



# THE ROLE OF BANKS IN THE DEVELOPMENT OF THE ECONOMY AND SOCIETY OF THE COUNTRY. (ON THE EXAMPLE OF BANKS IN UZBEKISTAN AND SOUTH KOREA)

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## ANNOTATION

*This paper we used Data Envelopment Analysis (DEA) to measure the efficiency of the Uzbekistan and Korean banks from 2015 to 2020, and then to explore implications about two countries' banks efficiency. Our findings in this paper are as follows. 1. Korean banks have CRS and IRS trends during these 5 years, but most Uzbekistan banks showed DRS trends. 2. The efficiency of PB and MKB in Uzbekistan is higher than other banks- state-owned banks. 3. The efficiency of NB is the highest in Korea. The results showed that Korean banks efficiency is higher than Uzbekistan banks.*

**KEY WORDS:** Banks, Efficiency, Data Envelopment Analysis, Uzbekistan, South Korea

# РОЛЬ БАНКОВ В РАЗВИТИИ ОБЩЕСТВА И ЭКОНОМИКИ СТРАНЫ. (НА ПРИМЕРЕ БАНКОВ УЗБЕКИСТАНА И ЮЖНОЙ КОРЕИ)

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## Аннотация

*В этой статье мы использовали анализ охвата данных (DEA) для измерения эффективности банков Узбекистана и Кореи с 2015 по 2020 годы, а затем изучили последствия для эффективности банков двух стран. Наши выводы в этой статье заключаются в следующем. 1. Корейские банки имели тенденции CRS и IRS за эти 5 лет, но большинство банков Узбекистана продемонстрировали тенденции DRS. 2. Эффективность ПБ и МКБ в Узбекистане выше, чем у других банков-госбанков. 3. Эффективность NB самая высокая в Кореи. Результаты показали, что эффективность корейских банков выше, чем банков Узбекистана.*

**Ключевые слова:** банки, эффективность, анализ охвата данных, Узбекистан, Южная Корея.

## I. INTRODUCTION

Uzbekistan Banking Association was established in July 1995 by initiative of the President of the Republic of Uzbekistan Islam Karimov. Association is a voluntary alliance of commercial banks of the Republic and represents a noncommercial public organization, which fulfils the tasks for protection of legitimate interests of banks,

ensuring of national commercial banks' conformity to the level of international standards with subsequent integration of banking sector in the world banking community. Presently, the Association unites 23 national commercial banks, which possess over 97% of bank assets in the Republic.

South Korean banks also achieved wonderful economic performance and played an important role



in the financial sector in the East Asia. But the South Korean financial sectors still have deficiency; the critical event happened during the Asian banking crisis, many South Korean institutions suffered from the crisis. The problem was exacerbated by the problem non-performing loans at many of South Korean's merchant banks. By January 1998, the government had shut down a third of Korean's merchant banks.<sup>1</sup> Meanwhile, Korean's currency experienced massive fluctuations, declining by 34% against the dollar. So, after the crisis, the government carried out many policies on the banking sector. And then, Korean government proposed a wonderful plan to develop Korea as a financial center in the Northeast Asia.

Korean government began a two stage financial restructuring. In the first<sup>2</sup> stage, two banks were nationalized for later sale to foreigners, five insolvent banks were closed and then merged with blue -chip banks, foreign capital injections were given to seven banks, and public funds were used to normalize operations of the remaining surviving banks. The second stage of restructuring began in June 2000 and focused on restoring bank profitability.

The reminder of the paper is organized as follows. Section 2 presents a brief overview of theoretical literature on bank efficiency. Section 3 introduces the research methodology related to this study. Section 4 presents data and empirical results. The final section concludes the paper.

## II. THE LITERATURE REVIEW

The literature about efficiency of Uzbekistan and Korean banks is not extensive compared with the literature about western country's efficiency. Two countries quantitative analysis on banking efficiency starts relatively late but the study on the commercial banks efficiency is rapidly increasing.

### 1. Uzbekistan literature

The term "efficiency" is one of the key concepts for financial institutions. It has been extensively studied due to its importance. Mainly, the studies making typical comparisons of bank performance can be divided into two categories: (1) those which use simple aggregate bank ratios relating cost to revenues or assets, and (2) frontier technique which measures a bank's efficiency by its distance to the efficient frontier (Laeven 1999). In this paper we will use the particular frontier technique of Data

Envelopment Analysis (DEA) to analyze the efficiency of the Uzbek banking system.

