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Efficiency and Malmquist Indices of Productivity Change in Indonesian Banking

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ABSTRACT:

In this study we utilise a non-parametric, slacks-based model (SBM) approach to analyse efficiency and productivity changes for Indonesian banks over the period January 2006 to July 2007. Efficiency scores and Malmquist productivity indices are estimated using the approach for efficiency and super-efficiency estimation suggested by Tone (2001, 2002). Additionally, the Malmquist indices are decomposed into technical efficiency change and technological shift components. Using monthly supervisory data provided by Bank Indonesia we find that, under the intermediation approach to efficiency estimation, average bank efficiency was reasonably stable during the sample period, ranging between 70% and 82%, with 92 of the 130 banks in existence at that time having efficiency scores of over 70%, including 10 with (super)efficiency scores above unity. We also find that technical efficiencies under the Intermediation approach to describing the banking production process are relatively stable. Malmquist results for the industry suggest that the main driver of productivity growth is technological progress. A strategy based on the gradual adoption of newer technology, according to our results, thus seems to have the highest potential for boosting the productivity of the financial intermediary operations of Indonesian banks.

JEL Classification: C23; C52; G21

Keywords: Indonesian Finance and Banking; Productivity; Efficiency.

∗ The opinions expressed in this paper do not necessarily reflect those of Bank Indonesia or its staff.

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1. INTRODUCTION

Since the Asian financial crisis (AFC) in 1997/98, Indonesia has seen a complete transformation of its financial services industry compared with that which operated under the General Soeharto regime. The AFC saw Indonesia sign a 'Letter of Intent' on 13th October 1997 with the International Monetary Fund (IMF) to reform the banking system and its operations and supervision. That is, the country pledged that "insolvent banks have been closed and weak, but viable, institutions have been required to formulate and implement rehabilitation plans. At the same time, steps are being taken to minimize future systemic risks. In particular, the legal and regulatory environment will be strengthened by establishing strong enforcement mechanisms and introducing a stringent exit policy," (paragraph 24). However, given the problems surrounding the financial crisis, where Indonesia was the worst affected (see Jao, 2001, Chapter 2), there was no quick solution to overcoming the country's inherent internal problems (Sato, 2005).[1]

Whilst the IMF was supervising the transformation of the Indonesian financial system up to 2003, the Indonesian government introduced the Central Bank Act (Act No. 23) of 1999, which gave independence to Bank Indonesia. This was then superseded by the 2004 amendment to the Central Bank Act of 1999 which enhanced the representation of and supervision by government officials, and reintroduced Bank Indonesia's status as 'lender of last resort'. Since then, the evolution of supervision and regulation has continued, embracing, *inter alia*, the introduction of deposit guarantees and the establishment of a Financial Stability Net (involving Bank Indonesia, the Ministry of Finance and the Deposit Guarantee Agency (LPS)) in March 2007.

Non-performing Loans (NPL) have also led to problems in Indonesian banking. [2] The largest state-owned bank, Bank Mandiri, had a NPL ratio which increased from 7.2% (Sept. 2004) to 23.4% (Sept. 2005) after the introduction of the NPL Regulation No. 7/2/P131/2005. This regulation ensured that the credit worthiness of a debtor which had

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[1] Indeed, Bank Central Asia, the largest Indonesian private bank, was run by the Salin family and was linked to corruption in lending to inter-bank markets and family or the regime's firms. However, in 1997, it was taken over by the Farallon, the San-Francisco based fund, that introduced new corporate governance regulations to reduce corruption that was wide-spread under the Soeharto regime.

[2] It is interesting to note that the aggregate NPL ratio before the AFC was equal to 8.8% for all Indonesian banks in 1996 and, at the peak of the crisis during 1997/98, was greater than 25%. By 2005 this had fallen to a level of 8.8%.

loans from many different banks would be reflected in the same credit classification at each bank. This resulted in many of the larger banks seeing their NPLs increase considerably, thereby reducing their earnings. For example, Bank Mandiri saw an 88% slide in earnings in 2005 due to the NPL regulation. Hence, in the two years after the IMF restructuring programme finished, there were still many changes that could have distorted analysis of the banking industry in Indonesia. However, after 2005, the changes were more in line with the promotion of stability and increasing the efficiency of the banking system and of the individual banks themselves.

The latter development is consistent with the aim of Bank Indonesia to see a more stable banking environment by reducing the number of banks in the country. This was implemented in three different ways. The first was that banks must have a minimum Tier I capitalisation of Rp 80 billion (US$ 8.81 billion) by 2007, increasing to Rp 100 billion (US$10.2 billion) by 2010; hence, many small private banks would be priced out of the market and would have to merge.[3] Secondly, in June 2006, Bank Indonesia introduced the 'single presence policy' that prohibits investors from holding more than 25% of the shares of more than one bank. This creates problems, not only for multiple holdings by foreign investors but also for the government itself, which owns stakes in five of the country's largest banks, including Bank Mandiri, Bank Rakyat Indonesia and Bank Negara Indonesia. It is hoped that the 'single presence policy' will lead to further consolidation within the industry in the coming years. Finally, the Financial Stability Net, introduced in 2007, saw a reduction in the depositor guarantee level from Rp 2 billion to Rp 100 million (US$11,000), which covers 98% of all depositors and 38% of deposits. Given the increased risk of holding cash in banks in excess of the deposit guarantee level it is hoped that investors will be more selective in their choice of bank, leading to a natural consolidation in the financial services industry in Indonesia.

The above discussion highlights why this study is both a timely and warranted analysis into the efficiency and productivity changes taking place in Indonesia during the most recent period of consolidation. We utilise a relatively-new, non-parametric modelling technique and a monthly data set compiled by Bank Indonesia – the only

[3] The rise in the Tier I minimum capital requirement is due to the central bank's feeling that, presently, 50 out of the 130 banks operating in Indonesia are too small and hence mergers are the only viable option to ensure the future stability of the financial system.

previous bank efficiency analysis using monthly data that we are aware of is that conducted by Hadad et al. (2008) – to conduct our analysis. The paper is organised as follows. In the next section, we explain our SBM efficiency methodology and the estimation of the Malmquist productivity indices. Section 3 discusses the data and variables utilised. Section 4 presents our results and we conclude in Section 5.

2. NON-PARAMETRIC MODELLING METHODOLOGY

Data Envelopment Analysis (DEA) originated from Farrell's (1957) seminal work and was later elaborated on by Charnes et al. (1978), Banker et al. (1984) and Färe et al. (1985). The objective of DEA is to construct a relative efficiency frontier through the envelopment of the Decision Making Units (DMUs) where the 'best practice' DMUs form the frontier. In this study, however, we utilize a DEA model which takes into account input and output slacks, the so-called Slacks-Based Model (SBM), which was introduced by Tone (2001) and ensures that, in non-parametric modelling, the slacks are taken into account in the efficiency scores. For, as Fried et al. (1999) argued, in the 'standard' DEA models based on the Banker et al. (1984) specification "the solution to the DEA problem yields the Farrell radial measure of technical efficiency plus additional non-radial input savings (slacks) and output expansions (surpluses). In typical DEA studies, slacks and surpluses are neglected at worst and relegated to the background at best" (page 250). Indeed, in the analysis of public sector Decision Making Units (DMUs), for which DEA was originally proposed by Farrell, the idea of slacks was not a problem unlike when DEA is employed to measure cost efficiencies in a 'competitive market' setting. That is, in a 'competitive market' setting, output and input slacks are essentially associated with the violation of 'neo classical' assumptions. For example, in an input-oriented approach, the input slacks would be associated with the assumption of strong or free disposability of inputs which permits zero marginal productivity of inputs and hence extensions of the relevant isoquants to form horizontal or vertical facets. In such cases, units which are deemed to be radial-or Farrell-efficient (in the sense that no further proportional reductions in inputs is possible without sacrificing output) may, nevertheless, be able to implement further additional reductions in some inputs. Such additional potential input reductions are typically referred to as non-radial input slacks, in contrast to the radial slacks associated with DEA or Farrell inefficiency, that is, radial deviations from the efficient frontier. In addition, we employ the super-efficiency SBM model proposed by Tone (2002).

The measurement and analysis of productivity growth have attracted increased interest among researchers studying bank performance in recent years. A Malmquist index of productivity change, initially defined by Caves, Christensen and Diewert (1982) and extended by Färe et al., (1992) by merging it with Farrell's (1957) efficiency measurement, has become increasingly popular. However, as discussed earlier, if the technology is estimated using the DEA models suggested by Charnes et al. (1978) or Banker et al. (1984), input and output slacks are ignored. Hence, for the estimation of the Malmquist productivity index in the second part of the analysis, similar to the study of Liu and Wang (2008), we utilise the SBM model introduced by Tone (2001, 2002).

