Republici Hrvatskoj, gdje banke imaju ključnu ulogu u financijskom sustavu, s udjelom od gotovo 70% ukupne imovine financijskog sektora u 2018.

Cilj je ovog rada procijeniti i raspraviti relativnu efikasnost triju malih poslovnih banaka koje djeluju sa sjedištem u sjevernoj Hrvatskoj primjenom metodologije DEA (*Data Envelopment Analysis* – Analiza omeđivanja podataka). Model koristi dvije ulazne i dvije izlazne varijable, slijedeći Banker et al. (2010), Cvetkoska i sur. (2021a) i Cvetkoska i sur. (2021b). Iako se uzorak sastoji od 20 banaka koje posluju u Hrvatskoj krajem 2019., samo tri od njih imaju sjedište u sjevernoj Hrvatskoj (Banka Kovanica d.d., Varaždin; J&T banka d.d. Varaždin i Podravska banka d.d. Koprivnica). Istraživanje je fokusirano na tri odabrane banke iz sjeverne Hrvatske. Vremenski okvir je od 2015. do 2019. godine.

Rezultati istraživanja pokazuju da je J&T Banka d.d. Varaždin zabilježila 86,8% efikasnosti, Podravska banka d.d. Koprivnica 78,7%, a najefikasnija od ovih malih banaka je Banka Kovanica d.d. Varaždin s rezultatom efikasnosti od 100% u cijelom analiziranom razdoblju. Ukupna prosječna ocjena efikasnosti za cijeli hrvatski sektor iznosi 90,9%.

Rezultati ove studije pružit će vrijedne uvide i povratne informacije za menadžment analiziranih banaka, kao i za dionike banke. To bi u konačnici trebalo dovesti do poboljšanja učinkovitosti analiziranih banaka, a na kraju i cijelog bankarskog sustava. Rezultati istraživanja mogli bi ukazati na činjenicu kako su male banke koje posluju u ruralnim županijama zanemarene u istraživanjima znanstvenika u Hrvatskoj, ali i globalno. Rezultati su donekle u skladu s mnogim prethodnim studijama koje su pokazale da su velike banke efikasnije od malih banaka.