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THE DEVELOPMENT OF EFFICIENCY MODEL BY USING TRADITIONAL APPROACH METHOD (RATIO) AND FRONTIER APPROACH (DEA) FOR MICRO FINANCIAL INSTITUTIONS (STUDY ON RURAL BANKS AT FINANCIAL SERVICES AUTHORITY MALANG)

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Abstract

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ABSTRACT

This study aims to review the efficiency level of Rural Bank. This study used 26 Rural Banks as sample in the area of Financial Services Authority Malang from 2014 – 2016. The efficiency was measured by using Data Envelopment Analysis (DEA). The result of this study shows that 4 (four) banks achieve intermediate level of efficiency, 17 (seventeen) banks achieve profitable level of efficiency, the profitability level of efficiency decreased 2%. Contractual interest expense decreased 40.66% and followed by BangilAdyatama Bank which decreased 63.53% in term of contractual interest income on the same period. The greatest decline was experienced by Bangil Adyatama ROA -11 %, BOPO 151% in 2015 , ROA -14%, BOPO 179%. Banks which achieve a better efficiency have a better financial performance rather than banks which do not. DEA reveals a recommendation in term of the development of rural banks which later can be used to achieve an optimal efficiency level. Based on the above recommendation, hopefully, banks can maximize their profit through efficiency. The limitation of this study is, it has not been reviewed by production approach.
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Efficiency is an important indicator in the performance assessment of an industry, as well as in the banking industry. Competition and integration plan of ASEAN financial sector in 2020 enables Qualified ASEAN Banks (QAB) to be free to operate in ASEAN region. This will increase competition among national banks including rural banks and commercial banks from the ASEAN region. This increased competition demands the industry of rural banks to be more efficient. Efficiency can be defined as the ratio of output to input, or the amount of output produced with one input used.

Efficiency in the banking field is one of the most popular performance parameters which is commonly used because it can provide answers to various difficulties in calculating various performance measurements (hadad, 2003). According to Ida (2006) a Bank can be classified into efficient if: (1) Using the smaller number of input units rather than the number

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of inputs used by other banks which use the same number of inputs, (2) Using the same number of input units and produce the greater outputs. Measurement of efficiency involves various efforts that can be made on efficiency, what included into the efficiency is and how importance of efficiency in management and economics is (Wang et al., 2004). In this case, Reynaud 2005 and Rokhim have used the concept of efficiency to conclude problems in term of concept and measurement.

Rural Banks as a financial intermediary between parties with funds and other parties which need of funds have a strategic role in the growth of a country's micro and small economy. Increased efficiency in the Rural Bank sector will encourage the mobilization of saving funds, deposit and greater loan demand thereby increasing economic growth (Karimzadeh, 2012).

Model Development

Measurement by using financial ratio has two disadvantages. Those are, first, financial ratio compares only one variable with another, so it cannot accommodate inputs and outputs that have more than one variable to measure performance (Viverita & Ariff, 2011). In addition, performance measurement by using ratio cannot directly measure the level of efficiency achieved by a bank compared to other banks (Subekti, 2004). This led to the need to use other methods to measure bank efficiency. One of them is Data Envelopment Analysis (DEA). By using DEA model, we can analyze what makes the bank to be inefficient between inputs and outputs. DEA model used in this research is BCC model (Banker, Charnes, Cooper) assumption using VRS (Variable Return to Scale) which is input oriented (minimize input). The measure of efficiency generated by assuming VRS is called Pure Technical Efficiency. This Technical Efficiency is an efficiency that measures management performance (Kumar & Gulati, 2008). Research on the technical efficiency of Indonesian banking is important because the level of technical efficiency of Indonesian banking is still relatively low compared to other countries. Barry et al. (2008) which measures technical efficiency based on DEA with VRS assumptions on banks in 6 Asia Pacific countries in 1999-2004.

By using traditional methods (ratios) coupled with DEA we can determine operational efficiency and profitability. DEA analysis is a non-parametric technique which measures the efficiency of the Indonesian banking sector. According to Berger and Humprey (1997) states that the use of financial ratios and efficiency approach simultaneously will be able to measure the bank's performance better so it can provide more optimal benefits. This

research developed Halkos and Salamouris (2004) format in assessing the efficiency level of banking in Indonesia.

