

Efficiency of Islamic and Conventional Banks: Empirical evidence from Bosnia and Herzegovina

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Abstract

This paper aims to investigate the efficiency of the banking sector of Bosnia and Herzegovina (B&H) and to make a comparison between Islamic and conventional banking efficiency. B&H is a European, non-Muslim majority, post-conflict and transition country where there has been significant development of the banking sector in the last two decades. Due to the country's relatively unstable recent history, there has been a lack of academic research on its banking sector. To assess the efficiency level, we employ the multistage Data Envelopment Analysis (DEA) with an output oriented intermediation approach. The analysis covers the period from 2002 until 2015. Our results reveal the higher efficiency of conventional banks to the existing Islamic bank. In addition, we find that larger banks are more efficient. However, our results also suggest significant potential for efficiency improvements in the banking sector as a whole.

Key words : Efficiency, Islamic banking, DEA, Bosnia-Herzegovina

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1. INTRODUCTION

The efficiency of banks is of significant importance for any country due to their "pivotal position in the process of fostering economic growth" (Wanke, et al. 2016, 127), and their significant impact on the growth (Coccorese, 2004). Accordingly, for long-term development, country's economy need a well-functioning financial system (Hassan, et al. 2013). In the last three decades, numerous empirical studies have been conducted on bank efficiency (Emrouznejad et. al, 2008). Although there are many research methods for efficiency analysis, among the most used is DEA, with more than

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10,000 related articles in the literature (Emrouznejad and Yang, 2017). Among the top in the field of Islamic banking efficiency is the study conducted by Hassan and Hussein (2003). Since then, there are many studies that have been done (among others: Hassan, 2006; Srairi, 2010; Abdull-Majid, et. al, 2010; Beck, et. al, 2013; Mokhtar, et. al, 2006, Wanke et. al, 2016). However, Islamic banking still lacks academic evidence on its functioning in general (Beck, et. al, 2013). This specially applies to Western countries with strong Islamic banking presence, since most of the research has been conducted for Muslim-majority countries and regions like GCC countries (Johnes, et. al, 2014, Srairi, 2010), Asian countries (Mokhtar, et. al, 2006, Rosly and Abu Bakar, 2003, Ghroubi and Abaoub, 2016; Omar, et. al, 2007), African countries (Naceur, et. al, 2011), or on a global level (Hassan, 2006, Abdull-Majid, et. al, 2010, Bader, et al. 2008, Beck, et. al, 2013). To the best of our knowledge, Islamic banking in B&H and its efficiency has not been in the research focus of any previous studies. Therefore, our motive is to explore the efficiency of banks in B&H by comparing the efficiency of Islamic bank (IB) and conventional banks (CB). This country has a five hundred year long tradition of Islamic finance practices (Hadzic and Efendic, 2012). B&H is a unique non-Muslim majority² European country in transition, a post-war region with significant development in its banking sector over the last two decades. The Islamic banking efficiency is low in countries that were subject to war in comparison with those with normal conditions (Wanke, et al. 2016). Accordingly, we aim to gather deeper insight in the efficiency of banks in B&H, as a post-war country, and to explore the potentially different efficiency between Islamic and conventional banking. Finally, the size of banks is often found to be relevant to its efficiency (Beck, et al., 2013). After the war ended in 1995, the consolidation, regulation and privatization of the banking sector, together with the entering of foreign banks resulted in a dramatic drop in the number of banks, from seventy in the late nineties (Efendic, 2014) to today's twenty-six (FBA, 2016; ABRS, 2016). This affected the concentration of the sector as well as the size of the banks individually. Therefore, we want to explore the efficiency of different sized CBs and existing IB in B&H. As a method of analysis, we employ a local grand-frontier DEA with output oriented intermediation approach.

The paper is organized as follows: Section 2 provides the literature review. Section 3 presents the Banking sector in B&H, Section 4 covers the data and the methodology. Section 5 presents the Banking efficiency results, while Section 6 provides conclusions with policy recommendations.

2. Muslim population in Bosnia counts 51%, source: Agency for statistics in Bosnia and Herzegovina, Census of population, households and dwellings in Bosnia and Herzegovina, 2013, final results: <http://www.popis.gov.ba/popis2013/knjige.phpid=2>

2. LITERATURE REVIEW

In the last two decades, numerous empirical studies have been conducted on performance and efficiency in Islamic banking. Most of the studies were done for specific regions while the results are significantly different among the countries (Abdull-Majid et al., 2010). Although higher efficiency of Islamic financial institutions are expected (Shili 2013), it is not possible to identify a standardized pattern in the efficiency of IBs compared to CBs. However, there are some studies conducted on a global level as well that find IBs to be less efficient than conventional ones. Among the first to conduct such research was Hassan (2006) who analyzed the efficiency of the Islamic banking industry from different countries, and found that CBs are over performing IBs. Similarly, Back et al. (2013) found that CBs over perform IBs on a global level. This applies to cost efficiency as well where CBs are often found to be more efficient than Islamic ones. The results for cost efficiency are heterogeneous for different countries (Al-Khasawneh et al., 2012). Miah and Sharmeen (2015) found CBs in Bangladesh to be more efficient in managing costs than IBs. Also, Mokhtar et al. (2006) found that CBs have higher efficiency than IBs in Malaysia. On the other hand, Johnes et al. (2009) concluded that IBs have less cost efficiency, but more profit and revenue efficient in GCC, while Srairi (2010) found that IBs in GCC are less cost efficient as well as profit efficient. However, performance of IBs is sub-optimal, which suggests the potential for possible reductions in resources used (Mostafa, 2011).