So far no research has been conducted assessing the performance of Uzbek banks using Data Envelopment Analysis or any other frontier approaches. Usually, the papers in the literature are restricted by the qualitative assessment of aggregate bank ratios or relating these ratios to cost, revenue and asset structures of banks using regression analysis. For example, some yearly reports provided by investment companies such as Ansher Capital (2006) and East Orient Capital Management (2008) analyzed the overall performance of the system over each year. These analytic papers are comprehensive source which investigated the development of Uzbek banking sector and provide detailed analysis of individual banks using traditional methods of bank performance evaluation. Yet none of these studies used a predetermined frontier approach which eliminated the possibility to deeper analyze the reasons for inefficiencies in the operation of banking sector.

### 2. Korean Literature

Park and Kim (2002) estimated efficiency and productivity change for the period 1995-2000 and found that regional banks are less efficient and experience fewer gains in efficiency than nationwide banks.

Park and Yi (2002) used data from the period 1995-1999 to estimate efficiency and simulate the effects of various hypothetical merger scenarios. They found evidence of decreasing returns to scale for mergers of two technically efficient banks, but if those same two banks produce different mixes of outputs, strong scope economies might arise via the merger.

Kang H. Park, William L. Weber (2006) present estimates of Korean bank inefficiency and productivity change for the period 1992-2002 that are derived from the directional technology distance function. It indicates that technical progress during the period was more than enough to offset efficiency declines so that the banking industry experienced productivity growth.

Cho and Shin (2004) found that although the five biggest South Korean banks experienced a decline in profitability during 1992-1997, they maintained greater cost efficiency and technical efficiency relative to other Korean banks.

## III. METHODOLOGY

DEA can be roughly defined as a non-parametric method of measuring the efficiency of Decision making unit (DMU) with multiple inputs and multiple outputs. The DEA CCR model was first created by Charnes Cooper and Rhode (1978) based on Ferrell's (1957) idea on production efficiency, which assumes CRS (constant return scale). We call

<sup>1</sup> Koo, Ja Hyeong and Kiser, Sherry L. (2001). "Recovery from a financial crisis: the case of South Korea" (w). Economic & Financial Review. Retrieved 2009-05-05

<sup>2</sup> Kang H. Park and William L. Weber, "A Note on efficiency and Productivity Growth on the Korean Banking Industry, 1992~2002", 2006

it DEA-CRS model. The DEA BCC model was first proposed by Banker Charnes and Cooper (1984) based on CCR model, which assumes VRS (variable return scale). We call it DEA-VRS model.

### 1. The Constant Returns to Scale Model (CRS)

The DEA=CRS technical efficiency (DEA-CRS model): to simplify the problem, let's consider that these N banks operate under the CRS and employ three inputs ( $X_j, j = 1, 2, 3,$ ) to produce two output ( $Y_i, i = 1, 2$ ). The formal problem for the technical efficiency (TE) can conveniently be expressed in the following way:

$$\begin{aligned} & \text{Min}_{TE,W} TE_i \\ \text{s.t. } & Y \cdot w_i \geq y_i, \quad (1) \\ & X_j \cdot w_i \leq TE_i \cdot x_i, \quad j = 1, 2, 3 \\ & w_i \geq 0 \end{aligned}$$

Where  $TE_i$  is a scalar and represents the technical efficiency measure for the i-th bank,  $w_{ij}$  is the  $1 \times N$  vector of intensity weights defining the linear combination of efficient banks to be compared with the i-th bank. The inequality ( $Y \cdot w_i \geq y_i$ ) implies that the observed outputs must be less or equal to a linear combination of outputs of the banks forming the efficient frontier. The inequality ( $X_j \cdot w_i \leq TE_i \cdot x_i$ ) assures that the use of inputs at the linear combination of the efficient banks must be less or equal to use of inputs of the i-th bank. The formulation will show that  $TE_i \leq 1$ . According to the Ferrel (1957), an index value of 1 refers to a point on the frontier and thus to a technically efficient bank.