In our modelling, we assume that there are n banks (DMUs) operating in the banking industry which convert inputs X ($m \times n$) into outputs Y ($s \times n$) using common technology T which can be characterised by the technology set $\hat{T}$ estimated using DEA:

$$\hat{T} = \left\{ (x, y) \in \left| y_o \leq Y\lambda, x_o \geq X\lambda, \sum \lambda = 1, \lambda \geq 0 \right. \right\} \quad (1)$$

where x_o and y_o represent observed inputs and outputs of a particular DMU and λ is the intensity variable. $\hat{T}$ is a consistent estimator of the unobserved true technology set under variable returns to scale.

Given these conditions, the individual non-oriented efficiency for each DMU in period t is computed relative to the estimated frontier of period t by solving the following SBM linear programming problem:

$$\min \qquad \hat{\rho}(x_o^t, y_o^t \left| T^t(x)\right.) = l - \frac{1}{m} \sum_{k=1}^{m} S_k^- / x_{ko}^t$$

$$\text{subject to} \quad 1 = l + \frac{1}{s}\sum_{r=1}^{s} S_r^+ / y_{ro}^t$$

$$l x^t{}_o = X^t \Lambda + s^-, \tag{2}$$

$$l y^t{}_o = Y^t \Lambda - s^+,$$

$$\sum \Lambda = l,$$

$$\text{and} \quad \Lambda \geq 0, \quad S^- \geq 0, \quad S^+ \geq 0, \quad l > 0$$

where $S^- = ls^-$ and s^- is output shortfall, $S^+ = ls^+$ and s^+ is input excess, $\Lambda = l\lambda$ and an optimal solution of program (2) is given by $(\hat{\rho}, \hat{\lambda}, \hat{s}^-, \hat{s}^+)$.

If $\hat{\rho}(x_o^t, y_o^t \,|\, T^t(x)) = 1$, we employ the non-oriented Super-SBM model using the following linear program to estimate $\hat{\delta}(x_0^t, y_0^t \,|\, T_*^t(x))$ [which replaces $\hat{\rho}(x_o^t, y_o^t \,|\, T^t(x))$]:

$$\min \quad \hat{\delta}(x_0^t, y_0^t \,|\, T_*^t(x)) = \frac{\frac{1}{m}\sum_{k=1}^{m} \bar{x}_k / x_{k0}^t}{\frac{1}{s}\sum_{r=1}^{s} \bar{y}_r / y_{ro}^t}$$

$$\text{subject to} \quad \bar{x} \geq \sum_{j=1,\neq 0}^{n} \lambda_j x_j^t, \tag{3}$$

$$\bar{y} \geq \sum_{j=1,\neq 0}^{n} \lambda_j y_j^t,$$

$$\sum \lambda = 1,$$

$$\text{and} \quad \lambda \geq 0, \quad \bar{x} \geq x_0, \quad \bar{y} \leq y_0, \quad \bar{y} \leq 0.$$

The performance measures for the DMU *o* operated in time t+1, $\hat{\rho}(x_o^{t+1}, y_o^{t+1} \,|\, T^{t+1}(x))$ and $\hat{\delta}(x_0^{t+1}, y_0^{t+1} \,|\, T_*^{t+1}(x))$, can then be obtained using models (2) and (3) and by changing *t* to *t+1*.

In cases when the slacks-based performance measure of the DMU *o* is obtained relative to the frontier of another period, the following models are used, which measure the performance of DMU *o* operated in time *t* with respect to the frontier of time *t+1*:

$$\min \quad \hat{\rho}(x_o^t, y_o^t \middle| T^{t+1}(x)) = l - \frac{1}{m}\sum_{k=1}^{m} S_k^- / x_{ko}^t$$

$$\text{subject to} \quad 1 = l + \frac{1}{s}\sum_{r=1}^{s} S_r^+ / y_{ro}^t$$

$$l x^t{}_o = \sum_{j=1}^{n} x_j^{t+1}\Lambda + x_o^t \Lambda_{n+1} + s^-, \qquad (4)$$

$$l y^t{}_o = \sum_{j=1}^{n} y_j^{t+1}\Lambda + y_o^t \Lambda_{n+1} - s^+,$$

$$\sum_{j=1}^{n+1} \Lambda_j = 1,$$

$$\text{and} \quad \Lambda \geq 0, \quad S^- \geq 0, \quad S^+ \geq 0, \quad l > 0.$$

When $\hat{\rho}(x_o^t, y_o^t | T^{t+1}(x)) = 1$, we employ the following specification of the Super-SBM model to measure the super-efficiency performance measure $\hat{\delta}(x_0^t, y_0^t | T^{t+1}(x))$ which replaces $\hat{\rho}(x_o^t, y_o^t | T^{t+1}(x))$:

$$\min \quad \hat{\delta}(x_0^t, y_0^t \middle| T^{t+1}(x)) = \frac{\frac{1}{m}\sum_{k=1}^{m} \bar{x}_k / x_{k0}^t}{\frac{1}{s}\sum_{r=1}^{s} \bar{y}_r / y_{ro}^t}$$

$$\text{subject to} \quad \bar{x} \geq \sum_{j=1}^{n} \lambda_j x_j^{t+1}, \qquad (5)$$

$$\bar{y} \geq \sum_{j=1}^{n} \lambda_j y_j^{t+1},$$

$$\sum \lambda = 1,$$

$$\text{and} \quad \lambda \geq 0, \quad \bar{x} \geq x_0, \quad \bar{y} \leq y_0, \quad \bar{y} \leq 0.$$

The slacks-based performance measures $\hat{\rho}(x_o^{t+1}, y_o^{t+1} | T^t(x))$ and $\hat{\delta}(x_0^{t+1}, y_0^{t+1} | T\ (x))$ can then be obtained using equations (4) and (5) by interchanging *t* and *t+1*.

For the second stage of the analysis, the Malmquist productivity index of the DMU_o between periods *t* and *t+1* is estimated as follows, in line with Färe et. al. (1992):

$$M_o^{t,t+1} = \left[\frac{\hat{\rho}(x_o^{t+1}, y_o^{t+1} \big| T^t(x))}{\hat{\rho}(x_o^t, y_o^t \big| T^t(x))} \frac{\hat{\rho}(x_o^{t+1}, y_o^{t+1} \big| T^{t+1}(x))}{\hat{\rho}(x_o^t, y_o^t \big| T^{t+1}(x))} \right]^{1/2} \qquad (6)$$

If the productivity measure, $M_o^{t,t+1}$, is greater than 1, then this implies a productivity gain of DMU_o between period t and t+1, and, contrarily, if $M_o^{t,t+1}$ is less than 1 it indicates a productivity loss. A $M_o^{t,t+1}$ equal to 1 implies that the DMU_o has no change in its productivity.

The productivity measure $M_o^{t,t+1}$ can be decomposed into two indices which capture technical efficiency change (TEC_o) between the periods *t* and *t+1*, and the technological (frontier) change (FS_o), i.e. the shift of the technology between the two periods:

$$M_o^{t,t+1} = TEC_o \times FS_o = \frac{\hat{\rho}(x_o^{t+1}, y_o^{t+1} \big| T^{t+1}(x))}{\hat{\rho}(x_o^t, y_o^t \big| T^t(x))} \times \left[\frac{\hat{\rho}(x_o^{t+1}, y_o^{t+1} \big| T^t(x))}{\hat{\rho}(x_o^{t+1}, y_o^{t+1} \big| T^{t+1}(x))} \frac{\hat{\rho}(x_o^t, y_o^t \big| T^t(x))}{\hat{\rho}(x_o^t, y_o^t \big| T^{t+1}(x))} \right]^{1/2}$$

(7)

In equation (7), TEC_o measures the efficiency catching-up of the DMU_o, which, in the case of TEC_o=1, shows that the firm is still in the same position relative to the efficient boundary. When $TEC_o > 1$ the firm has moved closer to the frontier, whereas if $TEC_o < 1$ the firm has moved away from the frontier between two periods. With regard to the FS_o, which indicates the change in technology, $FS_o < 1$ indicates a negative shift of the frontier (or regression), $FS_o > 1$ a positive shift (progress) and $FS_o = 1$ implies no shift in the technological frontier.