Recently, Wanke, et al. (2016) found low efficiency of IBs at the global level, but also concluded that competition could bring some positive impulse to the development of IBs. However, this is a challenge at the same time since CBs sometimes have higher efficiency than full-fledged IBs (Majeed and Zanib, 2016). Interestingly, Majeed and Zanib (2016) find that Islamic branches of CBs are more scale-efficient than conventional ones. Ahmad and Abdul Rahman (2012), concluded that IBs in Malaysia have a lower efficiency than CBs, probably because of the higher managerial and technological efficiency. Similarly Hardianto and Wulandari (2016) identified that IBs in Indonesia are also less efficient.

However, there are several studies that find a higher performance and efficiency of IBs compared to conventional ones. Accordingly, Omar et al. (2007) found that IBs in Indonesia are averagely more efficient than their conventional counterparts. In addition, Arslan and Ergec (2010) as well as Ata and Bu?an (2016) reveal that the Islamic or participation banks in Turkey performed better than CBs, while Islam and Kassim (2015) find IBs to be more efficient than their conventional counterparts in Bangladesh. At the international level, Beck et al. (2010) found that IBs are averagely more cost-effective than their CB counterparts.

Mixed results are reported in some studies as well. Ghroubi and Abaoub (2016) observed significantly higher efficiency of CBs compared to Islamic ones. Although the growth rate of revenue efficiency of IBs is less than CBs in the North African Arab countries, Al-Khasawneh et al. (2012) find that IBs have higher revenue efficiency. Khan et al. (2017) find in their study that IBs in Pakistan have better profitability, efficiency, risk, and liquidity management, but lower asset quality. Also, Azad et al. (2017) established that CBs are more efficient in converting earning assets into loans. In addition, the authors found that IBs are better in production as well as in profitability (Azad et al., 2017).

There are several studies that reported almost equal efficiency among Islamic and CBs. Among others, Yahya et al. (2012) observed no difference in the performance of Islamic and CBs in Malaysia, while Bader et al. (2008) revealed no significant difference of CBs and IBs in twenty-one selected countries internationally. Mohamad et al. (2008) also concluded the same in twenty-one OIC countries.

The existing literature is reporting significantly different efficiency of IBs in different countries and regions (Sufian and Noor, 2009). For example, IBs in MENA region are found to be more efficient than the ones that operate in the Asian region (Sufian and Noor, 2009). Also, Tahir, et al. (2011) showed that IBs operating in the Middle East are more efficient from the non-Middle Eastern banks. In addition, Sufian and Kamarudin (2015) demonstrated that domestic IBs in Southeast Asian are more revenue efficient than foreign IBs. Literature on bank efficiency reported significant differences in efficiencies of IBs compared to conventional ones in different regions and countries (Abdull-Majid et al., 2010).

The size of the bank is relevant for its efficiency with a positive impact of size on the bank efficiency (Poghosyan and Poghosyan, 2010, Staikouras et al., 2007; Grigorian and Manole, 2006). The same applies to IBs which are smaller in assets size, hence these banks often do not benefit from economies of scale (Srairi, 2010). Ata and Bagan (2016) discovered that with increase in the size of assets, efficiency of the IB will increase as well. However, Abdull-Majid et al. (2010) found that IBs sometimes do have moderately higher returns to scale than CBs. Islam and Kassim (2015) determined that most of the IBs in Bangladesh recorded optimal scale of operation. Hassan et al. (2009) found better revenue efficiency in big IBs and higher profit efficiency in small IBs. Alternatively, Cihák and Hesse (2010) found that smaller IBs perform better than larger ones. The authors also established that, in terms of small banks, IBs are stronger than conventional ones (Cihák and Hesse, 2010). However, when it comes to analysis of large banks, the opposite was determined to be true. In addition, Cihák and Hesse (2010) concluded that, although IBs tend to be more stable when operating on a small

scale, the opposite applies on a large scale. Hence, IBs should be more focused on increasing their asset size to achieve economies of scale and higher efficiencies (Srairi, 2010).

Due to the geographical position of B&H, being a European country, and the unique population structure with a fifty-one per cent domicile Muslim population, it is identified as one of the countries with significant potential for Islamic banking development (Efendic and Izhar, 2017). In addition, the country is in transition and as a post-conflict country is expected to have lower bank efficiency than stable countries (Wanke et al., 2016). Islamic banking is present in B&H since 2000 (Hadzic and Efendic, 2012), but still lacks academic research. It is not known how Islamic banking affects the performance of the banking system in general. For example, El-Gamal and Hulusi (2005) determined that IBs do not negatively affect the performance of the banking system. Although it is possible that there is no significant relation between bank size and efficiency (Kasman and Yildirim, 2006), Efendic and Avdic (2011) reported that large banks in FBiH³ have higher efficiency than small and medium sized ones. However, to the best of our knowledge, Islamic banking is still unexplored in B&H and the main aim of this study is to contribute to the literature of Islamic banking in this field.