### 2. The variable Return to Scale model (VRS)

The VRS technical efficiency (DEA-VRS model): the CRS assumption is only appropriate when all DMU's are operating at an optimal scale. The CRS assumption will be incorrect if all banks are not operating at an optimal scale. In this case, the CRS specification will be as the estimation of the technical efficiency by confounding scale effects. But, the substitution of the CRS with variable returns to scale (VRS) assumption brings about the estimation of the pure technical efficiency (PTE), i.e., TE devoid of the scale effects. This can be achieved by adding a convexity constraint ( $N_1 \cdot w_i = 1$ ) to (1) which allows VRS as demonstrated below:

$$\begin{aligned} & \text{Min}_{TE,W} TE_i \\ \text{s.t. } & Y \cdot w_i \geq y_i, \quad (2) \\ & X_j \cdot w_i \leq TE_i \cdot x_i, \quad j = 1, 2, 3 \\ & N_1 \cdot w_i = 1 \\ & w_i \geq 0 \end{aligned}$$

Where  $N_1$  is a  $1 \times N$  vector of ones, the VRS frontier obtained this way envelops the data more tightly than the CRS frontier and thus generates technical efficiency scores which are greater than or equal to those obtained from the CRS frontier.

### 3. -The scale Efficiency (SE)

Many studies have decomposed the TE scores obtained from a CRS DEA into two components, one due to scale inefficiency and one due to "pure" technical inefficiency. This may be done by conducting both a CRS and a VRS DEA upon the same data. If there is a difference in the two TE scores for a particular DMU, then this indicates that the DMU has scale inefficiency, and that the scale inefficiency can be calculated from the difference between the VRSTE score and the CRSTE score.<sup>3</sup>

## IV. DATA AND EMPIRICAL ANALYSIS

In this paper, we used 3 inputs and 2 outputs. Inputs are  $X_1, X_2, X_3$  and outputs are  $Y_1, Y_2$ . We have selected 7 banks from Uzbekistan and Korea. They are Hamkor Bank (HB), KDB Bank (KDB), Microcredit Bank (MKB), Peoples Bank (PB), Trust Bank (TB), Aloqa Bank (AB), Ravnaq Bank (RB), and Hana Bank (HB), Kookmin Bank (KB), National Agricultural Cooperative Bank (NHB), Shinhan Bank (SB), Woori Bank (WB), and Korea exchange Bank (KEB) in Korea. We use the bank's annual panel data, for the years from 2015 to 2020.

<sup>3</sup> We use the software DEAP version 2.1 computer program by Tim Coelli to measure DEA's efficiency.



Table 1 - Summary of the Input and Output Variables

Variable	Description	Unit	Mean	Min	Max	S. D
Y <sub>1</sub>	T- Loans	Million dollar	22.03722	14.19041	26.11543	3.808174
Y <sub>2</sub>	Operating Revenue	Million dollar	20.17573	13.92890	24.25210	2.870697
X <sub>1</sub>	Employees	People	8.183237	5.950643	10.02109	1.367239
X <sub>2</sub>	T- assets	Million dollar	22.67917	16.17944	26.49418	3.419503
X <sub>3</sub>	T- equity	Million dollar	20.48236	15.11234	24.08929	3.092455

Summary information on the input and output variables are shown in Table 1. All money values transformed into the US dollar applying Uzbekistan

currency exchange rate to US dollar and Korean currency also same exchange rate to US dollar.

## V. THE RESULTS

Table 2 - Uzbekistan and Korean Bank's Efficiency

Year	Nation	CRSTE	VRSTE	SE
2010	Uzbekistan	0.973	0.987	0.986
	Korea	0.999	0.999	1
2011	Uzbekistan	0.972	0.987	0.985
	Korea	0.999	0.999	1
2012	Uzbekistan	0.959	0.984	0.974
	Korea	0.997	0.998	0.999
2013	Uzbekistan	0.954	0.962	0.992
	Korea	0.998	0.998	0.999
2014	Uzbekistan	0.934	0.956	0.977
	Korea	0.997	0.997	0.999

SE: scale efficiency = CRSTE/VRSTE.