Pancurova & Lyocsa (2013), in a study entitled: Determinants of Commercial Bank "Efficiency" Evidence from 11 CEE Countries" stated that low capital ratios lead to low efficiency as well. Sandi (2013), Analysis of banking efficiency level with DEA approach, Government-owned commercial bank has higher efficiency level compared to Private Bank. In addition, banks with high capital, bankruptcy risks tend to be low, so funding costs also tend to decrease (Nececur, Khediri, & Casu, 2009). Lambertte (2002) uses two different efficiency concepts of cost efficiency and profit efficiency with stochastic and free distribution approaches concluded that agency cost reduces the efficiency of micro banking. In addition, micro banking is very efficient, although the efficiency of banking is the usual cost. Because micro-banking can charge higher fees for the quality provided.

Kusumawardani (2008), shows that capital, earnings and liquidity have no real relationship with DEA analysis. Hosen & Muhari (2014) examined the efficiency level of 73 BPRS by using DEA, indicates that the efficiency level of BPRS has a real positive relationship but is weak to performance. Firdaus & Hosen (2013) examined 10 BUS in Indonesia with two-stage of DEA, indicates there is a significant difference in DEA analysis with Camel. Galleman (2008) in his research entitled: Operational efficiency, service coverage and lending rates, revealed that service channels, lending rates, bopo and AO productivity are more efficient. Syafaat & Hosen (2014) indicated that the efficiency level of the SRB has a weak relationship to the Bank's performance. Bonin (2004) also shows that the efficiency of private banks is better than state-owned banks, where foreign banks have the greatest degree of efficiency and state-owned banks have the lowest efficiency levels.

LITERATURE REVIEW

Bank Efficiency

Efficiency is one of the Banking performance parameters, the measuring method of banking efficiency can be done by two approaches, and those are:

a. Traditional approach is an index number or ratio, such as ROA, CAR, BOPO, CR, LDR;

b. Frontier Approach: based on the firm's optimal behavior in order to maximize output or minimize costs, as a way of business units to achieve organizational goals. This research uses Deterministic approach: often classified in non-parametric approach,

public funds to the community who need it as venture capital. Given the efficiency of banking institutions, especially cost efficiency that will lead to an optimum profitability, additional funding, more competitive costs, improved customer service, increased security and banking health (Berger, et al., 1997).

Iswardono S.P.dan Darmawan, (2000), in his research used the concept of efficiency which refers to economic efficiency and technical efficiency. This efficiency is analyzed using Profit Function approach. The results of research on groups of Government Banks, National Private Banks, and Foreign Banks (1991-1996), show that the Government Bank has the highest level of technical efficiency compared with National Private Banks and Foreign Banks. Meanwhile, Foreign Bank has relatively high efficiency level compared to national private foreign exchange bank. For private national banks, foreign exchange has low efficiency level or even inefficiency when compared to other bank group. Susty Ambarraiani (2003) examined the factors that affect the efficiency level in the banking industry in Indonesia. The result of the analysis which uses linear regression coefficient is efficiency over bank management can be measured through *Return On Asset, Return On Equity, Profit Margin*, and *Asset Turn Over*.

The development of efficiency indicators indicates that each of these efficiency indicators did not change significantly from 1994 to 1996, and then generally declined in 1997. In addition, generally, foreign banks have higher levels of efficiency than other bank groups. According to a research conducted by Muchamad Hartana Iswandi Putra (2003) the efficiency of the banking industry in Indonesia by using DEA in 2001-2002, the result showed that from 45 foreign exchange banks, there were only 12 which could be categorized as efficient foreign exchange banks and other 33 foreign exchange banks have not efficient yet. In 2002 there were 14 efficient foreign exchange banks and other 31 foreign exchange banks have not been efficient yet. Dyah Nirmalawati T (2001) in her research aimed to see the impact of merger between banks in Indonesia to its' profitability, this research was conducted on state-owned banks, commercial banks, foreign national private banks and non-foreign exchange banks in 1995-2000 by using ROE to calculate the profitability of OLS and DEA to calculate efficiency. The result showed that the interbank merger in Indonesia has no positive effect on both profitability and the banking industry efficiency improvement. Setiyanti Purwengtyas (2002) studied 10 BPR and BPR BKK in Semarang regency, with DEA method which was resulted that different resources can affect operational efficiency.

