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THE EFFICIENCY AND PRODUCTIVITY OF THEREGIONAL DEVELOPMENT BANKS IN INDONESIA: AN APPLICATION OF DATA ENVELOPMENT ANYLYSIS (DEA)- MULTISTAGE (INPUT ORIENTED VRS) APPROACH COMPARE WITH CAMEL APPROACH

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The study employs DEA-Multistage (input oriented VRS)-model to investigate the efficiency and productivity of the 26 regional development bank in Indonesia from 1994 to 2004. DEA results suggest that the average estimate scores of sample banks have ranged from 19.14 percent to 69.14 percent. From this approach, BPDWS is the most efficient with the highest average estimate efficiency score of 69.14 percent and has the lowest average input inefficiency of 30.86 percent. On the other hand BPDP has the lowest average efficiency score, whis is 19.14 percent with the highest average input inefficiency of 80.86 percent. Moreover, 69.2 percent of banks have the estimate efficiency score above the mean of 33.28 percent. In general, the efficiency scores of all banks showed a decline when the financial crisis stuck the Asian region in 1997. Another significant contribution of DEA model is a possible explicit determination of bank's excesses in input resources and also output deterioration for the first itme in Indonesia development banks. Among four input variables, capitas has the highest average input slack of 11.26 percent followed by deposit, fixed assets and total operating expenses with the average imput slacks of 10.13 percent, 6.44 percent, 6.44 percent, and 3.65 percent respectively.

Keywords: DEA multistage input oriented VRS, regional development banks, efficiency, productivity

Introduction

Since the Data Envelopment Analysis (DEA) model was proposed by Charmer et al., (1978), it has been widely used in non-profit and profit organizations to measure the efficiency and productivity. It is used in non-profit organization, such as hospital (Sarkis and Talluri, 2002; Ferrier and Valdmanis, 2004); 87 Countries/Capital and GDP growth (Kruger, 2003) Taiwan/Multinational R&D Project (Kuang, 2005); Norway/Traffic Accidents & Safety (Odeck, 2005). For profit organizations such banking industry or financial institution: see Avrikan, (1999) Zenios *et al.*, (1999); Drake, Howcroff (2002) Chien, Dauw (2004); Krishnasamy *et al*., (2004); Wai *et al.*, (2003); Karr (2005) etc.

DEA modeling allows the anylist to select inputs and outputs in accordance with a managerial foucs. Furthermore, the technique works with variables of different units without the need for standardization (e.g. dollars, number of transactions, or number of staff) (Banker, 1984; Burle, 1995; Mester, 1996). .. That is, DEA does not assume a particular production technology or correspondence. The importance of this feature of DEA is that a banks's efficiency can be assessed based on other observed performance. As an efficient frontier technique. DEA identifies the inefficiency, in a particular Decision Making Units (DMU) comparing it to similar DMUs regarded as efficient, rather than trying to associate a DMU's performance with statistical average that may not be applicable to that DMU.

Assessment of operational-performance through DEA can be complemented by ratio analysis that measures financial performance of a branch (Oral et al., 1992). DEA is that it alloswa management to nominate the inputs and ouputs entering the analysis. DEA allows to be classified as either controllable or uncontrollable by management. This facilities an analysis where performance can be interpreted in the context of unctrollable environmental conditions (Banker and Morey, 1986; Epstein and Henderson, 1989). Dea models can offer much potential for a significant advance in the comparative analysis of financial institution by enabling the the concurrent study of the multiple varibales that affect bank efficiency overtime (Bauer et al., 1997).

Data envelopment analysis is used to compare the efficiency estimates among the Indonesia regional development banks and to determine the input usage/saving and ouput deterioration for each bank's performances.

There are four input variables (deposit, operationg expenses, capital and fixed assets and one variable (loan) as output used in this study.

Overview of the Banking System in Indonesia

Indonesia's financial system stability relies heavily on the banking industry, covering, of about 90 percent of total asset of the country's financial system Indonesia's banking system is dominated by 13 large banks, including ten (10) recapitalization banks, which represent 74.8 percent of the total assets of banking industry. Therefore, ensuring the soundness of these large banks is the key in maintaining stability of banking system and financial system (BI 2002).