CRSTE: technical efficiency VRSTE: Pure technical efficiency

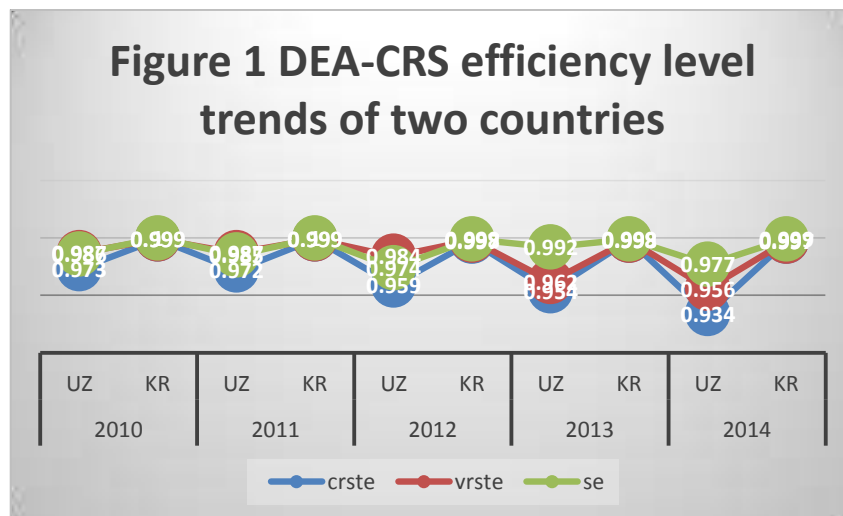


Table 2 and Figure 1 show the efficiency level of two countries' banks. The results showed that the banks of Korea have relatively

higher CRSTE than Uzbekistan, and scale efficiency of Korean banks is a little higher than that of Uzbekistan banks'.

**Table 3 - the Efficiency Level of Input-Oriented DEA-CRS and DEA-VRS Model**

		2010	2011	2012	2013	2014	Mean
DMU 1	CRS	0.966	0.965	0.949	0.941	0.903	0.9448
(PB)	VRS	0.966	0.965	0.954	0.95	0.906	0.9482
DMU 2	CRS	0.976	0.973	0.958	0.952	0.936	0.959
(AB)	VRS	0.977	0.974	0.959	0.959	0.945	0.9628
DMU 3	CRS	0.934	0.948	0.903	0.889	0.882	0.9112
(HB)	VRS	0.939	0.949	0.916	0.89	0.884	0.9156
DMU 4	CRS	1	1	1	1	1	1
(KDB)	VRS	1	1	1	1	1	1
DMU 5	CRS	0.957	0.948	0.924	0.91	0.882	0.9242
(MKB)	VRS	0.966	0.957	0.94	0.915	0.892	0.934
DMU 6	CRS	0.968	0.96	0.957	0.942	0.969	0.9592
(TB)	VRS	0.969	0.96	0.962	0.951	0.939	0.9562
DMU 7	CRS	0.997	1	1	0.987	0.969	0.9906
(RB)	VRS	1	1	1	1	1	1
DMU 8	CRS	0.971	0.981	0.982	0.97	0.962	0.9732
(HB)	VRS	1	1	1	1	1	1
DMU 9	CRS	0.976	1	1	1	1	0.9952
(IBK)	VRS	1	1	1	1	1	1
DMU 10	CRS	0.951	0.957	0.951	0.957	0.948	0.9528
(KEB)	VRS	0.988	0.986	0.986	0.978	0.979	0.9834
DMU 11	CRS	1	0.998	1	1	1	0.9996
(KB)	VRS	1	1	1	1	1	1
DMU 12	CRS	0.922	0.915	0.919	0.933	0.924	0.9226
(NHB)	VRS	0.992	0.991	0.98	0.977	0.977	0.9834



DMU 13	CRS	0.982	1	1	1	1	0.9964
(SHB)	VRS	1	1	1	1	1	1
DMU 14	CRS	0.941	0.947	0.941	0.95	0.933	0.9424
(WB)	VRS	0.993	0.991	0.99	1	0.987	0.9922

Table 3 shows the efficiency levels which are measured from the assumptions of CRS and VRS by using input-oriented DEA method. The average efficiency of DMU4 (KDB) is highest (equal to 1) in both CRS and VRS model; DMU3 (HB) is the lowest in CRS and VRS model. About Korean banks, the

average efficiency of DMU11 (KB) is the highest (equal to 1) in VRS. DMU14 (WB) is relatively low in both models. The efficiency values showed that the Uzbekistan banks are lower than Korean banks.