3. DATA AND VARIABLES USED

In modelling the Intermediation approach, we specify 3 outputs and 5 inputs, in line with Sealey and Lindley (1977). The first output is 'total loans' (total customer loans + total other lending), the second output is 'other earning assets' (placements in Bank of Indonesia + interbank assets + securities held), and the third output is 'total off-balance-sheet income' (income form dividends/fees/commissions/provisions + income from forex/derivative transactions + securities appreciation). The third output variable set is included in the analysis to reflect the fact that banks around the world have been diversifying, at the margin, away from traditional financial intermediation (margin) business and into "off-balance-sheet" and fee income business. Hence, it would be inappropriate to focus exclusively on earning assets as this would fail to capture all the business operations of modern banks. The inclusion of 'total off-balance-sheet income' is therefore intended to proxy the non-traditional business activities of Indonesian banks.

The inputs estimated in the Intermediation approach are: 'total deposits' (demand deposits + saving deposits + time deposits); 'total employee expenses' (total salaries and wages + total educational spending); 'total non-employee expenses' (R & D + rent + promotion + repair and maintenance + goods and services + other costs); 'off-balance-sheet expenses (securities depreciation + losses from forex/derivative transactions + losses from commission/provisions); and 'total provisions' (allowances for loan losses).

INSERT TABLE 1

With respect to the last-mentioned input variable (i.e. 'total provisions'), it has long been argued in the literature that the incorporation of risk/loan quality is vitally important in studies of banking efficiency. Akhigbe and McNulty (2003), for example, utilising a profit function approach, include equity capital "to control, in a very rough fashion, for the potential increased cost of funds due to financial risk" (page. 312). Altunbas et al. (2000) and Drake and Hall (2003) also find that failure to adequately account for risk can have a significant impact on relative efficiency scores. In contrast to Akhigbe and McNulty (2003), however, Laevan and Majnoni (2003) argue that risk should be incorporated into efficiency studies via the inclusion of loan loss provisions. That is, “following the general consensus among risk agent analysts and practitioners, economic capital should be tailored to cope with unexpected losses, and loan loss reserves should instead buffer the expected component of the loss distribution. Consistent with this interpretation, loan loss provisions required to build up loan loss reserves should be considered and treated as a cost; a cost that will be faced with certainty over time but that is uncertain as to when it will materialise” (page 181). We agree with this view and hence also incorporate provisions as an input/cost in the relative efficiency analysis of Indonesian banks.

Summary statistics on the data are given in Table 1, where, from 2006-01 to 2006-04, the sample includes all 131 Indonesian banks and, from 2006-05 to the end of our sample period, one bank dropped out of the sample leaving us with 130 banks. In the estimation period, observations totalled 2,473. However, it must be noted that separate frontiers were estimated for each time period to allow for comparisons with the Malmquist Index.

4. RESULTS

Table 2 and Figure 1 provide a summary of SBM efficiency scores for Indonesian banks during the time-span of the 19 months between January 2006 and July 2007 obtained under the Intermediation approach to describing the banking production process. As can be seen from the table and the graph, the average efficiency/super-efficiency scores of Indonesian banks are relatively stable over the analysed period and range between 70% in April 2007 and 82% in early 2006. However, it is noteworthy that the least efficient banks have, to some extent, suffered a deterioration in their efficiency profiles – see Appendix 1 for individual bank performance.

INSERT TABLE 2

INSERT FIGURE 1

In Table 3, the grouping of banks by the average efficiency/super-efficiency scores is presented. It suggests that the majority of Indonesian banks are relatively efficient. Accordingly, 92 out of 130 banks have efficiency scores above 70%. This includes 10 banks with average efficiency/super-efficiency score above unity. The kernel density illustration of the average efficiency and efficiency/super-efficiency scores given in Figure 2 implies that the distribution of efficiency in the industry has a multi-modal structure. The adjustment for the super-efficiency effect flattens the modes of the distribution, especially the one at about the 95% level of efficiency. However, this adds an additional mode at the super-efficiency level.

INSERT TABLE 3

INSERT FIGURE 2

With respect to the second stage of the analysis, Table 4 reports the average Malmquist productivity index and its technical efficiency change and frontier shift components. The dynamics of the Malmquist index and its constituents are shown in Figure 3. According to Table 4 and Figure 3, the average productivity of banks gradually improved between January 2006 and January 2007 from 0.87 to 1.14.

INSERT TABLE 4

INSERT FIGURE 3

However, in February 2007, the Indonesian banking system experienced a sharp productivity decline with the Malmquist index falling back to 85%. Productivity decomposition results attribute this fall in productivity mainly to a deterioration of financial intermediation technology. Accordingly, the average technological efficiency of Indonesian banks worsened by 15% during February 2007. Although, throughout the considered period, technical efficiency was somewhat unchanged standing at around unity, in May 2007 it improved by 21%. However, the fall in technological efficiency offset the effect of the technical efficiency improvement on banking productivity resulting in a 5% overall productivity decline during this period.

Overall, the results suggest that the main driver of the productivity change in the financial intermediary activities of Indonesian banks was the improvement in their intermediation technology. Consequently, the pattern of the Malmquist productivity indices somewhat mirror the trend in technological changes. With respect to technical efficiency change (i.e., the catching-up effect), there appears to be a relatively stable pattern excepting May 2007 when the technical efficiency on average improved by 21%. However, substantial improvement in technical efficiency was accompanied by significant technological regression. This suggests that banks must gradually improve their intermediation technology. This strategy, according to our results, seems to have the highest potential for boosting the productivity of their financial intermediary operations.

5. CONCLUSIONS

In this study, we have estimated efficiency scores and Malmquist productivity indices for Indonesian banks over the period January 2006 and July 2007 using the non-parametric, slacks-based approach for efficiency and super-efficiency estimation suggested by Tone (2001, 2002) and using a unique monthly dataset provided by the Central Bank of Indonesia, Bank Indonesia. The results, based upon the adoption of the "intermediation" approach to efficiency estimation, firstly indicate that the average efficiency/super-efficiency scores of Indonesian banks were relatively stable over the sample period, ranging between 70 % and 82%. 92 out of the 130 banks in existence at that time had efficiency scores above 70 per cent, with 10 of them having average (super)efficiency scores above unity, indicating that the majority of banks were relatively efficient. Secondly, the kernel density analysis demonstrates that the distribution of efficiency in the industry has a multi-modal structure. Thirdly, the Malmquist productivity index reveals that the average productivity of Indonesian banks gradually improved from 0.87 to 1.14 between January 2006 and January 2007, but then fell back to the 85 per cent level in February 2007, largely due to a 15 per cent deterioration in technological performance during February 2007. By July 2007, however, average productivity had recovered to 0.97. By way of contrast, the average technical efficiency change component of the Malmquist index was shown to be relatively stable during the sample period, standing at around unity for most of the time apart from May 2007, when it improved by 21 per cent. Even then, however, the improvement in technical efficiency was insufficient to offset the technological regress experienced during that month, resulting in an average productivity decline of 5 per cent, as indicated by the Malmquist index (0.95).

The implications of these results for policymakers are three-hold. Firstly, the outliers in the efficiency ranking of the banks warrant closer examination by the supervisory authorities with a view to identifying the factors causing their 'extreme' performance. Bank management can then be asked to address their relative weaknesses and "best practice" can be disseminated throughout the banking industry, thereby stimulating competition and raising overall levels of bank efficiency. Secondly, the efficiency rankings can be used by regulators to inform the debate on bank mergers, which are still being sought to help stabilise the banking and financial sectors in Indonesia. And thirdly, identification of technological change as the main driver of productivity growth suggests that banks need to focus on adopting the latest technology if they are to raise their productivity levels.

Table 1.