Before the 1997 crisis, Indonesia evolved into five stages: (1) the rehabilitation period (1967-1973) to restore the economy from high inflation; (2) the ceiling period (1974-1983) where interest rates ceing were applied; (3) the growth period (1983-1988) following banking deregulation of June 1983 removed the interest rate ceiling; (4) the acceleration period (19881991) following the impact of extensive bank reforms in October 1988; and (5) the consolidation (1991-1997) in which prudential banking principles were introduced including capital adequency and bank ratings (Batunaggar, 2002).

After the 1997 crisis, on November 16, 1997, the bank authority of Indonesia liquidated 16 private banks as the 1 st round closures. In April 1998, ten (10) private banks were frozen (BBO) for the 2nd round closures. For the 3rd round closures on March 13, 1999, 38 private banks were frozen. Other strategies made by the bank authority are bank take over and recapitalization. On April 4, 1998, seven (7) private banks had taken over (BTO) and on May 29, 1998, one (1) private bank had taken over for the 1 st round of take over. For the 2nd and 3rd rounds of take over March 13 and April 4, 1998, respectively, seven (7) private banks and two (2) private banks had been taken over.

Recapitalization for private banks accrued on April 21, 1999 and March 2000 for the 1st and the 4th rounds, where seven (7) and three (3) banks had been recapilatalized, respectively. There were 12 regional development banks and four (4) state banks that had been recapitalized (BI, 2000).

During the resolution of banking crisis, m there are 12 cut of 26 regional development banks that received injection of capital from the bank's authority. Fourteen (14) banks grouped in A category with CAR greater thatn 4 percent, eight (8) banks grouped in B category with CAR greater than negative twenty five percent but less thatn four percent (-25%<CAR, 4%), and the rest four (4) banks be categorized in level C with CAR less than -25 percent (BI, 2002).

Regional Development Bank (BPD) was established based on the Law No. 13,1962, which stipulated the establishment of regional development bank in each province in Indonesia, serving as an intermediator to the investors in that area.

Methodology

DEA – MultistageModel (Input-oriented variable retruns to scale _VRS technology). DEA was originally introduced by Charnes et aL (1978) and is a non-parametric linear programming approach, capable of handling multiple inputs as well as multiple outputs. DEA assumes that the inputs and outputs have been correctly identified. Usually, of 1 as they become too specialized to be evaluated with respect to other units. On the other hand, if there are too few inputs and outputs, more DMUs tend to be comparable. In any study, it is importand to focus on correctly specifying inputs and outputs. According to Krugger (2003), DEA is a local method in that calculates the distance to the frontier function through a direct comparison with only those observations in the samples that are most similar to the observation for which the inefficiency is to be determined.

The Piece-wise linear form of non-parametric frotntier in DEA can cause a few difficulty in efficiency mearure. The problem arises because of the sections of the piece-wise linear frontier, which run parallel to the axes which do not occur in most parametric function Coelli et al., 1998).

Environment is the factor which could influence the efficiency of a firm, where such factors are not traditional inputs and are assumed not under the control of manager. Some examples of environmental variables include ownership, location, labor, and government regulation (Fried *et al.*, 1999). If the values of the environmental variable can be ordered from the least to the most detrimental effect upon efficiency, then the approach of Banker and Morey (1986a) can be natural ordering of the environmental variable then one can use a method proposed by Chames et al. (1985).

Chames *et al.* (1978) stated that the DEA technique as an efficiency measure of production unit by its position relative to the frontier of the best performance, established mathematically by the ration of weighted of sum of inputs; different decision makin units (DMU) can be compared based on productivity and efficiency. A common practice in this case is to run DEA where all the inputs are treated as controllable and then regress the emerging efficiency scores on non-discretionary inputs.

In this study, the multistage DEA model was utilized to compute the total efficiency scores. According to Coelli *et al.* (1998), p. 150), the constant returns to scale (CRS), DEA model is only appropriate when the firm is operating at an optimal scale. Some factors such as imperfect competition, constraints on finance, banking, corruption, political crisis etc, may cause the bank to be not operating at an optimal level in practice.

The fall of Soeharto and five (5) years after the financial crisis, Indonesia is still struggling to deal with economics restricting and recovery, political transition, decentralization and redefining national identity (Deuster, 2002). Moreover, the Asian financial and economic crisis of 1997-1998 hit the country hardes, which caused its real GDP declined by 13 percent in 1998 as its banking and modern corporate sectors collapsed in the wake of short-term capital outflows. Corporate debts remain largely unreconstructed, bank lending is limited, the government owns or controls most of the banking system and substantial business assets, fiscal sustainability is questionable, inflationary pressures are strong and investment climate is unattractive.