3. THE BANKING SECTOR IN BOSNIA AND HERZEGOVINA

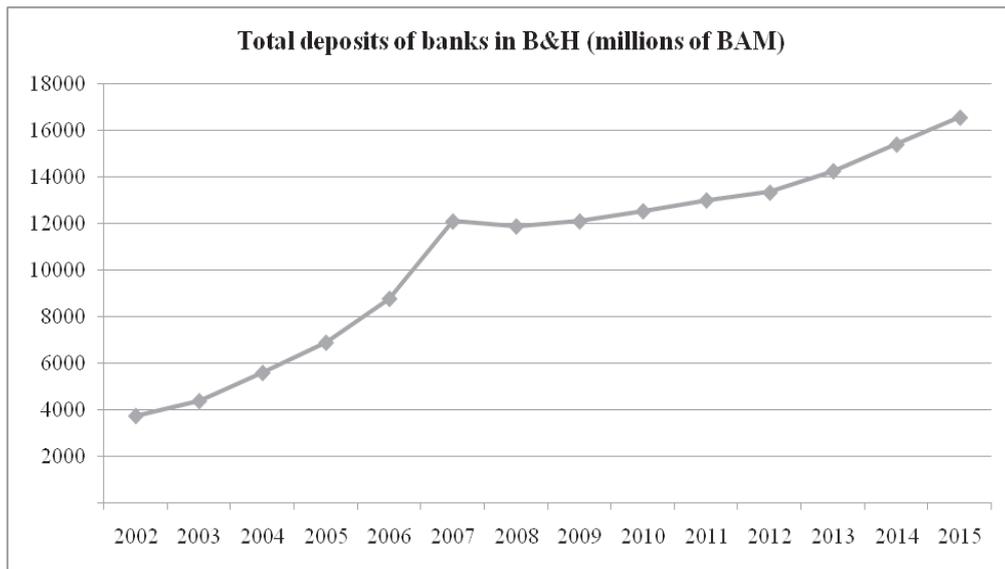
B&H is a European country with a rich heritage of both eastern and western cultures influenced by the two big empires that ruled the country between the fifteenth and nineteenth centuries. Firstly, the Ottoman's ruled the country from the fifteenth until the late eighteenth centuries. This was followed by Austro-Hungarian rule after the Ottoman period until the nineteenth century (Hadzic and Efendic, 2012). As can be expected, each of these empires determined significantly the development of the Bosnian society and economy, as well as financial relations and banking development (Hadzic and Efendic, 2012). With the spread of Islam in B&H, the Ottoman period was a breaking point in cultural, economic and social development of the country. From this period, we have recorded the first cases of lending and deposit activities in B&H. The first exchange officers "sarafi" during the Ottoman period introduced financial activities that laid the foundations of banking development in the country (Hadzic and Efendic, 2012). In the sixteenth century, the first cases of "waqf" institutions appeared with the first models of interest-free loans (Hadzic and Efendic, 2012). When it comes to the modern banking history of B&H, after the Bosnian conflict of 1992-1995, the B&H banking sector was privatized and experienced some significant structural and organizational changes (Efendic, 2014).³

3. FBiH - Federation of Bosnia and Herzegovina - one of the entities in B&H

Today, the B&H banking system is divided into two sectors controlled by two banking agencies at the entity levels⁴, the Banking Agency of Federation of Bosnia and Herzegovina and Agency for banking Supervision in the Republic of Srpska. However, there are no legal barriers for doing business at the state level of B&H, no matter in which entity (banking sector) the bank is established. Accordingly, the B&H banking system works as a single banking market.

The intensive privatization process finished in early 2000s with ninety-eight per cent of private (domestic and foreign) ownership. During the last two decades, the banking system developed significantly and is confirmed by the increase in confidence in the banking system, which is determined by a significant growth of deposits (Figure 1.)

Figure 1. The growth of total deposits in banking sector of Bosnia and Herzegovina

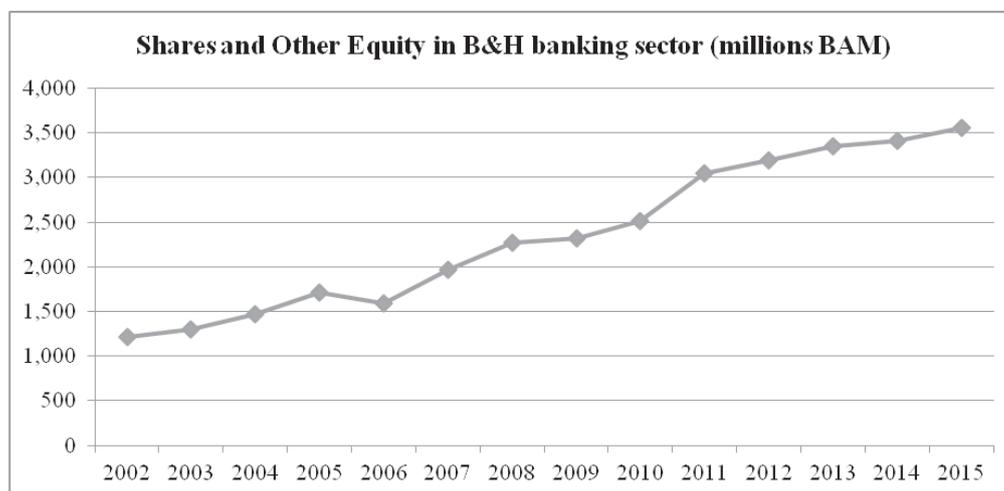


Source: CBBH (2017), statistics of Central bank of Bosnia and Herzegovina, <http://www.cbbh.ba/content/read/915/lang=en> (13.03.2017)

In addition, the capital of the banking sector increased within the analyzed period significantly, which resulted in the higher stability of banks in general (Figure 2).

4. After the war, the country is split into two administrative entities, Federation of Bosnia and Herzegovina (FBiH) and Republic of Srpska (RS).

