

## Efficiency and Productivity Change of the Indonesian Commercial Banks

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**Abstract**—This paper investigates the efficiency of the Indonesian commercial banks, compares the efficiency of different groups of ownership, and investigates the productivity change during the period of 1994-2008. We use consistent data for 70 banks, and groups them into four groups based on ownership, i.e. government owned, local government owned, private owned and joint venture and foreign owned. By employing Data Envelopment Analysis (DEA), it reveals that during the covered period, the mean of efficiency for overall sample was 0.866, while the most efficient bank group was government owned followed by joint venture and foreign owned, in which the mean of efficiency was 0.953 and 0.943, respectively. Moreover, during the sample period covered, productivity growth increased by 0.5 percent annually, supported by technological change that grew 1.7 percent annually, while at the same period efficiency change declined by 1.1 percent annually.

**Keywords**—bank efficiency, productivity change, Data Envelopment Analysis, Malmquist Index, Indonesia

### I. INTRODUCTION

Banking system is very important for the modern economy. As a financial intermediary, banks gather savings, allocate resources, and provide liquidity and payment services. Considering this vital role, it is very important to develop a sound banking system in which banks operate with good performance. To measure performance of banking sector, two kinds of measurement are widely used, namely financial ratio measures and efficiency measures. Financial ratio measures have been common to evaluate profitability as well as liquidity and solvability ratios. In the banking industry, CAMELS has been well known as a measure of financial performance. The using of efficiency measures has become more popular considering that the ability of financial ratios measures to capture a comprehensive picture of performance is limited and such measures do not adequately focus on the long-run performance aspects.

This paper attempts to: (i) investigate efficiency of the Indonesian commercial banks during 1994-2008 by using Data Envelopment Analysis (DEA), and compare the efficiency of different ownership groups; (ii) investigate the productivity change during that period by employing Malmquist index.

### II. OVERVIEW OF THE INDONESIAN BANKING SECTOR

The financial liberalization at its initial phase, in early 1980s, was a part of broader structural adjustment policies imposed by the Indonesian authorities to respond to the worsening price of oil and worldwide recession raising difficulties in balance of payment and fiscal position. The authorities introduced the first financial reform package in June 1983. The reforms enacted in this package included abolishing Bank Indonesia's control over interest rates on deposits and loans, eliminating credit ceilings for state-owned banks, and phasing out the practice of funding state-owned banks by means of government liquidity credits.

The big bang of financial reforms was launched on October 27, 1988. The reforms included: abolishing entry barriers that allow the set up of new banks, abolishing restriction on opening up new branches, allowing state-owned companies to deposit up to 50 percent of their funds in private banks, reducing reserve requirements to induce liquidity, introducing legal lending limits requirement, allowing banks to issue shares, and removing tax exemption on interest to equalize the treatment between interest payment and dividends.

Following that, the Indonesian authorities had continuously introduced further reforms in protective and preventive frameworks. During 1989-1990, the authorities introduced a new regulation on legal lending limit, imposing restriction on net open position to limit foreign borrowing, and launched a measure to limit credit programs provided by the central bank. Many of the previous reforms became codified under the new banking law stipulated in March 1992. This law significantly changed the status of the state banks by making them limited liability companies, provided for foreign ownership of Indonesian banks, and introduced prudential measures such as limits to concentrated loans and loans to associated interests while strengthening the supervisory powers of the banking authorities by giving them power to issue directives and to close and liquidate unsound banks [1]. Finally, in 1993-1996, it phased in more prudential regulations and supervisory tools for ensuring bank soundness—from reporting requirements, to self-regulation, to capital adequacy, asset quality, management, earnings, and liquidity (CAMEL) bank ratings. By end-1996, prudential practices in Indonesia's banking sector were largely in line with those recommended by the Basel Committee and comparable to those adopted in the US and EU [2].

As expected, financial liberalization had improved the Indonesian financial system. There is no doubt that after the deregulation, the quality and availability of banking services has increased markedly. Although operating environment of bank sector had improved, Indonesia was hit by severe financial crisis in 1997. The currency crisis hit the Indonesian economy had then evolved into a full-blown banking crisis. Refer to [3], the situation of banking sector decline can be attributed as banking crisis if meets at least one of these four conditions: (i) ratio of non-performing assets exceeds 10 percent; (ii) the cost of rescuing more than 2 percent of GDP; (iii) banking problems causing nationalization of banks; and (iv) bank runs or deposit freezes or imposing blanket guarantee. Confirmed to this definition, the Indonesian banking sector really in the crisis, manifested in these indicators: (i) ratio of non-performing assets to total assets was estimated at 60-85 percent of all loans [4]; (ii) estimated cost of rescuing was Rp 643 trillion (about US\$ 89 billion), or 60 percent of GDP [5]; (iii) some banks were nationalized; and (iv) bank run happened on some banks even after imposing blanket guarantee.