To consider all these environmental factors that may affect the banking performance in Indonesia, this study adopted Baker at al. (1984) DEA model of variable returns to scale (VRS). Due to the consequence of the heavy intervention by the government in banking system in indonesia as mentioned earlier, bankers amy well have been prevented from operating at the optimal level in their operation. Therefore, technical efficiency in this study is calculated using the input-oriented VRS model. The envelopment form of the input-oriented of CRS and VRS DEA model is specified as stated by Coelli *et al.* (1998, pp. 150, 151).

$$min_{\theta,\lambda}\theta, \text{ st:} -y_i+y_\lambda \geq 0,$$
$$\theta x_i - x\lambda \geq 0$$
$$N1'\lambda=1$$

$$SE_i = \frac{TE_iCRS}{TE_iVRS}$$

$$min_{\theta,\lambda}\theta, \text{ st:} -y_i+y_\lambda \geq 0,$$
$$\theta x_i - x\lambda \geq 0$$
$$N1'\lambda=1$$
$$\lambda \geq 0$$

Where θ is scalar and λ us a N*1 vector of constants, N*1 is an vector of one.

In this study, θ_i efficiency score for each bank, N is number of bank which is 26, λ is the lambda weight of each bank to the target or peer, y is the ouput variable(loan) and x is the input variables (deposit, total expenses, fixed assets, and capital). The efficiency score will satisfy if the value of θ is less and equal than one. If there is a difference in the CRS and VRS TE (Coelli *et al*, 1998, pp.134, 140, and 141). Furthermore, the nature of the scale inefficiencies for particular firm can be determined by seeing whether the non increasing return to scale (NIRS) technical efficiency (TE) of NIRS TE score is equal to the VRS TE score. If they are unequal, then increasing return to scale exists for the firm. If they are equal, the decreasing return to scale applies. And if $TE_{CRS} = TE_{VRS}$ the firm is operating under constant return to scale CRS (Coelli *et al.*, 1998, pp. 150-151). The efficiency scores in this study were estimated, using the computer program known as Efficiency Measurement System – EMS (Scheel, 2000).

Slacks. The piece-wise linear form of the non-parametric frontier in DEA can cause a few difficulties in efficiency measurement. The problem arises because of the sections of the piece-wise linear fronties which run parallel to the axes which do not occur in most parametric functions Coelli et al. (1998). Some authors argue that both the Farrell measure of technical efficiency (θ) and any non-zero input or output slacks should be reported to provide an accurate indication of technical efficiency of firm in DEA analysis Coelli *et al.* (1998). They sated that the output slacks will be equal to zero if and only if $Y\lambda - y_1 = 0$ and the input slacks will be equal to zero if and only if $\theta x_1 - X\lambda = 0$ (for the given optimal values of θ and λ).

Coelli *et al.* (1998) stated that there are two major problems associated with the second stage LP. The first and most obviouse problem is that the sum of the slacks is maximized rather than minimized. Hence, it identifies not the nearest efficient point but the furthest efficient point. The second major problem associated with the second- stage approach is that is not invariant to unit of measurement. To avoid the two problems mentioned, the multi-stage DEA method was used. Coelli (1998) staed that the multistage method involves a sequence of radial DEA models and hence is more computationally demanding that the first-stage and second stage methods. However, the benefits of the approach are that it identifies efficient projected points which have input and output mixes as similar as possible to those of ineffiecient points, and that it also invariant to units of measurement. For a detailed explanation, see Coelli *et al.* (1998).

Data and Variables

Data. This study uses a panel data set of 26 regional: development:' banks is in Indonesia from 1994 to 2004. The sample include all the regional development banks, owned by 26 provinces in Indonesia. The time period from 1994 to 2004 was selected based on data for the audited financial reports. The number of Indonesia's regional development banks is shown in Table 1 below:

Table 1. Regional Development Bank

Name of Bank	Code
BPD, Aceh (NAD)	BPDNAD
BPD, North Sumatera	BPDSS
BPD, Bengkulu	BPDBE
BPD, Lampung	BPDL
BPD, DKI Jakarta	BPDDKI
BPD, Central Java	BPDCJ
BPD, East Java	BPDEJ
BPD, West Kalimantan	BPDWK
BPD, North Sulawesi	BPDNSU
BPD, Maluku	BPDM
BPD, West Nusa Tenggara	BPDWNT
BPD, West Sumatera	BPDWS
BPD, South Sumatera	BPDSS
BPD, Jambi	BPDJ
BPD, Pekanbaru-Riau	BPDR
BPD, West Java	BPDWJ
BPD, DIY	BPDDIY
BPD, Bali	BPDBa
BPD, South Kalimantan	BPDSK
BPD, Central Kalimantan	BPDCK
BPD, East Kalimantan	BPDSK
BPD, South Sulawesi	BPDSSU
BPD, Central Sulawesi	BPDCSU
BPD, South East Sulawesi	BPDSESU
BPD, Papua	BPDP

Variables. This study used one (1) output variable and four (4) input variables to evaluate bank's efficiency through the DEA multistage model (input oriented VRS techonology). The output variable is total loans and input variables are (1) total Deposits, (2) total opearational expenses, (3) capital, (4) total fixed assets.

Total loans are composed of loan of rupiah currency (related parties and third parties) and loan of foreign currency (related parties and third parties). Total deposits are composed of demand deposits, saving deposits, time deposits, and certificate deposits. Total operating expenses consist of interest expenses, fees and commissions, general and administrative expenses, salary and employees' benefits, loss on fair value on trading account securities and foreign exchange. Capital is composed of capital stock, donated capital, increment of financial report, unrealized gain (loss) from trading account securities, and other comprehensive income, and difference on affiliated retained earning. Lastly, fixed assets are composed or premises and equipment, assets in direct financing lease and real and chattel properties.

Emperical Results

DEA and CAMEL. DEA was used in this study to compare the efficiency estimates among the Indonesia's regional development banks and evaluate the input usage savings and output deterioration for each bank's performance. The key advantage of DEA over other methods of performance evaluation is that it allows one to consider a nuber of outputs and inputs simultaneously, regardless of whether all the variables of interest are measured in common units. (Sexton, 1986).

In this evaluation process, the study used four (4) Variables (deposit, operating expenses, capital, and fixed assets) as inputs and loans as output. The result of efficiency score and inputs slacks compared with the summarized in Table 2, 3 and 4, respectively.

Results reveal that bank, which has the highest efficiency estimate score among 26 banks is BPDWS (69.14 percent), whch means BPDWS could possibly reduce the usage of all input (deposit, operating expenses, capital an fixed asset) by 30.86 percent (1-0.6914) without reducing the current output. This same bank had an efficiency score of 100 percent in1994 and 1995, which means that it did not incur input excesses.

Even though, BPDWS showed a decline from 93.21 percent in 1996 to 53.7 percent in 2004, this bank still posted the highest efficiency performances for the entire evaluation period.

BPDDKI posted an efficiency score of 100 percent from 1997 to 1998, however, this bank occupied the eight rank in terms of efficiency scores of 28.17 percent (1994 1996) and 27.35 percent (1997-2004). The banks that have the second and third ranks with a higher efficiency estimate score are BPDENT and BPDBE with scores of 61.20 percent and 58.34 percent, respectively. Results imply that BPDENT and BPDBE could reduce their given inputs by 38.80 percent and 41.66 percent, respectively without reducing the present output. Otherwise, the: bank that has the lowest efficiency score is BPDP with a 19.14 percent efficiency estimate score. This means that this bank has-been wasting in using all the inputs-by 80.86 percent.

Based on Table 3, BPDWS which has the highest rank in terms of an efficiency estimate score, only occupied the seventh rank in terms of the average rank of CAMEL ratios. Meanwhile, BPDEK, which is in rank twenty three in terms of an efficiency estimate score,m is in the first rank in terms of the average rank of CMAEL ration. Furthermore, banks (BPDENT and BPDBE) which occupied the second and third rank in terms of an efficiency estimate score, only occupied the twelfth an twentieth rank in terms of the average rank of CAMEL ration. BPDP, which has the lowest efficiency estimate score, occupied the eight rank in terms of the average rank of CAMEL ratios. To evaluate if there have been a significant association between the resultin CAMEL analysis and DEA approach, it will be discussed in the next article.