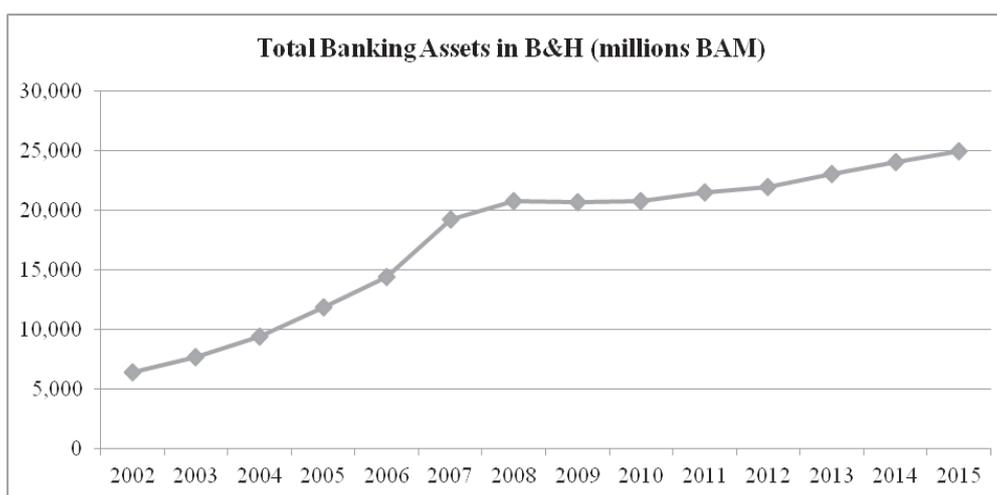
Figure 2. The equity growth in the Banking sector of Bosnia and Herzegovina



Source: CBBH (2017), statistics of Central bank of Bosnia and Herzegovina, <http://www.cbbh.ba/content/read/915?lang=en> (13.03.2017)

However, parallel with the mentioned changes, rapid growth in the concentration of the banking system happened as well. Numerous mergers and acquisitions produced the significant growth in the asset size of the banking sector in B&H (Figure 3).

Figure 3. The growth of total assets in Banking sector of Bosnia and Herzegovina



Source: CBBH (2017), statistics of Central bank of Bosnia and Herzegovina, <http://www.cbbh.ba/content/read/915/lang=en> (13.03.2017)

The first IB was established in 2000 (Bosna Bank International) with capital provided by the Islamic Development Bank (45,46%), Dubai Islamic Bank (27,27%) and Abu Dhabi Islamic bank (27,27%)⁵. Although there is no a special regulation for Islamic banking in B&H, the given bank works according to the local conventional/secular regulation. In the future, regulatory changes are needed for the spread and development of Islamic banking on a larger scale. In 2015, the market share of the IB in total banking assets in B&H was at the level of three per cent.

4. METHODOLOGY AND DATA

The data for this research has been obtained from BankScope data base; the most comprehensive data base of banking reports worldwide. The sample consists of twenty-six banks and includes most of the banks that were active from 2002 to 2015, out of which only one claims to be an IB (Appendix 1).

Due to the limited number of banks in B&H, we took data starting from 2002 until 2015, as the last year for which we have available data from BankScope. In addition, 2002 is the first year with reliable data or financial reports for the IB. Within the given period, significant growth of the banking sector is recorded, which is reflected in our sample statistics. (Table 1.).

Table 1. Statistics of the total assets of the banks in the sample

Total assets in million BAM - Descriptive Statistics					
year	N	Minimum	Maximum	Mean	Std. Deviation
2002	17	21.60	930.60	223.3471	257.38131
2003	18	25.10	1388.10	282.9056	360.01920
2004	16	28.60	2040.00	418.0438	578.98471
2005	16	36.30	2487.00	573.9188	695.04042
2006	16	41.90	3085.60	709.1563	849.75025
2007	17	54.50	3799.30	973.2353	1023.10343
2008	17	53.90	4270.40	1046.3294	1229.10089
2009	16	147.50	4197.00	1077.9250	1229.07769
2010	19	167.30	3722.20	998.3789	1059.67965

5. Source: <http://www.bbi.ba/documents/izvjestaji/2015.pdf> (20.04.2017)

2010	19	167.30	3722.20	998.3789	1059.67965
2011	19	159.90	4015.70	1012.0579	1075.91646
2012	22	103.20	3744.20	906.9500	1010.67426
2013	22	152.30	3779.00	947.9364	1001.21284
2014	22	160.40	3961.80	1025.0955	1000.77264
2015	15	476.50	4517.00	1424.3333	1145.51189

Source: BankScope (2016)

The given table shows a rapid growth in asset size up until 2008, where there is recorded stagnation until 2013 because of the global crisis. However, in the last two years there is recorded re-growth in banking assets which is a sign of the post-crisis recovery.

In the efficiency analysis, we employ the DEA method. This method was introduced by Charnes et al. (1978), who followed Farrell's (1957) work in which he proposes new techniques for performance analysis. The DEA is a linear programming technique in which each analyzed Decision Making Unit (DMU) is compared with a similar one (Coelli, 1996). According to this, the reference DMUs (in our case banks) create the efficiency frontier, while all the banks that are below the efficiency frontier are considered inefficient. The distance from the frontier reflects the level of the inefficiency. Hence, we obtained information on the technical efficiency of each bank in our sample which reflects the ability of the bank's management to find the best way to transform given inputs into the desirable outputs. Accordingly, a full technically efficient bank is considered to be one that maximizes outputs from the given inputs. In the DEA, there are two possible approaches: production and intermediation approaches (Ferrier and Lovell, 1990). According to the "Production approach", the bank is considered as a DMU that transforms the inputs like labor and capital into certain outputs like loans, number of open accounts, number of issued cards and financial products (Casu and Girardone, 2004). However, in this research we use the intermediation approach where the bank is considered an intermediary between depositors and borrowers (Mathews and Thompson, 2008). Two orientations for analysis are possible: input-oriented and output-oriented analysis. When it comes to the input-oriented analysis, we are measuring the possibility in reducing the amount of inputs keeping the level of output fixed (Cooper et. al, 2011). Alternatively, in the output-oriented analysis we are measuring the possible increase in the level of output with fixed level of inputs (Cooper et. al, 2011). In this research, we employed the output-oriented intermediation approach on the pooled sample of banks in B&H for the

whole sample within the 2002-2015 period on a grand-frontier (one frontier for all banks and all years). The output-oriented approach is a mathematical problem as follows (Widiarto and Emrouznejad, 2015).