RESEARCH METHOD

Method

This study is a comparative research since it compare between input and output variables in the research model. The populations of this research are rural banks that have been operated in the working area of the Financial Services Authority of Malang in the period 2010 to 2016. The study used Purposive Sampling as its' sampling technique. The criteria used as the sample basis selection are as follows:

a. Rural banks which have been operated in Indonesia for the period of 2010 to 2016.

b. The Bank should publish the financial statements of publications for the period of 2010 to 2016. According to purposive sampling method, the author got 26 bank as DMU. see Table 1.

Table 1. Research Sampling Criteria

Criteria	Company Total
BPR amount	46
Rejected because of incomplete financial statements	(20)
	26

Source: processed data

Based on Table 1, the analysis unit should be the panel data of observation period (t) = three years (2014-2016) and N = 26 banks. The data used in this study was secondary data which sourced from annual financial reports published in the Financial Services Authority in 2014-2016. DEA analysis was obtained by using win DEA software version 1.03. Based on the results of the analysis of these data, then the assessment criteria was determined. The UPK (in this case BPR) is classified to be efficient if it shows Ø = 1 or 100 and vice versa, it is classified to be inefficient if it shows Ø <1 or less than 100. As soon as all samples efficiency values have known, then it is tested differently by using analysis of variance (ANOVA) in order to know if there are differences in term of efficiency among groups of banks before and after adding capital.

Input and Output variables used in this study are listed below:

Table 2. Input and Output variables

Approach	Input	Output
Intermediation Approach	• Savings • Deposits	• Credit
Profitability Approach	• Contractual Interest Expense • Provision for Earning Assets Losses • Marketing Expenses • Administrative and General Expenses • Other Operating Expenses • Non Operational Expenses	• Contractual Interest • Amortization of Provision, • Amortization of Transaction Fees • Non-Operating Income.

Result and Discussion

Result

Here, the author explains the result of DEA analysis through two used approach:

Table 3. The result of BPR Efficiency Measurement through Intermediation Approach (in percent)

No	BPR Name	Year		
		2014	2015	2016
1	BPR Gunung Arjuna	37.13	49.40	81.26
2	BPR Gunung Ringgit	22.59	24.60	32.00
3	BPR Tugu Artha Malang	68.26	38.32	52.51
4	BPR Sumber Arto	13.00	29.24	42.07
5	BPR Sumber Dhana Makmur	100.00	100.00	92.19
6	BR Dau Lestari	100.00	100.00	55.36
7	BPR Dau Anugerah	68.41	62.07	73.69
8	BPR Bhaskara Pakto	37.91	39.82	73.27
9	BPR Eka Dana Utama	0.97	45.38	90.18
10	BPR Pujon Jaya makmur	37.22	31.70	36.90
11	BPR Eka Dana Mandiri	50.18	47.37	90.18
12	BPR Artha Kanjuruan Pemkab Malang	70.59	56.49	78.93
13	BPR Kerta Artha Mandiri	38.69	38.65	43.40
14	BPR Tumpang Arthasarana	0.56	1.55	100.00
15	BPR Sadhya Muktiparama	30.40	30.37	33.39
16	BPR Bangil Adyatama	0.40	16.77	28.97
17	BPR Danaputra Sakti	42.05	34.58	69.51
18	BPR Pandaan Arta Jaya	42.55	56.58	74.11
19	BPR ArtaTamanDayu	79.45	68.54	74.26
20	BPR Arta Seruni Surabaya	44.55	29.68	64.40
21	BPR Tumpang Arthasarana	10.84	75.55	100.00
22	BPR Bangil Idaman	71.88	57.64	80.36
23	BPR Semeru Swasti	24.49	29.42	40.08
24	BPR Armindo Kencana	66.36	70.16	76.14
25	BPR Surasari Hutama	37.60	33.64	43.04
26	BPR Angga Perkasa	15.33	18.25	22.55

Source: processed data

Based on Table 3, the twenty-six Rural Banks, in 2014 there were 2 BPRs that have been efficient since they have reached 100% efficiency percentage i.e. BPR Sumber Dhana Makmur, BPR Dau Lestari, while 24 other BPRs have not been declared as an efficient bank. Furthermore, similar to the previous year's condition, in 2015 the two BPRs that have been efficient include BPR Sumber Dhana Makmur and BPR Dau Lestari. Meanwhile, 24 other BPRs have not been declared as an efficient bank. In 2016 there were 2 BPRs that have efficiency, but there were changes, namely BPR Tumpang Arthasarana and BPR

bank groups with low efficiency have LDR 74.5% and Cash Ratio 31.3%. The profit approach from 2014 to 2016, efficient bank groups have BOPO 88.2%, 4% ROA, while inefficient banks have BOPO 91% and ROA 2.4%.