Table 2. **Summary of Efficiency Score (%) of Regional Development Banks in Indonesia (1994-2004)**

Banks	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Mean
BPDNAD(C)	39.8	36.21	33.38	34.8	61.3	22 57	5743	45 72	39.05	32.19	51 5	41 27
BPDNS(A)	31.3	28.28	28.53	2867	35.4	1441	36.21	38.78	27.56	31.90	44.97	31 45
BPDBE(C)	82.6	56.44	51.43	4797	44.0	7294	76.02	56A5	48.52	46.10	59.4	58.34
BPDL(B)	45.3	38.20	35.62	40.1 t	259	2911	65.64	64.24	45.71	46.07	58.5	44.94
BPDDKI(A)	23.6	25.35	35.48	100	too	100	14.49	11,82	14.61	23.22	35.6	44.19
BPDCJ(B)	28.8	29.18	3592	34.95	39 5	36.74	36.70	4150	41.24	4109	53.8	3912
BPDEJ(C)	31.9	34.58	40.89	4+21	497	3670	32.28	40.62	39.39	44.95	49.3	40.33
BPDWK(A)	50.2	48.23	32.86	30.68	23.5	26.14	23.36	29.83	34.17	37.42	49.6	35.09
BPDNSUA	32.9	35.62	32.54	33.20	21.2	19.84	72.74	48.96	27.51	28.35	35.6	35.32
BPDM(A)	63.1	66.11	63.12	63.12	100	3634	24 19	39.44	30.81	35.95	35.2	50.67
BPDWNT(B)	41.4	41.51	40.13	19.46	96.4	3253	45.59	4700	40.15	44.32	65.3	49.53
BPDENT(B)	73.4	78.00	72.72	55.77	100	31.62	56.86	41.69	42.69	44.44	76.1	61.20
BPDWS(C)	100	100	93.21	67.78	62.9	61.95	56.48	54.83	50.18	59.48	53.7	69.14
BPDSS(A)	39.1	33.88	30.06	30.07	16.3	1790	25.89	29.10	23.88	24.45	23.9	26.78
BPDJ(A)	611	48.01	36.17	36.34	27.5	27.18	2991	31.38	33.29	33.80	30.7	35.93
BPDR(A)	27.7	28.88	29.74	25.83	9.54	11.13	1783	23.52	25.60	28.83	33.9	2387
Banks	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**Mean**
BPDWJ(B)	32.6	30.31	29.70	2993	22.7	22.68	41.56	4549	51.25	48.86	100	41.36
BPDDIY(A)	36.4	31.79	24.99	25.29	16.2	15.00	22.39	24.57	27.66	29.35	27.5	25.56
BPDB(B)	31.9	3128	30.27	29.69	21.4	2337	29.04	37.30	45.93	49.19	48.3	34.24
BPDSK(A)	35.4	31.92	25.39	22.64	14.4	17.48	17.89	20.02	17.54	21.74	21.8	21''
BPDCK(B)	41.6	3426	28.37	26.65	13.0	13.19	15.00	15.82	16.14	12.48	15.5	21.09
BPDEK(A)	33.4	26.59	26.23	22.36	12.8	IO 30	16.75	15.29	19.26	25.85	31.1	21.81
BPDSSU(A)	36.2	36.73	37.57	39.31	28.9	30.91	37.36	4112	44.04	48.72	56.4	39.75
BPDCSU(A)	100	79.03	62.06	56.79	442	53.29	55A8	27.02	19.96	23.67	29.1	50.05
BPDSESU(A)	72.53	55.75	44.61	40.25	24.8	30.58	31.01	22.91	21.37	21.97	277	35.78
BPDP(A)	Z6.91	24.17	25.44	24.32	16.6	17.08	15.07	12.52	12.20	17.73	18.6	19.14
Mean	40.98	38.05	35.12	35.33	34.1	26.96	30.13	2954	27.87	30.46	37.6	33.29

Table 3. **Rank Based on Average Rank of CAMEL Ratios and Average Rank of Efficiency Estimates Score (DEA) of Regional Development Banks in Indonesia (1994-2004)**

Banks	CAMEL	DEA Efficiency estimates score
BPDNAD(C)	17	10
BPDNS(A)	16	19
BPDBE(C)	20	3
BPDL(B)	19	8
BPDDKI(A)	9	7
BPDCJ(B)	24	13
BPDEJ(C)	15	11
BPDWK(A)	23	17
BPDNSU(A)	14	16
BPDM(A)	16	4
BPDWNT(B)	16	6
BPDENT(B)	12	2
BPDWS(C)	7	1
BPDSS(A)	21	20
BPDJ(A)	2	14
BPDR(A)	3	22
BPDWI(B)	22	9
BPDDIY(A)	10	21
BPDBa(B)	18	18
BPDSK(A)	4	24
BPDCK(B)	11	25
BPDEK(A)	1	23
BPDSSU	6	12
BPDCSU(A)	13	5
BPDSESU(A)	5	15
BPDP(A)	8	26