**Table 4 - the Efficiency Level of Output-Oriented DEA-CRS and DEA-VRS Model**

		2010	2011	2012	2013	2014	Mean
DMU 1	CRS	0.966	0.965	0.949	0.941	0.903	0.9448
(PB)	VRS	0.97	0.966	0.95	0.943	0.93	0.9518
DMU 2	CRS	0.976	0.973	0.958	0.952	0.936	0.959
(AB)	VRS	0.976	0.974	0.958	0.956	0.937	0.9602
DMU 3	CRS	0.934	0.948	0.903	0.886	0.882	0.9106
(HB)	VRS	0.942	0.959	0.938	0.919	0.92	0.9356
DMU 4	CRS	1	1	1	1	1	1
(KDB)	VRS	1	1	1	1	1	1
DMU 5	CRS	0.957	0.948	0.924	0.91	0.882	0.9242
(MKB)	VRS	0.972	0.967	0.956	0.936	0.91	0.9482
DMU 6	CRS	0.968	0.96	0.957	0.942	0.929	0.9512
(TB)	VRS	0.968	0.961	0.961	0.945	0.93	0.953
DMU 7	CRS	0.997	1	1	0.987	0.969	0.9906
(RB)	VRS	1	1	1	1	1	1
DMU 8	CRS	0.971	0.981	0.982	0.97	0.962	0.9732
(HB)	VRS	1	1	1	1	1	1
DMU 9	CRS	0.976	1	1	1	1	0.9952
(IBK)	VRS	1	1	1	1	1	1
DMU 10	CRS	0.951	0.957	0.951	0.957	0.948	0.9528
(KEB)	VRS	0.991	0.99	0.989	0.985	0.986	0.9882
DMU 11	CRS	1	0.998	1	1	1	0.9996
(KB)	VRS	1	1	1	1	1	1
DMU 12	CRS	0.922	0.915	0.919	0.933	0.924	0.9226
(NHB)	VRS	0.994	0.993	0.985	0.983	0.983	0.9876
DMU 13	CRS	0.982	1	1	1	1	0.9964
(SHB)	VRS	1	1	1	1	1	1
DMU 14	CRS	0.941	0.947	0.941	0.95	0.933	0.9424
(WB)	VRS	0.994	0.994	0.993	1	0.992	0.9946

Table-4 shows the efficiency levels which are measured from the assumptions of CRS and VRS by using output-oriented DEA method. The average

efficiency of DMU4 (KDB) is highest (equal to 1) in both CRS and VRS model; DMU3 (HB) is the lowest in CRS and VRS model. About Korean banks, the





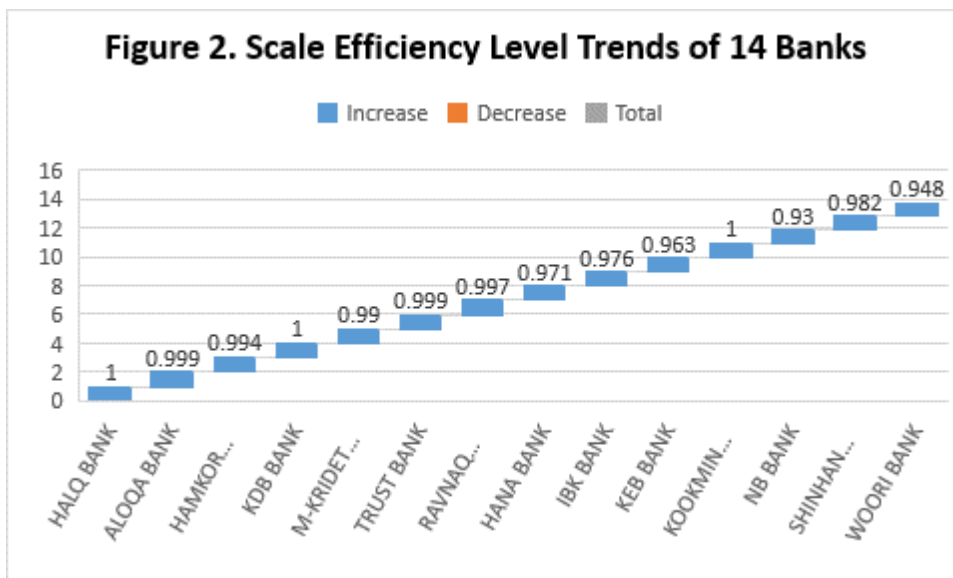
average efficiency of DMU8 (HB)-9 (IBK) and DMU11 (KB) are the highest (equal to 1) in VRS. DMU10 (KEB) is relatively low in both model. The efficiency values showed that the Uzbekistan banks are lower, but the efficiency of these banks has been increasing during 5 years.