DISCUSSION

Based on the results of this study, only a few Rural Banks that become the sample reached the level of efficiency in the period 2014 -2016. By using the DEA intermediate non-parametric intermediation approach, and the variables determined, there are two banks that achieve efficiency levels. The banks are BPR Sumber Dhana Makmur, BPR Dau Lestari, but the two banks could not maintain their efficiency level in 2016. The efficiency decrease of BPR Sumber Dhana Makmur amounted to 7.87% as a result of the increase of inputs by 18.60% with 20% decrease in output, while BPR Dau Lestari reduced efficiency by 44.64%, as a result of 3.50% increase in inputs and 1.40% decrease of output.

The impact of the decrease in efficiency of BPR Sumber Dhana Makmur resulted in 2015 LDR by 86% down to 82% in 2016, as well as BPR Dau Lestari has been decreased LDR from 74% in 2015 to 71% in 2016. The Decrease number in Loan Deposit Ratio (LDR) gives meaning to the Bank's ability to channel credit in decline, and to reduce the intermediation function. The decline in the intermediary function indicates a decline in the interest of the public to deposit funds in the form of savings and deposits, as well as credit facilities also decreased.

Increasing number of efficiency occurred in BPR Kraton Suropati at 24.45% and BPR Tumpang Arthasarana at 98.45%. Increasing number of efficiency in BPR Kraton Suropati due to decrease of input 12,20% and decrease of output 4,12%. The increase in efficiency of BPR Kraton Suropati was also followed by an increase in LDR by 87% in 2015 and 89% in 2016, BPR Tumpang Arthasarana LDR 2015 by 76% and in 2016 to 98%. The increases in the LDR of two banks provide evidence that the ability to channel third party funds is getting bigger.

Based on the profitability approach, there are ten banks that can still maintain the level of efficiency and seven banks that have decreased. Banks that decreased in efficiency in the period 2014 to 2015 due to increased inputs by 12.50% and decreased output 395.24%, and the period 2015 to 2016 input decreased 10.28% followed by a decreased output of 23.65%. The biggest efficiency decrease was experienced by BPR Bangil Adyatama amounted to 51.29% in the period 2015/2016.

The decrease number of efficiency was caused by a decrease number of contractual interest expense in 2015/2016 40.66%, followed by a greater decrease of contractual interest income 63.53%. As a result of the decrease in efficiency, BPR Bangil Adyatama ROA -11%, BOPO 151% in 2015, ROA -14%, BOPO 179%. The decrease in Return on Assets (ROA) followed by the increase of BOPO gives BPR Bangil Adyatama experience in managing assets and costs which increasingly inefficient, resulting in lower profit before tax. Increased efficiency in the Rural Bank sector will encourage the mobilization of savings and deposit funds as well as greater loan demand thereby it can increase economic growth.

Based on the group, the efficient banks have an LDR financial performance of 81.7%, CAHS Ratio of 6.2%, BOPO 88.2%, ROA 4%. Inefficient group of banks has financial performance of LDR 74.5%, CAHS Ratio 31.3%, BOPO 91%, ROA 2.4%. From these conditions, proving that efficient banks have better financial performance compared to inefficient banks. However, the efficient performances of bank groups and inefficient banks still have better ROA and BOPO than the other industries where ROA based on the provisions, at least 1.215% and BOPO maximum 93.52%. This study supports the research which has been conducted by Hosen & Muhari (2013), the result indicated that the efficiency level of rural credit banks have a real positive relationship to performance but weak. Syafaat & Hosen (2014) indicated that the efficiency level of BPR has a weak relationship to the Bank's performance. This could be happened, since the Rural Bank, has a greater opportunity to earn income (contractual interest and provision) when compared to commercial banks.