Summary Statistics of Variables Used in Estimation (IDR m)

Outputs	Total Loans	Other Earning Assets	Total Off Balance Sheet Income
min	239	8220	0
max	108491512	149332184	7543351
mean	5794214.97	5901874.32	135008.74
standard deviation	14277221.63	17568202.71	500953.20

Inputs	Total Deposits	Total Employee Expenses	Total Non-Employee Expenses	Allowance for Earning Asset Losses	Total Off Balance Sheet Expenses
min	4196	129	32	76	0
max	197438261	4878933	2445929	18031253	7276712
mean	9441324.11	166411.63	80226.68	358925.62	67694.92
standard deviation	25789582.27	3040490.05	264319.48	1575706.56	433709.97

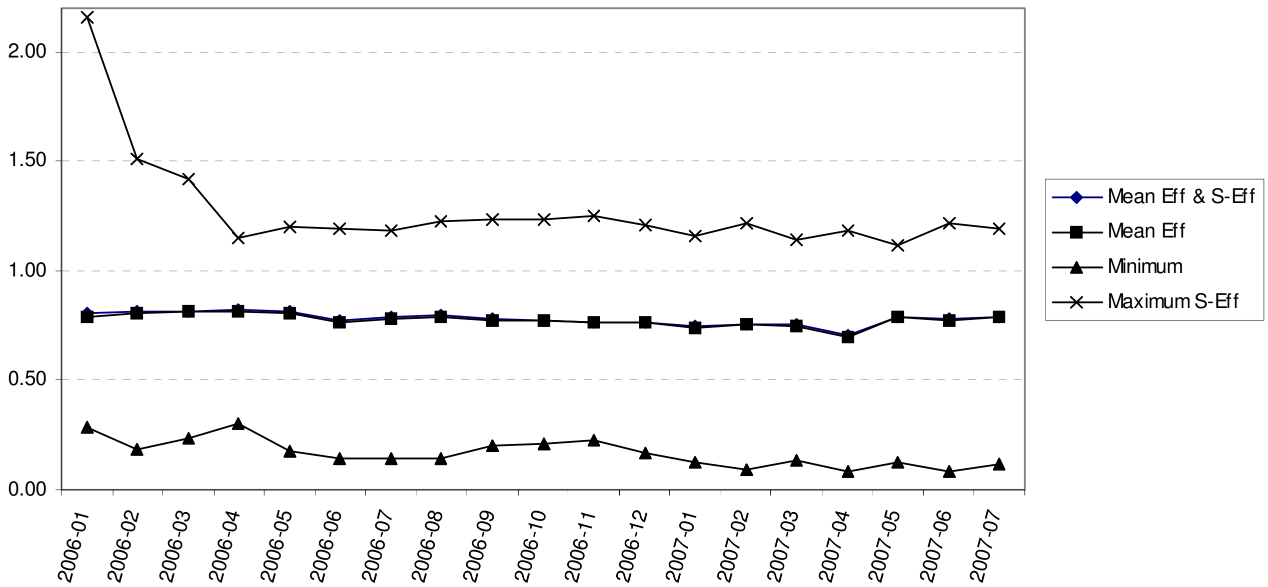
Table 2.

Summary of efficiency and super-efficiency scores of Indonesian banks (January 2006 – July 2007)

Bank	2006-01	2006-02	2006-03	2006-04	2006-05	2006-06	2006-07	2006-08	2006-09	2006-10	2006-11	2006-12	2007-01	2007-02	2007-03	2007-04	2007-05	2007-06	2007-07
Mean efficiency and super-efficiency scores	0.81	0.82	0.82	0.82	0.81	0.77	0.79	0.79	0.78	0.77	0.77	0.77	0.75	0.76	0.75	0.70	0.79	0.78	0.79
Mean efficiency scores	0.79	0.81	0.81	0.82	0.81	0.77	0.78	0.79	0.78	0.77	0.76	0.76	0.74	0.75	0.75	0.70	0.79	0.78	0.79
Minimum	0.29	0.18	0.24	0.30	0.17	0.15	0.14	0.15	0.20	0.21	0.23	0.16	0.13	0.09	0.13	0.08	0.12	0.08	0.11
Maximum of super-efficiency scores	2.15	1.51	1.42	1.15	1.20	1.20	1.19	1.23	1.23	1.24	1.25	1.21	1.16	1.21	1.14	1.18	1.12	1.22	1.19

Figure 1.

Efficiency Summary Scores for Indonesian Banks: January 2006 – July 2007



N.B.: ‘Mean Eff & S-Eff’, ‘Mean Eff’ and ‘Maximum S-Eff’ respectively denote the mean of the efficiency and super-efficiency scores, the mean of the efficiency scores and the maximum of the super-efficiency scores. ‘Minimum’ represents the minimum of the efficiency scores.

Table 3.

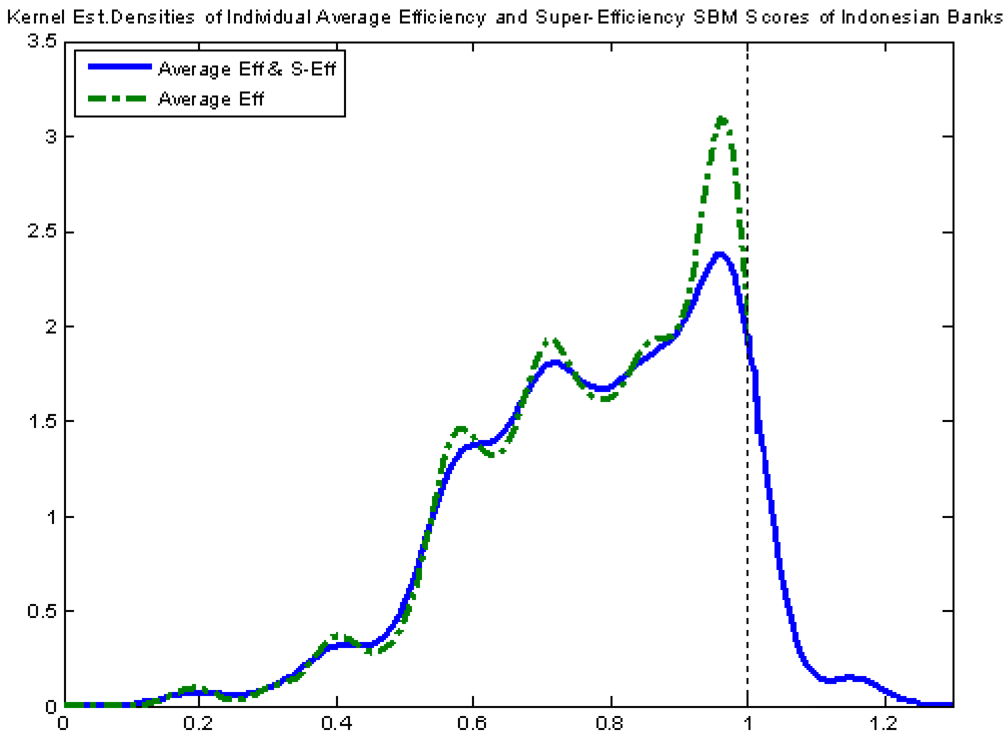
Average SBM efficiency Scores for Indonesian Banks by Efficiency Levels

Average efficiency/super-efficiency scores	Number of banks	Banks
1.00 and over	10	didi, iidi, iibr, iirr, iddp, idai, idhr, irsb, iipi, ipsp
Over 0.90 and less than 1.00	32	iihp, ihib, iiar, didb, ippa, iqar, idpb, iiqa, irrb, iiaa, iipp, dqip, iipb, idpi, iirb, iiqb, iira, iibi, ipap, idir, iaia, ddii, iiir, iimi, diqr, iqib, ipqr, iiqr, idap, iiap, iihb, iiba
Over 0.80 and less than 0.90	24	iqma, ddpr, idrp, ihdr, iqrb, disb, diib, idpa, ipsb, iphb, ipai, disa, idsb, iibb, irda,ipbi, ddhb, idmr, ipba, iqpp, idia, iphi, ihhp, idii
Over 0.70 and less than 0.80	26	dqia, disi, ipab, iimr, idri, ihir, ipsr, ddpp, iihi, ipar, dihi, drqr, idpp, ipbr, ihdi, idqa, dibb, iphp, ipqa, ipmi, ipma, ddda, ipsa, ihhr, dimb, ihpb
Over 0.60 and less than 0.70	15	Ippr, iisb, diii, ipsi, ipmp, diaa, iisi, dddi, dima, ihpr, ipha, dqii, ihhb, dihr, diab
Over 0.50 and less than 0.60	15	Iqra, iphr, ippb, ddhr, idqr, ipbp, iqqp,dirr, iimb, ipbb, ipaa, ipqb, iqmp, iapr, ihpp
Less than 0.50	8	Iahi, iddr, idqi, drqa, ddhp, irar, iqhb, ddpi

N.B. Letters are used to identify the banks to preserve their anonymity.

Figure 2.

Distributions of Average Individual Efficiency and Super-Efficiency Scores for Indonesian Banks: January 2006 – July 2007



N.B.: ‘Eff’ and ‘Eff & S-Eff’ respectively denote efficiency and efficiency/super-efficiency scores. The vertical axis refers to the (estimated) probability density function of the distribution of efficiency/super-efficiency scores and the horizontal axis refers to the efficiency/super-efficiency scores. We use the Gaussian kernel density. The bandwidths are obtained using the Sheather and Jones (1991) ‘solve-the-equation’ plug-in-approach.

Table 4.