Note: CAMEL rank is computed by sum of the rank of each ratio divided by total ratios (8)

Table 4. **The Rank Based on CAMEL Ratio and Efficiency Estimate Score (DEA) of the 26 Regional Development Banks in Indonesia (1994-2004)**

Bank	DEA	C/TPA	TE/TELO	TLO/TA	NPL/TLO	Exp/TA	ROA	ROE	CPCB/TDB
BPDNAD(C)	10	25	20	6	22	2	23	20	5
BPDNS(A)	19	4	7	16	8	15	24	26	22
BPDBE(C)	3	24	26	21	23	7.5	16	11	11
BPDL(B)	7	13	22	23	9	6	18	18	24
BPDDKI(A)	8	10	19	12	2	3	21	23	to
BPDCJ(13)	13	12	21	20	24	16	20	22	25
BPDEJ(C)	11	22	24	15	11	8	12	8	14
BPDWK(A)	17	18	18	14	21	12	22	25	17
BPDNSU(A)	16	6	14	19	20	14	8	13	16
BPDM(A)	4	14	13	9	26	5	17	17	2
BPDWNT(B)	6	5	12	25	10	13	13	21	23
BPDENT(B)	2	21	23	17	13	4	6	3	19
BPDWS(C)	1	19	1	1	19	25	5	2	8
BPDSS(A)	20	8	16	22	6	21	19	24	26
BPDJ(A)	14	2	4	10	16	9	1	1	12
BPDR(A)	22	23	3	3	12	7.5	10	6	1
BPDWJ(B)	9	20	25	26	1	24	14	16	20
BPDM(A)	21	9	Is	18	14	23		9	6
BPDBa(B)	Is	11	17	24	7	26	11	14	15
BPDSK(A)	23	3	2	7	18	19	4	10	3
BPDCK(B)	25	15	10	4	17	20	15	15	9
BPDEK(A)	24	17	5	2	3	1	17	5	2
BPDSSU	12	26	6	11	4	17	3-	7	4
BPDCSU(A)	5	16	8	5	25	10	19	19	7
BPDSESU(A)	15	1	11	13	15	18	2	4	13
BPDP(A)	26	7	9	8	5	22	9	12	18

Determine the input usage/savings and output deterioration for each bank's performance (DEA approach)

Input slacks. The summary of input slacks over the evaluation period 1994 of this study is shown in Table 5. Keep in mind that input slacks refer to input surplus or excess that a bank need to reduce to be efficient.

Table 5. **Summary of input Slacks (%) of Regional Development Banks in Indoesia (1994-2004)**

BANKS	DEPOSIT	OPERATING EXPENSES	CAPITAL	FIXED ASSETS	MEAN
BPDNA(C)	17.36	2.54	10.27	10.49	10.165
BPDNS(A)	10.25	1.71	12.57	15.17	9.925
BPDBE(C)	14	2.81	7.12	10.16	8.523
BPDL(B)	16.03	0	17.01	13.16	11.550
BPDDKI(A)	5.73	0	8.82	7.14	5.423
BPDCJ(13)	13.41	6.8	11.71	13.07	11.248
BPDEJ(C)	17.02	7.43	11.15	1.29	9.223
BPDWK(A)	13.64	3.11	9.05	7.59	8.348
BPDNSU(A)	9.04	0.46	13.97	7.56	7.758
BPDM(A)	7.86	0.29	15.22	3.08	6.613
BPDWNT(B)	13.92	5.1	17.25	14.16	12.608
BPDENT(B)	29.03	11.75	19.85	4.26	16.223
BPDWS(C)	13.38	19.27	13.7	0	11.588
BPDSS(A)	6.63	0	9.96	4.11	5.175
BPDJ(A)	11.8	0	19.67	6.23	9.425
BPDR(A)	2.21	3.76	10.28	0	4.063
BPDWJ(B)	11.84	11.42	7.93	0	7.798
BPDDFYA)	0.65	0.71	4.28	0.72	1.590
BPDBa(B)	8.42	10.45	10.03	0.6	7.375
BPDSK(A)	2.72	0.11	10.7	5A	4.733
BPDSK(B)	3.35	0	3.87	4.23	2.863
BPDEK(A)	6.01	0.32	9.42	4.3	5.013
BPDSSU(A)	15.2	6.86	0	7.25	7.328
BPDCSU(A)	9.51	0	9.8	5.79	6.275
BPDSESU(A)	3.39	0	273	14.08	11.193
BPDP(A)	1.09	0	1.86	7.6	2.638
MEAN	10.13	3.65	11.26	6.44	7.87