CONCLUSION AND SUGGESTION

Conclusion

a.   DEA can generate bank efficiency scores and provide information for inefficient banks what to do in order to achieve efficiently.

b.   Using Intermediation approach, savings and deposits as input and credit as output there are 4 banks that can achieve efficiency, they are BPR Tumpang Arthasarana, BPR Sumber Dhana Makmur, BPR Dau Lestari, BPR Tumpang Arthasarana. It can be interpreted that the banks have been optimal in credit expansion.

c.   If using a profit approach, there are seventeen banks that achieve efficiency, which means the banks are already able to optimize contractual interest income and minimize interest costs.

d.   Bank's financial performance (ROA, BOPO, Cahs ratio) achieves better efficiency compared to banks that are not yet efficient.

e.   ROA and BOPO, the efficient and inefficient rural banks group that are still better than the average industry of rural banks in Indonesia.

The implications of this study are that the efficiency rating model using DEA can be applied to appropriate financial institutions. The limitations of this study only tested 26 conventional people's credit banks in the Working Area of the Financial Services Authority of Malang. And, it has not included a production approach yet.

Suggestion

It is important for Rural Bank Industries to view Efficiency decisions as a series that are not partially focused. Therefore, in improving the efficiency, BPR managers must be able to make optimal efficiency decisions so that the general purpose of the company can be achieved.

Efficiency was measured by DEA and Traditional approach. Although, the author has not inserted production approach and other financial ratios. Later, future research agenda can perform testing / assessment for various types of banks, rural banks owned by local government and private. This distinction is particularly important in terms of ownership of rural banks.

Reference list :

Ambarriani, A. Susty. 2003. "Faktor-faktor yang mempengaruhi efisiensi perbankan di Indonesia". MODUS Vol 15 (1): 37-46

Barry, T. A., DacanayIII, S. J., Lepetit, L., & Tarazi, A. (2008). Ownership Stucture and Bank Efficiency in The Asia Pacific Region. Retrieved October 1, 2013, from http://papers.ssrn.com/sol3/papers.cfm? abstract id=1331318

Bonin,John, P Hasan, Iftikhar, and wachtel,Paul (2004) " Privazation matters : Bank efficiency transition countries Willion davidson Institut,working paper no. 679

Charnes, Abraham, William Cooper, Arie Y. Lewin, Lawrence M. Seiford, (2001), Data Envelopment Analysis, Theory, Methodology and Applications, Kluwer Academic Publishers, Boston, London, sixth printing.

Cook, Wade D, Moez Hababou and Gordon S. Roberts, 2000, "Financial Liberalization and Efficiency in Tunisia Banking Industry : DEA Tests" Schulich School of Business

Dyah Nirmala T. (2001), " Dampak Merger antar Bank di Indonesia terhadap Profitabilita efisiensi pada Bank Pemerintah, Umum, Swasta, Devisa, non Devisa tahun 1995-2000. " Tesis Pasca Sarjana UGM 2001.

Farell,M.J (1957), The Measurement of Productive Efficency . Journal of The Royal statistical Society,Vol. 120.No.3, 253-290

Firdaus, F. M., dan Hosen, M. D. (2013). Efisiensi Bank Umum Syariah Menggunakan Pendekatan Two-Stage Data Envelopment Analysis. Buletin Ekonomi Moneter dan Perbankan, 16(2).

Galemann,Birgit,2008, Efesiaensi Operasional, Jangkauan Pelayanan dan Penetapan Suku Bunga Kredit BPR, Jakarta

Hadad, M,D, Santoso, Mardanugroho,2003, Analisis Efisiensi Industri Perbankan Indonesia Penggunaan Metohode Non Parametric Data Envolopment Analysis,. Buletin Ekonomi Moneter dan Perbankan.WWW.Google.Com

Halkos, G. E., & Salamouris, D., S. (2004) "Efficiency Measurement of the Greek Commercial Bank with the JAAI VOLUME 12 NO. 1, JUNI 2008: 37– 52 Use of Financial Ratios: a Data Envelopment Analysis Approach", Management Accounting Research

Iswardono dan Darmawan, 2000, "Analisis Efisiensi Industri Perbankan di Indonesia", Jurnal Ekonomi dan Bisnis Indonesia (JEBI), Volume : 15 Nomor : 1 Halaman : 1 – 13.