$$f = \text{Max } f$$

Subject to

$$\sum_{j=1}^n \lambda_j y_{rj} \geq \phi y_{r0} \quad r = 1, 2, \dots, s;$$

$$\sum_{j=1}^n \lambda_j x_{ij} \leq x_{i0} \quad i = 1, 2, \dots, m;$$

$$\lambda_j \geq 0 \quad j = 1, 2, \dots, n;$$

$$\sum_{j=1}^n \lambda_j = 1 \tag{1}$$

In the given formula (1) y_i and x_i are outputs and inputs respectively. The "1" represents a nx1 vector of constants. The first model of DEA was made assuming that all units are at the level of constant return to scale operations (CRS), or at the optimal level of their capacities (Charnes et al., 1978). Since it is hard to find such a sector in the real world, Banker et al. (1984) introduced the constraint that represents the convexity constraint for λ_j for Variable Return to Scale (VRS) condition. Hence, the DMUs can be compared whilst not being limited with the scale of their operations, or they will be benchmarked with a DMU that is a similar size and return to scale (Widiarto and Emrouznejad, 2015). Accordingly, when we conduct analysis with variable return to scale, if the observed DMU is not at the optimal level of the operation, it will be in the decreasing return to scale (DRS) or increasing return to scale (IRS). Accordingly, if the DMU is in the phase of IRS, unused capacities are present and this suggests that management could increase efficiency of a given DMU by increasing the scale of the operation. The opposite applies for the DRS.

The selection of the variables for the DEA analysis is dependent on the approach used. We found the approach of Johnes et al. (2014) to be the most comprehensive for the selection of variables. Accordingly, we use four inputs totaldep - customer deposits,

operexp - operating expenses, equity - bank equity, fixas - fixed assets, and two outputs: groloans - total gross loans and oearnas - other assets (Table 2.).

Table 2: Variables use in the DEA analysis

Type	Variables	Description
Output	Loans - grloans Other earning assets - oearnas	Total gross loans in the assets of the banks Total other earning assets in the assets of the bank: Net loans and advances to banks; Reverse repos, securities borrowed & cash collateral; Derivative financial instruments; Financial assets: trading and at fair value through P/L; Financial assets: available for sale; Financial assets: held to maturity; Other securities)
Input	Fixed assets - fixas Deposits - totaldep Equity - equity Operating expenses - operexp	Total value of the fixed assets of the bank Total customer deposits in the liabilities of the bank Total equity in the liabilities of the bank Total non-interest expenses

Source: author

As can be seen from the previous table, the first output is gross loans. These are the main product of the bank and the main item of the bank's assets (Rose and Hudgins, 2010). It usually makes around eighty per cent of the banking assets. The second output "other earning assets", represents all other asset items that bring some earnings to the banks as follows: Net loans and advances to banks; Reverse repos, securities borrowed & cash collateral; Derivative financial instruments; Financial assets: trading and at fair value through P/L; Financial assets: available for sale; Financial assets: held to maturity and Other securities. When it comes to inputs, the first input "fixed assets" is the variable that represents physical input or capital input that banks use in their business (Johnes et al., 2014). The second input "deposits" is the main liability item and main source of funds for banks (Rose and Hudgins, 2010). In addition, it makes on average up seventy-nine to eighty per cent of total liabilities in the bank. The third input "Total equity" reflects the riskiness of the bank and its ability to bear the risks. Staiskouras et. al, (2007) found that a higher level of equity indicates owner's risk aversion. Finally, the variable "Operating expenses" reflects the banking operational

efficiency in managing the costs (Staub et. al, 2010). With all previous variables, the model covers most of the banking business; conventional as well as IBs.

The statistics of the sample are provided in Table 3.

Table 3. Descriptive statistics of the inputs and outputs

Descriptive Statistics (millions of BAM)					
	N	Minimum	Maximum	Mean	Std. Deviation
grloans	252	9.20	3067.10	561.7440	662.93471
othearas	252	.20	940.10	127.8889	178.65109
fixas	252	.70	150.60	23.3837	24.81644
totaldep	252	5.00	3313.70	535.6925	678.07850
equity	252	5.60	726.20	101.8425	117.35666
operexp	252	.90	133.40	29.5552	29.84355

Source: author

As seen in the previous table, our sample consists of two hundred and fifty two observations over fourteen years. This means that we deal with a relatively small number of banks. However, DEA is the method that is appropriate for a small sample size, and can be used for conducting a comparison between DMUs in such a sample (Coelli, 1996). In addition, the correlation between the variables is very high (Table 4.)

Table 4. Correlations between input and outputs

Correlations (N= 252)						
	grloans	othearas	Fixas	totaldep	equity	nonintexp
grloans	1	.739**	.835**	.944**	.925**	.950**
othearas	.739**	1	.677**	.844**	.680**	.803**
fixas	.835**	.677**	1	.846**	.800**	.848**
totaldep	.944**	.844**	.846**	1	.919**	.959**
equity	.925**	.680**	.800**	.919**	1	.901**
operexp	.950**	.803**	.848**	.959**	.901**	1
**. Correlation is significant at the 0.01 level (2-tailed).						