Average Slacks-Based Malmquist Productivity Index and its Components for Indonesian Banks During January 2006 – July 2007

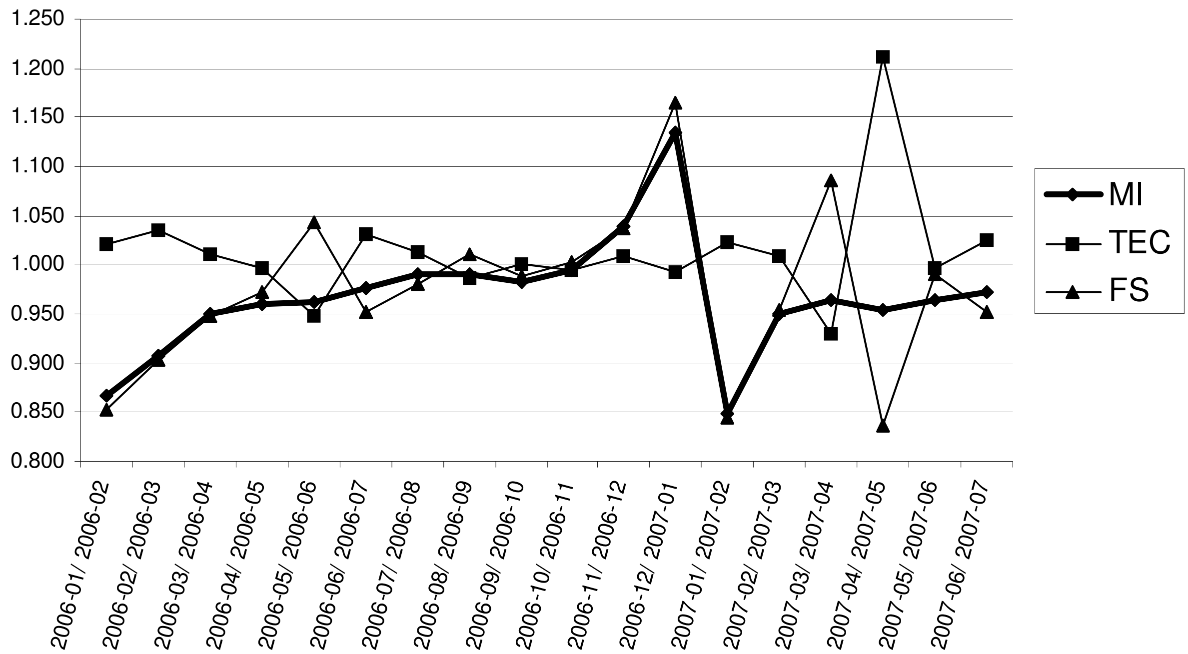
	2006-01/ 2006-02	2006-02/ 2006-03	2006-03/ 2006-04	2006-04/ 2006-05	2006-05/ 2006-06	2006-06/ 2006-07	2006-07/ 2006-08	2006-08/ 2006-09	2006-09/ 2006-10
MI	0.866	0.908	0.949	0.961	0.962	0.977	0.990	0.991	0.983
TEC	1.021	1.036	1.011	0.996	0.948	1.031	1.012	0.986	1.000
FS	0.852	0.904	0.948	0.972	1.044	0.953	0.981	1.012	0.988

	2006-10/ 2006-11	2006-11/ 2006-12	2006-12/ 2007-01	2007-01/ 2007-02	2007-02/ 2007-03	2007-03/ 2007-04	2007-04/ 2007-05	2007-05/ 2007-06	2007-06/ 2007-07
MI	0.994	1.038	1.135	0.849	0.949	0.963	0.954	0.963	0.973
TEC	0.995	1.008	0.993	1.023	1.009	0.929	1.211	0.997	1.026
FS	1.003	1.036	1.165	0.845	0.955	1.085	0.837	0.990	0.953

N.B.: MI, TEC and FS respectively denote Malmquist Index, Technical Efficiency Change and Technological Change (i.e. frontier shift).

Figure 3.

Dynamics of Indonesian Bank Efficiency: Malmquist Representation.



N.B.: MI, TEC and FS respectively denote Malmquist Index, Technical Efficiency Change and Technological Change (i.e. frontier shift).

Appendix 1. Individual efficiency and super-efficiency scores of Indonesian banks (January 2006 – July 2007)

Bank	*2006-01*	*2006-02*	*2006-03*	*2006-04*	*2006-05*	*2006-06*	*2006-07*	*2006-08*	*2006-09*	*2006-10*	*2006-11*	*2006-12*	*2007-01*	*2007-02*	*2007-03*	*2007-04*	*2007-05*	*2007-06*	*2007-07*	***Average***
iiir *	0.97	0.94	0.89	0.88	0.81	0.86	1.00	0.99	0.95	1.01	1.00	0.98	0.92	0.99	0.87	0.98	0.95	1.00	0.93	*0.94*
iidi	2.15	1.51	1.42	0.94	1.20	1.20	0.91	1.21	1.03	0.67	0.82	1.10	0.99	1.06	1.14	1.01	0.99	1.22	1.19	*1.15*
iipi *	1.08	1.06	0.98	1.04	1.05	1.05	0.97	0.98	0.98	0.97	0.98	0.96	1.01	1.01	0.96	0.99	0.92	0.99	0.97	*1.00*
iipp *	0.90	0.82	0.96	1.00	1.00	0.95	1.00	0.96	1.00	1.00	0.98	0.97	1.03	1.01	0.93	1.02	0.96	1.01	1.01	*0.97*
iipb *	1.00	0.99	0.96	0.95	0.99	0.95	0.99	0.95	0.89	0.95	0.97	1.00	0.94	0.98	0.99	1.00	0.94	1.00	0.95	*0.97*
iihi *	0.98	0.78	0.94	0.80	0.77	0.72	0.76	0.93	0.84	0.97	0.95	0.82	0.64	0.58	0.59	0.58	0.58	0.58	0.61	*0.76*
iihp *	1.00	0.98	0.99	1.03	0.94	0.98	1.02	0.98	0.96	1.01	1.01	1.01	1.00	1.02	1.02	0.94	0.92	0.99	1.00	*0.99*
iihb *	0.91	0.95	0.95	0.97	0.97	0.96	0.97	1.00	0.98	0.97	0.95	0.97	0.75	0.75	0.76	0.86	0.84	0.80	0.88	*0.90*
iiap *	0.89	0.99	0.98	0.86	0.92	0.85	0.82	0.87	0.98	0.91	0.95	0.85	0.96	0.77	0.85	0.92	0.94	0.97	0.91	*0.91*
iiaa	1.02	1.01	1.01	1.01	0.98	0.97	0.98	1.00	0.99	1.00	1.00	1.00	0.97	1.01	0.95	0.88	0.95	0.97	0.84	*0.98*
iiar *	0.96	0.91	1.00	1.01	0.98	0.99	0.99	0.89	1.00	1.00	0.96	1.00	1.01	1.00	0.99	1.01	1.01	1.01	0.97	*0.98*
iisi *	0.91	0.83	0.78	0.71	0.64	0.63	0.65	0.64	0.59	0.59	0.59	0.58	0.67	0.64	0.55	0.58	0.66	0.59	0.57	*0.65*
iisb	0.98	0.67	0.67	0.67	0.61	0.59	0.61	0.62	0.62	0.65	0.68	0.71	0.67	0.71	0.66	0.73	0.77	0.71	0.66	*0.68*
iibi *	1.00	0.98	1.00	1.00	0.95	1.00	1.00	0.98	0.99	1.00	0.91	1.01	0.76	0.92	0.80	0.91	1.00	0.95	0.98	*0.95*
iiba	0.97	0.73	0.76	0.91	0.97	0.78	0.68	0.96	1.01	0.94	1.02	0.84	1.01	0.87	0.84	0.88	1.00	0.99	0.99	*0.90*
iibb	0.73	1.00	0.70	0.82	0.88	0.74	0.68	0.75	0.84	0.90	0.94	0.88	0.65	0.94	0.98	0.90	0.88	0.89	0.92	*0.84*
iibr	1.17	1.03	1.02	1.06	1.04	1.09	1.07	0.90	1.01	1.05	1.02	1.04	1.04	1.21	1.10	0.67	1.10	0.98	1.09	*1.04*
iimi	0.91	0.97	0.86	0.87	1.00	0.86	1.00	0.98	0.89	0.98	0.97	0.91	0.94	0.89	0.87	0.98	0.95	0.98	0.91	*0.93*
iimb *	0.77	0.76	0.65	0.63	0.73	0.55	0.55	0.54	0.50	0.50	0.51	0.56	0.47	0.50	0.47	0.41	0.48	0.52	0.52	*0.56*
iimr *	0.64	0.82	0.71	0.90	0.72	0.63	0.67	0.66	0.69	0.73	0.68	0.69	0.88	0.86	0.92	0.94	0.92	0.92	0.79	*0.78*
iira	0.94	0.88	0.93	1.02	1.04	0.88	0.99	1.01	0.97	0.90	0.91	1.00	0.92	1.01	1.02	0.96	1.02	0.86	1.00	*0.96*
iirb	1.03	0.89	0.94	0.98	1.01	1.01	1.01	1.00	0.99	0.95	0.91	0.88	1.01	1.01	1.01	0.84	0.99	0.94	0.95	*0.97*
iirr	1.04	1.05	0.97	1.05	0.99	1.00	1.03	1.02	1.00	1.03	1.00	1.02	1.06	1.05	1.05	1.03	0.99	1.04	0.97	*1.02*
iiqa	1.03	1.10	1.04	1.03	1.02	1.00	1.03	0.98	1.00	1.00	0.99	1.01	0.88	0.97	0.91	0.90	0.85	0.91	0.94	*0.98*
iiqb	0.92	0.97	1.02	1.00	1.01	1.01	0.94	0.92	0.97	0.94	0.91	1.01	1.00	0.93	0.92	0.90	0.97	0.96	1.01	*0.96*
iiqr	1.05	0.98	0.95	1.00	0.99	0.82	0.81	0.96	0.97	0.98	0.98	0.97	0.71	1.00	0.91	0.96	0.97	0.80	0.73	*0.92*
idii	1.05	0.99	0.77	0.65	0.56	0.50	0.49	0.60	0.70	0.69	0.63	0.71	1.02	0.98	0.99	0.96	1.00	0.90	0.97	*0.80*
idia	0.76	0.84	0.63	0.78	0.84	0.68	0.73	0.72	0.67	0.71	0.73	0.77	0.74	0.89	1.02	0.96	0.91	1.03	1.01	*0.81*