Karimzadeh, M. (2012). Efficiency Analysis by Using Data Envelop Analysis Model: Evidence from Indian Banks. International Journal of Latest Trends in Finance & Economic Sciences , 2 (3), 228 - 237.

Kusmargiani,Safitri,Ida,2006, Analisys Efisiensi Operasional dan efisiensi Profitabilitas pada Bank Marger dan Akuisisi di Indonesia (studi pada bank setelah rekapitulasi dan restrukturisasi tahun 1999-2002), Program Pasca Sarjana Universita Diponegoro,Semarang.

Kesowo, M.T. 2001. Analisis Hubungan antara Efisiensi Operasional dengan Kinerja Operasional Bank Umum Swasta Devisa di Indonesia Periode Tahun 1995-1999. Fakultas Ekonomi Universitas Gadjah Mada Yogyakarta

Kumar, S., & Gulati, R. (2008). An examination of technical, pure technical, and scale efficiencies in indian public sector banks using data envelopment analysis. Eurasian Journal of Business and Economics , 1 (2), 33-69.

Lambrete, Mario dan Descrocher, Martein(2002), Effisiensy and Expenses Preference in Philipphines cooperative rural bankins. Discusstiion paper series no.2002-12 nopember .Philippines Institute Development Studies

Muazaroh, dkk, (2012), Determinants of Bank Profit Efficiency: Evidence From Indonesia, International Journal of Economics and Finance Studies, Vol 4, No 2, 163-173.

Payamta, dan Mas'ud Machfoedz, (1999), "Evaluasi Kinerja Perusahaan Perbankan sebelum dan sesudah Menjadi Perusahaan Publik Di Bursa Efek Jakarta (BEJ)," Kelola Gadjah Mada Business Review No.20/VIII, h. 55-69

Kuncoro dan Suhardjono, 2002,Manajemen Perbankan (Teori dan Aplikasi),Edisi Pertama, Penerbit BPFE , Yogyakarta

Muchamad Hartana Iswandi Putra (2003) , Analisis Efisiensi Industri Perbankan Di Indonesia (Studi Kasus Bank-Bank Devisa di Indonesia Tahun 1991-1996),Universitas Gajah Mada,Yogyakarta

Naceur, S. B., Kedhiri, H. B., & Casu, B. (2009). What drives the efficiency of selected MENA bank: A meta frontier. Economic Research Forum Working Paper Series , 1-20.

Reynaud dan Rokhim (2005), Do Banking Crises Enhance Effisiency? A Case Study of 1994 Thurkys and Indonesian 1997 Cresses,.WWW.Google.Com

Pancurova,D; & Lyocsa,S.(2013). Diterminants of Commercial Bank " Efficiency " Evidence from 11 CEE Countries, Journal of Economics and Finance,63 (2) 152-179

Sandi,Kusuma,wardana (2013), Analisis Tingkat Efisiensi Perbankan dengan pendekatan DEA (studi pada bank umum Indonesia periode 2009-2011), Universitas Brawijaya, Malang

Subekti, I. (2004). Investigasi empiris cost-efficiency perbankan indonesia berdasarkan metode Data Envelopment Analysis (DEA). Lintasan Ekonomi , XXI (1), 95-115.

Setiyanti Purwengtyas, 2002, "Analisis Efisiensi Operasional, Kualitas Pelayanan dan Profitabilitas BPR dan BPR BKK sebagai Dasar Strategi Bencmarking Studi Kasus pada 10 BPR dan BPR BKK di Kabipaten Semarang" Tesis MM Undip

Syafaat, Muhari & Hosen,Muhamad, 2014. Tingkat Efisiensi BPRS di Indonesia: Perbandingan metode SFA dengan DEA dan hubunganya dengan CAMEL. Jurnal Keuangan dan Perbankan. 18(2).307-327

Viverita, & Ariff, M. (2011). Efficiency Measurement and Determinants of Indonesian Bank Efficiency. Retrieved October 2013,

Wang, Y., Reasman.,Muhittin,,& Gattoufi. (2004), Relating The CCR Model in Data Invelopment Analysis to the Analysis Theory of The Firm best on the weak Axiom of Profit Maximation.