Source: Author

Although the correlation is very high, the DEA does not suffer from multi-co-linearity problems or problems of multiple outputs (Widiarto and Emrouznejad, 2015). Actually, the DEA is an appropriate method for this research and provides reliable results, since it can deal with small sample size as well as with highly correlated inputs and outputs (Widiarto and Emrouznejad, 2015)

5. Efficiency of banks in B&H: Islamic and conventional

Efficiency analysis focuses on output-orientated variable return to scale "vrste" analysis for pooled data on local grand-frontier for the period 2002 to 2015. The results of the study (given in Appendix 2) are shown to be highly asymmetrical, with the lowest recorded bank efficiency at the level of 0.25 (Table 5). In addition, our results reveal that the average bank efficiency for all banks in B&H is at a seventy-seven per cent moderate level. Accordingly, banks in B&H have significant potential for improvements in the efficiency of managing their inputs and outputs.

Table 5. Descriptive statistics for DEA results on Bosnian grand-frontiers

<i>DEA</i>	All banks 2002-2015 B&H Grand-frontier				
	N	Minimum	Maximum	Mean	Std. Deviation
Crste*	252	.23	1.00	.7223	.22003
Vrste**	252	.25	1.00	.7751	.21101
Scale***	252	.55	1.00	.9292	.09643
<i>DEA</i>	CB 2002-2015 B&H Grand-frontier				
Crste	238	.23	1.00	.7248	.22253
Vrste	238	.25	1.00	.7793	.21275
Scale	238	.55	1.00	.9270	.09857
Islamic bank on 2002-2015 B&H Grand-frontier					
Crste	14	.46	1.00	.6802	.17302
Vrste	14	.48	1.00	.7026	.16870
Scale	14	.89	1.00	.9658	.02952

*Constant return to scale technical efficiency; ** Variable return to scale technical efficiency; *** Scale efficiency

The previous table illustrates that there is no significant difference in the results with both constant return to scale and with variable return to scale approaches. Hence, high levels of the scale efficiencies are identified, suggesting that the size of the operation is not the source of the different efficiencies. This means that banking management set up the business capacities well. However, technical efficiency is the issue for management and it is the result of different efficiencies in managing the inputs and outputs of the bank. There is still significant space for management improvement over the given inputs and outputs. Also, our results reveal that fifty per cent of banks are in the increasing return to scale whilst thirty-two per cent of the sample is in the decreasing return to scale (Table 6.).

Table 6. Frequencies of scale level for DEA results

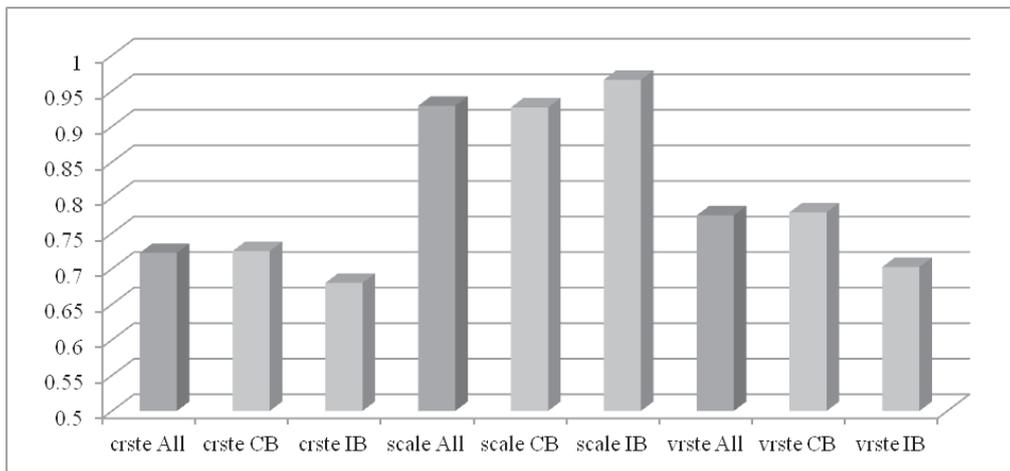
2002-2015 B&H Grand-frontier					
DEA	Frequency	Percent	Valid	Cumulative	
			Percent	Percent	
CB	Optimal	42	17.6	17.6	17.6
	Drs*	76	31.9	31.9	49.6
	Irs*	120	50.4	50.4	100.0
	Total	238	100.0	100.0	
IB	Optimal	2	14.3	14.3	14.3
	drs	5	35.7	35.7	50.0
	irs	7	50.0	50.0	100.0
	Total	14	100.0	100.0	
All	Optimal	44	17.5	17.5	17.5
	drs	81	32.1	32.1	49.6
	irs	127	50.4	50.4	100.0
	Total	252	100.0	100.0	

*Decreasing return to scale; ** Increasing return to scale

However, when we compare the efficiency of Islamic and CBs, we find that the IB has a significantly lower efficiency at the level of seventy per cent. Accordingly, IBs could increase their efficiency by thirty per cent with different managerial and technological solutions. The level of scale efficiency of the IB (ninety-seven per cent) confirms that the size of the operations is not the significant factor for efficiency difference.