Appendix 1. Individual efficiency and super-efficiency scores of Indonesian banks (January 2006 – July 2007) (continued)

Bank	*2006-01*	*2006-02*	*2006-03*	*2006-04*	*2006-05*	*2006-06*	*2006-07*	*2006-08*	*2006-09*	*2006-10*	*2006-11*	*2006-12*	*2007-01*	*2007-02*	*2007-03*	*2007-04*	*2007-05*	*2007-06*	*2007-07*	***Average***
idir	0.89	1.05	0.87	1.02	1.00	1.01	0.88	0.86	0.98	0.92	0.97	0.96	1.16	0.64	1.00	0.95	1.03	0.86	1.00	*0.95*
iddp	0.88	1.00	0.97	0.97	0.98	0.92	0.95	1.00	1.00	1.01	1.01	1.02	1.03	1.02	1.06	1.12	1.04	1.07	1.09	*1.01*
iddr	0.29	0.18	1.00	0.34	0.17	0.31	0.41	0.33	0.26	0.33	0.42	0.58	0.53	0.50	0.52	0.53	0.57	0.70	0.71	*0.46*
idpi	0.92	0.99	0.93	0.97	1.00	0.99	1.01	1.01	1.01	1.00	1.01	0.96	0.97	0.95	1.00	0.87	1.00	0.88	0.90	*0.97*
idpp	1.00	0.90	0.97	0.96	0.97	0.63	0.62	0.65	0.64	0.65	0.64	0.69	0.60	0.58	0.62	0.63	0.66	0.72	0.69	*0.73*
idpa	0.78	0.91	0.97	0.76	0.93	0.92	0.95	0.97	0.75	0.75	0.71	0.84	0.80	0.78	1.01	0.99	0.93	0.76	0.93	*0.87*
idpb	1.04	0.92	0.78	1.01	0.98	1.02	0.99	1.02	1.04	1.05	1.05	1.04	0.89	0.88	1.05	0.98	0.82	1.03	1.03	*0.98*
idhr	1.03	1.08	1.10	0.87	1.03	1.05	1.03	0.91	0.96	0.98	1.01	0.94	1.08	0.95	1.02	0.98	0.99	0.99	1.00	*1.00*
idai	1.05	1.06	0.99	0.96	0.95	1.00	0.93	0.92	0.98	1.01	1.02	1.01	1.05	1.05	1.02	1.02	1.02	1.02	1.02	*1.00*
idap	0.94	1.04	0.68	0.99	1.01	1.01	0.95	0.94	1.00	0.93	0.84	0.85	0.89	0.95	0.97	0.44	1.00	1.01	0.96	*0.92*
idsb *	0.78	0.82	0.97	0.84	0.78	0.81	0.84	0.79	0.79	0.78	0.99	0.73	0.81	0.85	0.94	0.84	0.86	0.99	0.89	*0.85*
idmr	0.86	0.89	0.95	0.98	0.92	0.87	0.90	0.88	0.83	0.79	0.82	0.74	0.75	0.78	0.75	0.75	0.84	0.78	0.78	*0.83*
idri	0.73	0.76	0.82	0.78	0.80	0.78	0.77	0.78	0.75	0.72	0.76	0.86	0.70	0.78	0.81	0.50	0.76	0.84	0.99	*0.77*
idrp	0.66	0.68	0.69	0.72	0.71	0.68	0.93	0.98	0.97	0.94	0.99	1.00	0.97	0.92	0.99	0.99	0.99	1.01	1.00	*0.89*
idqi	0.49	0.52	0.54	0.56	0.54	0.38	0.41	0.38	0.38	0.38	0.38	0.41	0.44	0.45	0.46	0.31	0.30	0.28	0.27	*0.41*
idqa *	0.90	0.92	0.90	0.79	0.63	0.63	0.61	0.56	0.58	0.55	0.55	0.65	0.64	0.66	0.98	0.67	0.76	0.72	0.93	*0.72*
idqr *	0.46	0.51	0.44	0.49	0.56	0.50	0.52	0.48	0.41	0.43	0.40	0.47	0.54	0.98	0.46	0.91	0.95	0.72	0.71	*0.58*
ippa	0.91	0.99	1.01	1.00	0.99	0.95	1.01	0.99	1.01	1.01	1.01	0.99	0.90	0.97	0.99	1.00	1.00	1.00	0.96	*0.98*
ippb	0.66	0.76	0.73	0.77	0.57	0.50	0.54	0.53	0.53	0.55	0.57	0.63	0.62	0.51	0.54	0.49	0.54	0.58	0.55	*0.59*
ippr	0.73	0.76	0.75	0.76	0.70	0.71	0.75	0.72	0.66	0.72	0.71	0.63	0.65	0.64	0.63	0.62	0.65	0.66	0.67	*0.69*
iphi	0.94	0.84	0.88	0.93	0.92	0.85	0.85	0.99	0.88	0.85	0.88	0.74	0.85	0.64	0.63	0.65	0.74	0.66	0.67	*0.81*
iphp	0.97	0.95	1.00	1.00	0.67	0.66	0.63	0.63	0.60	0.59	0.58	0.57	0.66	0.64	0.64	0.68	0.72	0.67	0.70	*0.71*
ipha	0.66	0.62	0.64	0.67	0.66	0.60	0.61	0.63	0.64	0.66	0.63	0.61	0.65	0.62	0.61	0.55	0.68	0.60	0.65	*0.63*
iphb	0.89	0.91	0.87	0.91	0.96	0.75	0.81	0.97	0.86	0.82	0.82	0.90	0.87	0.73	0.87	0.86	0.86	0.86	0.84	*0.86*
iphr	0.65	0.66	0.65	0.65	0.57	0.47	0.51	0.54	0.54	0.54	0.55	0.57	0.61	0.63	0.62	0.64	0.66	0.61	0.60	*0.59*
ipai	0.72	0.80	0.80	0.80	0.83	0.97	0.87	0.87	0.97	0.86	0.79	0.99	0.81	0.84	0.89	0.93	0.89	0.85	0.89	*0.86*
ipap	0.87	0.96	0.94	1.01	0.93	0.95	1.00	0.98	0.95	1.00	0.96	1.00	0.81	0.99	0.99	0.93	0.92	0.93	0.96	*0.95*
ipaa	0.64	0.63	0.66	0.63	0.60	0.51	0.49	0.51	0.50	0.49	0.49	0.53	0.53	0.49	0.53	0.54	0.54	0.54	0.55	*0.55*
ipab	0.74	0.79	0.78	0.80	0.75	0.74	0.72	0.87	0.71	0.82	0.80	0.80	0.76	0.75	0.67	0.72	0.75	0.96	0.93	*0.78*
ipar	0.78	0.74	0.74	0.79	0.75	0.74	0.74	0.74	0.75	0.72	0.72	0.66	0.77	0.73	0.78	0.70	0.79	0.81	0.87	*0.75*