**Scale Efficiency and Return to Scale**

Table 5 shows that scale efficiency (SE) and returns to scale (RTS). We compared Uzbekistan banks with Korean banks, and then results shows the Uzbek banks are relatively lower except M-Kredit bank and Ravnaq bank. The number of employees, the fixed assets and total equity in Uzbekistan banks are absolutely lower than Korean banks.

**Table 5 - Scale Efficiency (SE) of DEA Model**

	2010	2011	2012	2013	2014
HALQ BANK	1	1	0.995	0.99	0.997
ALOQA BANK	0.999	1	0.999	0.993	0.991
HAMKOR BANK	0.994	0.999	0.985	0.995	0.997
KDB BANK	1	1	1	1	1
M-KRIDET BANK	0.99	0.99	0.983	0.995	0.989
TRUST BANK	0.999	0.999	0.995	0.991	0.99
RAVNAQ BANK	0.997	1	1	0.987	0.969
HANA BANK	0.971	0.981	0.982	0.97	0.962
IBK BANK	0.976	1	1	1	1
KEB BANK	0.963	0.971	0.965	0.979	0.969
KOOKMIN BANK	1	0.998	1	1	1
NB BANK	0.93	0.923	0.937	0.955	0.945
SHINHAN BANK	0.982	1	1	1	1
WOORI BANK	0.948	0.955	0.95	0.95	0.946



**Table 6 - The Measure of Return to Scale from DEA model**

	2010	2011	2012	2013	2014
HALQ BANK	CRS	CRS	IRS	IRS	IRS
ALOQA BANK	IRS	CRS	IRS	IRS	IRS
HAMKOR BANK	IRS	IRS	DRS	IRS	DRS
KDB BANK	CRS	CRS	CRS	CRS	CRS
M-KRIDET BANK	DRS	DRS	DRS	IRS	IRS
TRUST BANK	IRS	IRS	IRS	IRS	IRS
RAVNAQ BANK	IRS	CRS	CRS	IRS	IRS
HANA BANK	DRS	DRS	DRS	DRS	DRS
IBK BANK	DRS	CRS	CRS	CRS	CRS
KEB BANK	DRS	DRS	DRS	DRS	DRS
KOOKMIN BANK	CRS	DRS	CRS	CRS	CRS
NB BANK	DRS	DRS	DRS	DRS	DRS
SHINHAN BANK	DRS	CRS	CRS	CRS	CRS
WOORI BANK	DRS	DRS	DRS	DRS	DRS

Table 6 shows the measure of returns to scale derived from DEA model. Roughly, Uzbekistan banks have shown IRS and CRS trends. But, the most Korean banks show CRS and DRS trends in few years. It means output increases is less than the input increases.

## VI. SUMMARY AND CONCLUSION

Korean banks have CRS and IRS trends, but Uzbekistan banks have DRS during 5 years. But, the most of them are IRS during 5 years. They are developing well at the situation of the constant returns to scale.

DMU 3 and 4 showed relatively lower efficiency in DEA model. This result can be related to the inefficiency of state-owned commercial banks. Uzbekistan commercial banks input such as the number of employees and fixed assets are over-employed compared with other commercial banks, even 25 times more than Korean banks.

In Korea, an efficiency value of DMU 12 is relatively lower in DEA CRS model, but still higher compared with the Uzbekistan banks. But efficiency of two DMUs, are highest in both CRS and VRS model, even higher than some Korean banks. Therefore, Uzbekistan government should pay more attention on middle and small-sized commercial banks.

The average of the efficiency of Korean banks is higher than that of Uzbekistan. Uzbekistan located in Central Asia and Korea located in East Asia, even long distance between two countries, they have strong sense of competition at some aspects, especially in banking sector.

The model used in this paper is necessary to improve through more banks and data collections. More data and researches will be helpful to understand the bank shortcomings; furthermore, optimal allocation of resources will lead to the higher profitability and sustainable development. With the economic depression lasting for a long time, and the banking crisis that have been worldwide phenomena during the past 10 years, measuring, understanding and improving banking efficiency is a major matter of concern not only for banks managers, but also government.

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