Management of the IB is efficient in setting up the scale of the operations, of the bank, but should improve their management of given inputs and outputs. Their conventional counterparts over perform them significantly. In addition, the average technical efficiency of CBs is much higher than that of the IB (seventy-eight per cent), but lower in the scale efficiency (ninety-three per cent). The given results suggest that the efficiency of CBs in B&H is generally at a moderate level and there are still potentials for improvements. The low level of efficiency of banks in B&H is recorded in some previous DEA studies as well (Efendic and Avdic, 2011; Efendic, 2014). Accordingly, we can conclude that there is a significant gap in efficiency of these two kinds of banks (Figure 4.).

Figure 4. DEA results for the period 2002-2015



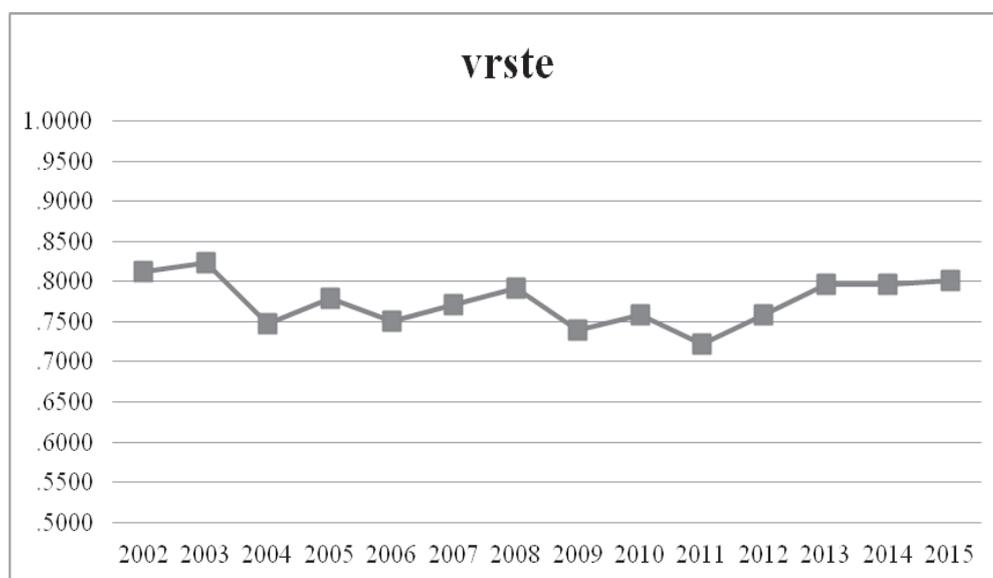
Source: Author

Higher scale efficiency is in the IB suggesting that the IB is using their available capacities better. Accordingly, IB management should look for their chances to compete with CBs in improving the technical efficiency while keeping the scale of the operation at the same level. On the other side, CBs should put more focus on the scale of their operation and together with a technical, try to improve and scale efficiency.

In addition, our results suggest that efficiency has had significant changes over the last fourteen years. After the sharp decline in the early 2000s, a pre-crisis increase in the bank efficiency (2008) is recorded. During the crisis, a significant drop in efficiency occurred, especially in 2011. When we observe the IB, considering the efficiency scores within the period of the crisis, it is more affected by the crisis than CBs. This means that the IB proved to be less resilient to the financial crisis. Although the clients in B&H appear to have more trust in IB due to its unique nature and the principles of

Islamic banking that clients expect to find within this bank, (Trokic and Efendic, 2017) the efficiency of the IB is behind the CBs. It is interesting to point out that Akhtar (2013) found IBs to be stable during the crisis in Saudi Arabia. Our study results reveal the slight drop during the crises and fast after-crisis recovery from 2011 (Figure 5).

Figure 5. Yearly average B&H DEA indices on local grand-frontier for the period 2002-2015



Source: Author

The previous figure shows that efficiency in the B&H banking sector. After all the changes recorded within the fourteen years covered in this study, disappointingly 2015 is at the level that was recorded in 2002. However, when it comes to the size of the banks, Efendic and Avdic (2011) find significant differences in bank efficiency in B&H depending on the size of the banks. Following the same strategy as Efendic and Avdic (2011), we split our sample relative to the size of the bank's assets and compared Islamic and CBs within the given cluster. Accordingly, we classify all banks in three groups as follows: large banks - assets size above one billion BAM, small banks below two hundred million BAM and otherwise, medium sized banks. Finally, the results of our study reveal significant differences in efficiency between banks of different size. The highest efficiency is within the cluster of large banks with an average efficiency of ninety per cent. The medium sized banks are behind the large ones with an average efficiency of seventy-seven per cent. The least efficient are small banks with close to sixty-five per cent efficiency (Table 7.).

Table 7. Descriptive statistic of the efficiency of small, medium and large banks

Type		N	Minimum	Maximum	Mean	Std. Dev.
Small banks	Crste	71	.23	1.00	.5663	.23288
	vrste	71	.25	1.00	.6501	.24158
	scale	71	.55	1.00	.8768	.12936
	Valid (listwise)	N 71				
Medium banks	crste	110	.27	1.00	.7396	.19226
	vrste	110	.27	1.00	.7733	.19198
	scale	110	.78	1.00	.9552	.05008
	Valid (listwise)	N 110				
Large banks	crste	71	.54	1.00	.8514	.14048
	vrste	71	.61	1.00	.9028	.10728
	scale	71	.66	1.00	.9413	.09329
	Valid (listwise)	N 71				

Source: Author's calculations

The previous analysis shows that, with an increase in the size of assets, banks in B&H benefit from economies of scale resulting in higher levels of bank efficiency. Since the IB in B&H belongs to the category of medium sized banks, the results suggest that the IB is competitive compared to small banks, while it is exposed to high competition from large CBs. In addition, the IB in B&H has lower efficiency scores than the average of its conventional counterparts of the same size. Long run growth in the operation and size of assets should be a long-term development strategy for the IB with a goal to reach an asset size higher than one billion BAM.