Appendix 1. Individual efficiency and super-efficiency scores of Indonesian banks (January 2006 – July 2007) (continued)

Bank	*2006-01*	*2006-02*	*2006-03*	*2006-04*	*2006-05*	*2006-06*	*2006-07*	*2006-08*	*2006-09*	*2006-10*	*2006-11*	*2006-12*	*2007-01*	*2007-02*	*2007-03*	*2007-04*	*2007-05*	*2007-06*	*2007-07*	***Average***
ipsi	0.68	0.70	0.71	0.73	0.68	0.66	0.67	0.66	0.66	0.64	0.65	0.60	0.64	0.67	0.69	0.68	0.74	0.71	0.76	*0.68*
ipsp	1.09	1.01	1.01	1.02	0.99	0.94	0.98	0.98	1.02	1.01	1.02	0.99	1.13	0.93	0.94	0.91	1.03	1.00	0.95	*1.00*
ipsa	0.71	0.74	0.74	0.90	0.74	0.69	0.69	0.82	0.67	0.75	0.67	0.58	0.60	0.61	0.61	0.62	0.70	0.72	0.74	*0.70*
ipsb	0.74	0.83	0.81	0.86	0.82	0.84	0.86	0.88	0.87	0.89	0.84	0.93	0.81	0.79	0.93	0.94	0.93	0.90	0.90	*0.86*
ipsr	0.78	0.84	0.78	0.87	0.87	0.73	0.84	0.87	0.79	0.82	0.83	0.82	0.73	0.65	0.64	0.60	0.69	0.64	0.68	*0.76*
ipbi	0.89	0.89	0.88	0.89	0.87	0.89	0.87	0.96	0.94	0.80	0.89	0.82	0.69	0.72	0.73	0.73	0.88	0.86	0.79	*0.84*
ipbp	0.70	0.69	0.70	0.67	0.66	0.58	0.54	0.53	0.51	0.49	0.48	0.48	0.55	0.55	0.58	0.54	0.55	0.51	0.56	*0.57*
ipba	0.74	0.80	0.78	0.81	0.85	0.90	0.80	0.85	0.81	0.80	0.86	0.79	0.85	0.74	0.75	0.77	0.85	0.92	0.87	*0.82*
ipbb	0.52	0.54	0.56	0.57	0.55	0.55	0.62	0.59	0.61	0.55	0.56	0.55	0.53	0.54	0.54	0.52	0.55	0.56	0.57	*0.56*
ipbr	0.64	0.68	0.72	0.98	0.67	0.64	0.66	0.71	0.67	0.66	0.66	0.63	0.70	0.72	0.69	0.71	1.00	0.69	0.98	*0.73*
ipmi	0.66	0.69	0.72	0.74	0.72	0.69	0.70	0.70	0.64	0.75	0.69	0.70	0.66	0.70	0.73	0.62	0.71	0.80	0.82	*0.71*
ipmp	0.71	0.65	0.71	0.72	0.71	0.69	0.69	0.65	0.66	0.65	0.65	0.63	0.64	0.62	0.62	0.42	0.67	0.68	0.70	*0.65*
ipma*	0.71	0.68	0.73	0.74	0.67	0.68	0.67	0.65	0.68	0.65	0.65	0.65	0.63	0.67	0.67	0.67	0.93	0.78	0.83	*0.70*
ipqa *	0.78	0.82	0.78	0.84	0.74	0.70	0.68	0.70	0.70	0.68	0.69	0.68	0.67	0.66	0.66	0.67	0.71	0.65	0.62	*0.71*
ipqb *	0.57	0.58	0.64	0.65	0.63	0.49	0.50	0.50	0.52	0.52	0.51	0.50	0.58	0.53	0.57	0.45	0.54	0.53	0.57	*0.55*
ipqr	0.83	1.00	0.88	0.88	1.00	1.00	0.95	0.91	0.88	0.94	0.91	0.97	0.90	0.88	0.94	0.89	0.96	0.90	1.00	*0.93*
ihib	0.93	1.00	0.97	1.00	1.00	1.00	1.00	1.02	0.99	0.97	1.00	0.98	0.93	0.99	0.98	1.00	1.00	0.98	0.99	*0.99*
ihir	0.83	0.95	0.86	0.80	0.84	0.82	0.87	0.74	0.80	0.76	0.64	0.95	0.68	0.54	0.50	0.44	0.98	0.88	0.79	*0.77*
ihdi	0.70	0.69	0.90	0.74	0.77	0.71	0.68	0.77	0.70	0.70	0.75	0.71	0.69	0.66	0.62	0.66	0.74	0.73	0.77	*0.72*
ihdr	0.74	0.92	0.86	0.93	0.82	0.89	0.87	0.88	0.88	0.80	0.80	0.93	0.83	0.93	0.93	0.98	0.93	0.88	0.90	*0.88*
ihpp	0.46	0.54	0.59	0.56	0.61	0.54	0.58	0.54	0.52	0.47	0.53	0.38	0.50	0.54	0.47	0.41	0.45	0.42	0.50	*0.50*
ihpb	0.66	0.56	0.69	0.72	0.76	0.72	0.74	0.71	0.74	0.74	0.64	0.80	0.70	0.73	0.67	0.58	1.00	0.51	0.56	*0.70*
ihpr	0.55	0.60	0.62	0.66	0.65	0.65	0.65	0.68	0.70	0.68	0.74	0.64	0.64	0.71	0.70	0.47	0.58	0.60	0.60	*0.64*
ihhp	0.76	0.85	0.90	0.83	0.85	0.85	0.86	0.86	1.00	0.87	0.84	1.00	0.65	0.66	0.69	0.45	0.88	0.74	0.79	*0.81*
ihhb	0.53	0.62	0.68	0.68	0.70	0.75	0.74	0.71	0.65	0.51	0.64	0.72	0.52	0.45	0.43	0.29	0.63	0.61	0.58	*0.60*
ihhr *	0.51	0.54	0.61	0.64	0.62	0.57	0.71	0.79	0.81	0.83	0.99	0.99	0.87	0.67	0.63	0.59	0.71	0.62	0.54	*0.70*
iaia	1.01	1.00	0.99	1.01	0.99	1.00	0.99	0.96	0.58	1.00	1.00	0.99	0.96	0.75	0.98	0.97	0.98	0.89	0.98	*0.95*
iapr	0.59	0.42	0.46	0.48	0.47	0.39	0.27	0.34	0.41	0.42	0.43	0.47	0.64	0.56	0.55	0.48	0.99	0.83	0.99	*0.54*
iahi	0.56	0.54	0.58	0.42	0.52	0.55	0.65	0.66	0.67	0.74	0.72	0.72	0.26	0.22	0.27	0.27	0.29	0.34	0.34	*0.49*
irda	0.84	0.86	0.80	0.99	0.96	0.80	0.92	0.97	0.91	0.73	0.95	0.67	0.37	1.00	0.99	0.88	0.83	0.77	0.75	*0.84*

Appendix 1. Individual efficiency and super-efficiency scores of Indonesian banks (January 2006 – July 2007) (continued)