Table 5 shows in detail how much each bank input could be reduced to reach the best practice frontier (efficiency level). In terms of deposit as an input, all banks incurred input slacks. Banks with a higher input slack have a lower efficiency performance. The result shows that the most inefficient bank is BPDENT, with the highest deposit slack of 29.03 percent, followed by BPDNAD of 17.36 percent, BPDEJ of 17.02 percent, and BPDL of 16.03 percent, all excesses in deposits. To become efficient, banks such as BPDENT needs to reduce its deposit of 29.03 percent. Otherwise, bank which has the lowest slack of deposit is BPDIY. Anallytically, this bank needs only to reduce its depost of 0.65 percent to be a 100 percent efficient.

The second input is operating expenses. Chic study found out that there are eight (8) banks that do not need to reduce their operating expenses due to zero slack result. Those banks are the following: BPDL, BPDKI, BPDSS, BPDJ, BPDCK, BPDCSU, BPDSESU and BPDP. On the other hand BPDWS, which is known as the top performer in the efficient estimate score, has the highest slack in operating expenses of 19.27 percent, compared with the highest efficiency estimate score of 69.14 percent.

The third input variable is capital. The result shows that most of the banks have capital surpluses, except for BPDSSU, which has a zero slack. There are three banks which have the highest input slack of capital among 26 banks. Those banks are the following: BPDSESU, with a capital surplus of 27.30 percent, BPDENT of 19.85 percent and BPDJ of 19.67 percent. In other words, these banks need to reduce their capital as much as their slack rating without reducing their current output.

The last input variable is fixed asset. There are two (2) banks that posted zero slack. Those banks are the following: BPDR and BPDWJ. BPDR occupied the third rank with the lowest slack in terms of deposit, eleventh rank in terms of operating expense slacks, and the fourteenth rank in terms of capital slacks. While BPDWJ has the sixteenth rank in terms of deposit slacks, the eight rank in the highest slack in terms of operating expenses, and the sixth rank in the lowest slack in terms of capital. By using the DEA approach, the result shows that no bank in the sample has a consistent efficiency performance in terms of efficiency or inefficiency score. The results of DEA approach seems to be similar with the result of the CAMEL analysis: none of the banks has a consistence performance for all variables used in DEA or CAMEL.

Table 5 shows that, on average, the highest slacks of all input variables were posted by BPDENT (12.68 percent) while the lowest slacks were posted by BPDIY (1.59 percent). BPDIY has managed to utilize efficiently its deposit, operating expenses, capital, and fixed assets to the production of loans (as an output): it calls for a reduction of all inputs by 1.59 percent only to become efficient. However, Table 1 shows that none of the banks incurred output slack, because the output slacks of all banks are zero. Thus, the presence of input slacks in deposit, operating expenses, capital and fixed assets did not effect to produce the loan as an output.

Output slack. Based on Table 6, 26 regional development banks during year 1994-2004 do not need the percentage improvement in terms of loan as an output, because all banks have zero output slack. Zero slack of output means there is no deficiency in output production of loans. The result implies that none of the banks has inefficiency in the procution of loans. Comparing the results shown in Table 2 and Table 5, only five (5) banks have zero input slack in terms of operating expenses; one (1) bank in terms of capital and three (3) banks in terms of fixed assets. In general, all banks have an input stack at least at the three (3) input variables to produce loan as an output. This result contradicts with the study of Avkiran (1999) that evaluated the efficiency of 65 banks in Australia, wherein, a rise in inputs will lead to a proportionate rise in outputs.