Finally, our results establish that although the IB is below the average efficiency of the banking sector in B&H, it can still compete within the group of small banks. In addition, the long-term strategy of the IB should be an increase in the size of its assets, but it has to take into account the stronger competition that is present within this cluster of banks in B&H. However, technical inefficiency of IB remains as a main issue.

Conclusions

This study provides results on the efficiency level of the banking sector in B&H as well as a comparison between the efficiency of Islamic and CBs. The efficiency analysis has been conducted using DEA with output-orientated analysis for pooled data on local grand-frontier for the period 2002-2015.

Our results reveal that the average bank efficiency for all banks in B&H is at a seventy-seven per cent moderate level suggesting significant potential for improvements in efficiency. In addition, high levels of the scale efficiencies suggest that the size of the operation is not the source of the different efficiencies among banks. However, the IB has significantly lower efficiency compared to CBs. Considering the time variations in efficiency through the analyzed period, the results show that the efficiency of the banking sector of B&H in 2015 at the level that was recorded in 2002. This is probably affected by post-war reconstruction and revitalization of the economy of Bosnia and Herzegovina. Islamic banking efficiency is low in countries that were subject to war (Wanke, et al. 2016).

Since bank size has the potential to lead to higher efficiency, we have conducted a comparison of efficiency between banks of different size. Our results suggest that the highest efficiency is within the cluster of large banks followed by medium sized banks, where the IB is located. The least efficient are found to be the cluster of small banks.

Finally, the study results lead us to the conclusion that with an increase in the size of assets, banks in B&H benefit from economies of scale. However, since the IB in B&H belongs to medium sized banks, it is only competitive with the small banks, while it is exposed to high competition from its own cluster as well as the cluster of large CBs. Hence, the long-term strategy of the IB should be focused on increasing the size of its operations considering the higher competition that is present within larger banks in B&H.

Since efficiency is generally significantly determined by local market conditions, further research should focus on gathering additional insight into the market conditions in B&H as well as the analysis of the determinants of the different efficiencies between the two bank groups. In particular, controlling the environmental and bank specific variables in addition to the sources of the identified inefficiencies of B&H banks should be explored.

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Web sites:

1. <http://www.bbi.ba/documents/izvjestaji/2015.pdf>
2. <http://www.popis.gov.ba/popis2013/knjige.php-id=2>

Appendix 1. List of the banks covered by the analysis

No	LIST OF BANKS
1.	Bobar Banka a.d.
2.	Bosna Bank Intertional dd (BBI)
3.	HVB Central Profit Banka dd
4.	HYPO AD BL
5.	Hypo Alpe-Adria-Bank a.d.,
6.	Intesa Sanpaolo Banka d.d.
7.	Komercijalna banka ad Banja Luka
8.	Komercijalno-Investiciona Banka dd Velika Kladusa
9.	MF Banka A.D. Banja Luka
10.	Moja Banka DD Sarajevo
11.	NLB Razvoj Banka ad
12.	NLB Tuzlanska Banka d.d.
13.	Nova Banka ad Banja Luka
14.	Pavlovic International Bank ad
15.	Privredna Banka Sarajevo dd
16.	ProCredit Bank B&H
17.	Raiffeisenbank d.d. B&H
18.	SBER
19.	SBER AD BL
20.	Sparkasse Bank dd
21.	Turkish Ziraat Bank Bosnia
22.	UniCredit Bank ad Banja Luka
23.	UniCredit Bank dd
24.	UNION B.
25.	UNIVERSAL B
26.	Vakufska Banka dd Sarajevo

Appendix 2. DEA results for all banks (variable return to scale)

Descriptive Statistics						
No ⁶	DEA	N	Minimum	Maximum	Mean	Std. Deviation
1.	vrste	14	.78	1.00	.9198	.09626
2.	vrste	14	.80	1.00	.9330	.06491
3.	vrste	14	.53	1.00	.8386	.17428
4.	vrste	6	.77	1.00	.9183	.08511
5.	vrste	7	.36	1.00	.5779	.28999
6.	vrste	9	.69	1.00	.8856	.11956
7.	vrste	13	.60	1.00	.8829	.13763
8.	vrste	6	.91	1.00	.9412	.03262
9.	vrste	14	.77	1.00	.8968	.08538
10.	vrste	14	.42	.98	.8054	.14208
11.	vrste	15	.44	.96	.7213	.13279
12.	vrste	14	.50	1.00	.7815	.18474
13.	vrste	14	.48	1.00	.7026	.16870
14.	vrste	9	.75	1.00	.9204	.10244
15.	vrste	5	.39	.70	.5388	.11967
16.	vrste	13	.36	1.00	.5575	.16439
17.	vrste	8	.39	1.00	.6146	.21290
18.	vrste	14	.46	1.00	.6822	.14436
19.	vrste	6	.91	1.00	.9683	.03624
20.	vrste	11	.76	1.00	.8770	.07199
21.	vrste	5	.77	1.00	.9444	.10153
22.	vrste	2	.95	1.00	.9735	.03748
23.	vrste	14	.25	.51	.3461	.08541
24.	vrste	5	.38	.56	.4732	.07021
25.	vrste	3	.81	.87	.8447	.02987
26.	vrste	3	1.00	1.00	1.0000	.00000

6. The given order does not reflect/match the previous list of banks