Bank	*2006-01*	*2006-02*	*2006-03*	*2006-04*	*2006-05*	*2006-06*	*2006-07*	*2006-08*	*2006-09*	*2006-10*	*2006-11*	*2006-12*	*2007-01*	*2007-02*	*2007-03*	*2007-04*	*2007-05*	*2007-06*	*2007-07*	***Average***
irar	0.45	0.45	0.49	0.49	0.50	0.36	0.42	0.39	0.42	0.39	0.38	0.36	0.44	0.44	0.37	0.26	0.23	0.19	0.21	*0.38*
irsb *	1.03	1.01	1.02	1.01	1.01	0.98	1.01	1.01	0.99	1.00	0.97	0.99	1.01	0.99	0.97	0.99	0.96	1.01	1.00	*1.00*
irrb *	0.99	1.00	1.00	1.00	0.98	0.96	1.00	0.99	1.00	0.97	0.98	1.00	0.87	1.00	0.92	0.94	1.00	1.00	0.98	*0.98*
iqib	0.91	0.91	0.73	0.92	0.95	0.97	0.99	1.00	1.00	0.93	0.91	0.89	0.92	0.86	0.96	1.00	0.90	0.87	1.00	*0.93*
iqpp	0.76	0.77	0.80	0.83	0.82	0.78	0.81	0.81	0.77	0.72	0.61	0.54	0.93	0.96	0.93	0.80	0.98	0.98	0.91	*0.82*
iqhb	0.41	0.43	0.42	0.44	0.47	0.40	0.45	0.47	0.33	0.28	0.23	0.20	0.23	0.14	0.13	0.11	0.28	0.15	0.27	*0.31*
iqar	0.98	0.99	0.96	1.00	0.98	1.01	1.00	0.96	0.94	0.99	0.98	0.94	0.97	1.00	1.00	1.00	0.99	0.99	0.99	*0.98*
iqmp	0.72	0.57	0.58	0.48	0.45	0.38	0.46	0.49	0.54	0.56	0.51	0.42	0.60	0.61	0.60	0.47	0.69	0.76	0.46	*0.54*
iqma	1.00	0.73	0.60	0.89	0.92	1.00	0.93	0.95	0.98	0.98	0.91	0.97	0.77	0.60	1.00	0.98	0.82	0.99	0.96	*0.89*
iqra	0.59	0.62	0.71	0.71	0.63	0.60	0.63	0.62	0.63	0.60	0.65	0.56	0.53	0.54	0.57	0.52	0.52	0.56	0.50	*0.59*
iqrb	0.81	0.79	0.98	0.89	0.94	0.98	0.99	0.90	0.96	0.95	0.92	0.84	0.86	0.95	0.97	0.39	0.61	0.91	0.98	*0.87*
iqqp	0.67	0.71	0.71	0.61	0.69	0.62	0.78	0.76	0.62	0.65	0.64	0.47	0.42	0.43	0.46	0.47	0.38	0.39	0.41	*0.57*
diii	0.68	0.70	0.71	0.71	0.74	0.71	0.71	0.72	0.71	0.69	0.66	0.64	0.58	0.61	0.55	0.38	0.56	0.93	0.95	*0.68*
diib	1.04	1.01	0.80	0.96	0.90	0.79	1.00	0.94	0.67	0.86	0.82	0.60	0.88	0.83	0.92	0.63	1.00	0.97	0.94	*0.87*
didi	1.14	1.15	1.18	1.15	1.16	1.18	1.19	1.23	1.23	1.24	1.25	1.21	1.15	1.02	1.10	1.08	1.12	1.11	1.06	*1.16*
didb	0.82	0.97	0.96	1.00	1.00	1.00	1.01	1.01	0.95	1.00	1.00	1.00	1.01	0.99	0.99	1.00	1.00	0.98	1.00	*0.98*
dihi	0.70	0.77	0.80	0.71	0.77	0.75	0.76	0.84	0.82	0.87	0.76	0.83	0.61	0.73	0.70	0.42	0.69	0.85	0.88	*0.75*
dihr	0.72	0.76	0.85	0.75	1.00	1.00	0.95	0.63	0.91	0.49	0.53	0.52	0.49	0.39	0.22	0.19	0.18	0.36	0.43	*0.60*
diaa	0.69	0.74	0.68	0.66	0.72	0.79	0.79	0.83	0.89	0.78	0.75	0.65	0.66	0.73	0.43	0.33	0.56	0.34	0.38	*0.65*
diab	0.74	0.66	0.82	0.71	0.87	0.55	0.57	0.56	0.53	0.53	0.50	0.48	0.59	0.55	0.56	0.47	0.57	0.59	0.50	*0.60*
disi	0.78	0.86	0.86	0.85	0.85	0.83	0.85	0.88	0.81	0.86	0.80	0.80	0.64	0.74	0.67	0.48	0.77	0.82	0.83	*0.79*
disa	0.90	1.01	0.97	0.97	1.01	1.00	1.00	0.98	0.94	0.95	0.99	0.97	0.95	1.00	0.42	0.37	0.92	0.38	0.37	*0.85*
disb	0.95	0.91	0.92	0.82	0.86	0.96	0.96	0.95	0.99	0.77	0.75	0.62	0.82	0.87	0.87	0.71	0.95	0.96	0.98	*0.87*
dibb	0.78	0.85	0.87	0.98	0.89	0.80	0.83	0.86	0.84	0.82	0.67	0.69	0.47	0.68	0.64	0.28	0.36	0.65	0.60	*0.71*
dima	0.83	0.87	0.90	0.53	0.87	0.26	0.47	0.46	0.46	0.44	0.51	0.39	0.55	0.48	0.47	0.95	0.94	0.93	0.91	*0.64*
dimb	0.76	0.77	0.79	0.79	0.79	0.80	0.74	0.76	0.66	0.71	0.67	0.72	0.65	0.56	0.52	0.42	0.64	0.71	0.77	*0.70*
dirr	0.67	0.70	0.67	0.67	0.60	0.60	0.61	0.61	0.56	0.53	0.47	0.41	0.57	0.67	0.62	0.28	0.55	0.51	0.42	*0.56*

Appendix 1. Individual efficiency and super-efficiency scores of Indonesian banks (January 2006 – July 2007) (continued)

Bank	*2006-01*	*2006-02*	*2006-03*	*2006-04*	*2006-05*	*2006-06*	*2006-07*	*2006-08*	*2006-09*	*2006-10*	*2006-11*	*2006-12*	*2007-01*	*2007-02*	*2007-03*	*2007-04*	*2007-05*	*2007-06*	*2007-07*	***Average***
diqr	0.95	0.90	0.96	0.81	0.85	0.98	0.94	0.92	0.85	0.88	0.97	0.98	1.04	1.00	0.93	0.89	0.98	1.00	0.83	*0.93*
ddii	1.01	1.01	0.86	0.97	0.86	0.84	1.00	0.99	0.84	0.97	0.85	0.96	1.03	0.97	0.94	0.94	1.01	0.97	1.00	*0.95*
dddi	0.64	0.67	0.68	0.69	0.65	0.67	0.66	0.65	0.63	0.63	0.58	0.66	0.59	0.64	0.67	0.44	0.73	0.73	0.75	*0.65*
ddda	0.61	0.68	0.69	0.71	0.70	0.68	0.69	0.69	0.72	0.72	0.74	0.75	0.67	0.68	0.66	0.59	0.77	0.74	0.80	*0.70*
ddpi *	0.31	0.26	0.24	0.30	0.34	0.15	0.14	0.15	0.20	0.21	0.23	0.16	0.13	0.09	0.14	0.17	0.12	0.13	0.12	*0.19*
ddpp	0.72	0.83	0.87	0.91	0.87	0.83	0.90	0.85	0.73	0.83	0.60	0.56	0.47	0.94	0.52	0.26	0.96	0.84	0.97	*0.76*
ddpr	0.99	1.00	1.00	1.00	0.97	1.00	1.00	1.00	1.00	0.95	0.79	0.82	0.80	0.86	0.90	0.46	0.79	0.93	0.61	*0.89*
ddhp	0.46	0.50	0.54	0.46	0.54	0.54	0.63	0.61	0.61	0.56	0.32	0.49	0.33	0.27	0.21	0.08	0.12	0.08	0.11	*0.39*
ddhb *	0.75	0.75	0.76	1.00	0.87	0.79	0.95	1.00	0.90	0.72	0.71	0.87	0.75	0.76	0.78	0.98	0.78	0.83	0.95	*0.84*
ddhr	0.61	0.66	0.65	0.66	0.66	0.68	0.67	0.67	0.64	0.63	0.62	0.59	0.61	0.44	0.46	0.39	0.45	0.47	0.47	*0.58*
drqa	0.51	0.64	0.72	0.41	0.46	0.29	0.27	0.27	0.31	0.29	0.33	0.40	0.35	0.29	0.42	0.41	0.44	0.44	0.44	*0.41*
drqr	0.57	0.69	0.78	0.98	0.99	0.48	0.45	0.48	0.49	0.45	0.54	0.55	0.97	0.79	1.01	1.03	1.03	0.77	1.01	*0.74*
dqii	0.66	0.73	0.82	0.68	0.64	0.49	0.60	0.63	0.48	0.85	0.52	0.66	0.56	0.48	0.53	0.53	0.90	0.62	0.57	*0.63*
dqip	1.02	0.97	0.99	0.99	1.00	1.00	0.82	0.94	0.97	0.90	0.99	1.01	0.56	1.01	1.01	1.18	0.83	1.09	1.16	*0.97*
dqia	0.79	1.01	0.94	0.97	0.87	0.99	0.95	0.72	0.73	0.66	0.69	0.75	0.69	0.78	0.66	0.53	0.83	0.62	0.91	*0.79*

N.B.: *Banks listed on the Indonesian Stock Exchange (IDX).

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