Table 6. **Summary of Loan Slack (%) of Regional Development Bank in Indonesia (1994-2004)**

DMU	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
BPDNA(C)	0	0	0	0	0	0	0	0	0	0	0
BPDNS(A)	0	0	0	0	0	0	0	0	0	0	0
BPDBE(C)	0	0	0	0	0	0	0	0	0	0	0
BPDL(B)	0	0	0	0	0	0	0	0	0	0	0
BPDDKI(A)	0	0	0	0	0	0	0	0	0	0	0
BPDCJ(B)	0	0	0	0	0	0	0	0	0	0	0
BPDEJ(C)	0	0	0	0	0	0	0	0	0	0	0
BPDWK(A)	0	0	0	0	0	0	0	0	0	0	0
BPDNSU(A)	0	0	0	0	0	0	0	0	0	0	0
BPDM(A)	0	0	0	0	0	0	0	0	0	0	0
BPDWNT(B)	0	0	0	0	0	0	0	0	0	0	0
BPDENT(B)	0	0	0	0	0	0	0	0	0	0	0
BPDWS(c)	0	0	0	0	0	0	0	0	0	0	0
BPDSS(A)	0	0	0	0	0	0	0	0	0	0	0
BPDJ(A)	0	0	0	0	0	0	0	0	0	0	0
BPDR(A)	0	0	0	0	0	0	0	0	0	0	0
BPDWJ(B)	0	0	0	0	0	0	0	0	0	0	0
BPDDIY(A)	0	0	0	0	0	0	0	0	0	0	0
BPDBa(B)	0	0	0	0	0	0	0	0	0	0	0
BPDSK(A)	0	0	0	0	0	0	0	0	0	0	0
BPDSK(B)	0	0	0	0	0	0	0	0	0	0	0
BPDSK(A)	0	0	0	0	0	0	0	0	0	0	0
BPDSSU	0	0	0	0	0	0	0	0	0	0	0
BPDCSU(A)	0	0	0	0	0	0	0	0	0	0	0
BPDSESU(A)	0	0	0	0	0	0	0	0	0	0	0
BPDP(A)	0	0	0	0	0	0	0	0	0	0	0

Conclusions and Future Research

The significant findings and contributions of the study are as follows: Bank performance is modeled again using a non- parametric DEA model. This model fills in the limitation of CAMEL model (Financia), which generates single or partial measurement of efficiency and productivity, by accommodating multiple variables to generate a broader measurement of efficiency and productivity. DEA results suggest that the average estimate scores of sample banks have ranged from 19.14 percent to 69.14 percent.

From this approach, BPDWS is the most efficient with highest average estimate efficiency score of 69.14 percent and has the lowest average input inefficiency of 30.86 percent. On the other hand, BPDP has the lowest average efficiency score, which is 19.14 percent with the highest average input inefficiency of 80.86 percent Moreover, 69.2 percent of banks have the estimate efficiency score above the mean of 33.28 percent. In general, the efficiency scores of all banks showed a decline when the financial crisis struck the Asian region in 1997.

Another significant contribution of DEA model is a possible explicit determination of bank's excesses in input resources and also output deterioration for the first time in Indonesian development banks. Among four input variables, capitall has the highest average input slack of 11.26 percent followed by deposit, fixed assets and total operating expenses with the average input slacks of 10.13 percent, 6.44 percent, and 3.65 percent respectivel. For the capital variable, BPDSESU has the highest input slack of 27.30 percent that calls for a reduction of 27.30 percent of the capital used without reducing the output. Further, banks with the highest ratio of other input slacks are BPDENT (29.03 percent) for deposit, BPDWS (19.27 percent) for operating expenses, and BPDNS (15.17 percent) for fixed assets. Otherwise, ther are five banks that have a zero input slack for operating expenses (BPDL, BPDDKI, BPDSS, BPDJ, BPDCK), one bank for capital (BPDSSU), and three banks (BPDWS, BPDR, BPDWJ) for fixed assets. Overall, bank that has the highest weighted mean of the input slack for all variables in BPDENT with the mean value of 16.223

percent. On the other hand bank with the lowest weighted mean of the input slack for all variables is BPDIY with the value of 1.59 percent. Regarding output slack, the result shows that none of the banks has the output slack. In the operation of the banks to produce loans during 1994 to 2004, banks did not incur any deficiency.

New original findings of this study can also provide a starting point for further inverstigation on performance, efficiency and productivity for other banks or industries by using different models of CAMEL, and DEA. Moreover, results will be further validated by the aid of other statistical tools aside form tests used in this study. Significantly, results of this study contribute significantly to the theoretical modeling of performance (financial, efficiency, and productivity) extensively in banking sector as evident in the Indonesian state banks. The new empirical findings provided by the study are added new contributions to the literature on the banking performance management.

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