In response to the banking crisis, under the direction of the IMF, the authorities took some major interventions, among others were: (i) the closure of 16 small banks in November 1997; (ii) intervention into 54 banks in February 1998; (iii) the take-over of 7 banks and closure of another 7 in April 1998; (iv) the closure of four banks previously taken over in April 1998; (v) the closure of 38 banks together with a take-over of 7 banks and joint recapitalization of 7 banks in March 1999; and (vi) a recapitalization of six state-owned banks and 12 regional banks during 1999-2000 [6]. Later, after restructuring was completed, the previously taken-over banks were re-privatized. The privatization policy is expected to benefit the domestic banking industry by promoting governance, transfer of technology, and enhance risk management competencies. Besides those intervention policies, the authorities also introduced substantial financial reforms in banking sector. As cited in the first Letter of Intent to the IMF, financial reform included “the institutional, legal, and regulatory framework for banking operation to ensure the emergence of a sound and efficient financial system”. In this regards, the authorities launched prudential supervision, financial reporting, and relevant commercial laws, as well as implementing deposit insurance scheme. In order to improve the effectiveness of banking supervision, the new Central Bank Act (Act number 23 of 1999) gave independent status to the Bank Indonesia, which is free from the intervention of the government.

Further measures were introduced to continue bank consolidation. They included raising capital requirements to price small private banks out of the market, as well as introducing the “single presence policy” and reducing the depositor guarantee level that lead to a natural consolidation in the financial services industry in Indonesia [7]. A clear result of such consolidation was continuous decline of bank number, from a pre-crisis figure of 239 to 142 in 2002 and 126 in 2008.

### III. METHODOLOGY

#### A. Data Envelopment Analysis (DEA)

In assessing bank efficiency, we can use either parametric or non-parametric methodologies. The difference between these two approaches lies on how they handle random error and their assumption regarding the shape of the efficient frontier [8]. Each of the techniques has its own strengths and weaknesses. As in [9], the advantage of parametric approach is allowing noise in the measurement of inefficiency, while the advantage of non-parametric is simple and easy to calculate since it does not require specification of functional form. Common parametric approaches are the Stochastic Frontier Approach (SFA), the Thick Frontier Approach (TFA) and the Distribution Free Approach (DFA), while the common non-parametric techniques are the Data Development Analysis (DEA) and the Free Disposal Hull Analysis (FDH).

DEA has become popular under non-parametric approaches, mainly attributable to its flexibility in application, and ability to deal with multiple inputs and outputs. DEA can be used to evaluate the efficiency of a firm by comparing it with a ‘best practice’ or output efficient firm. An output efficient firm is one that cannot increase its output unless it also increases one or more of its input, whereas an output inefficient firm is one that can increase its output without increasing its inputs. An output efficient firm would have a score of 100% or 1.00 as being located on the output efficient frontier whereas an output inefficient firm would be inside the frontier and have a score of less than 1.00. Similarly an input efficient firm is one that cannot reduce its inputs without reducing its output whereas an input inefficient firm can. However, the scores can only be used for comparisons within the sample. DEA allows the researcher to select multiple outputs and inputs in complex production environments based on managerial concerns [10]. Moreover, DEA does not require specifying either the functional form of the model being tested or the weights to be used for consolidating multiple inputs and/or outputs [11]. As such, DEA efficiency estimates are highly sensitive to data errors and outliers, thus care has to be taken in applying and interpreting DEA results.

#### B. Malmquist Productivity Index

Using the DEA, there are three alternatives for measuring the productivity changes, which are Fisher index, Tornqvist index and the Malmquist Index. The Malmquist index has three main advantages relative to the Fischer and Tornqvist Indices [12]: (i) it does not require the profit maximization or the cost minimization assumption; (ii) it does not require information on the input and output prices; (iii) if the researcher has panel data, it allows the decomposition of productivity changes into two components, i.e. technical efficiency change or catching up and technical change or changes in the best practice. Its main disadvantage is the necessity to compute the distance functions. However, the data envelopment analysis (DEA) technique can be used to solve this problem.

The Malmquist index measures total factor productivity (TFP) change between two data points by calculating the ratio of the distances of each data point relative to a common technology and it requires the inputs and outputs from one time period to be mixed with the technology of another time period. Following [13], this paper adopts the output-oriented Malmquist productivity change index, referring the emphasis on the equi-proportionate increase of outputs, within the context of a given level of input. The output-oriented Malmquist productivity change index can be expressed as follows:

$$M_j^{t+1}(y^{t+1}, x^{t+1}, y^t, x^t) = \frac{D_j^{t+1}(y^{t+1}, x^{t+1})}{D_j^t(y^t, x^t)} \times \left[ \frac{D_j^t(y^{t+1}, x^{t+1})}{D_j^{t+1}(y^{t+1}, x^{t+1})} \times \frac{D_j^t(y^t, x^t)}{D_j^{t+1}(y^t, x^t)} \right]^{1/2} \quad (1)$$

Where:

$M_j$  = Malmquist productivity index

$D_j$  = Distance function

$x$  and  $y$  = represent inputs and outputs, respectively, across time period  $t$  to  $t+1$ .

Equation above presents the component of the Malmquist Index. The ratio outside the brackets is equal to the change of technical efficiency (EFFCH) between time  $t$  and  $t+1$ , representing the change in the relative distance of the observed production from the maximum potential production; while the component inside the brackets is the geometric mean of the two productivity indexes, representing the shift in production technologies (technical change, TECHCH) between time  $t$  and  $t+1$ . The product of the two components (EFFCH and TECHCH) is the Malmquist productivity change (total factor productivity change, TFPCH). In addition, technical efficiency change (EFFCH) can be further decomposed into pure technical efficiency change (PECH) and scale efficiency change (SECH).

### C. Variables and Data

One of the critical aspects in employing DEA is to decide input and output variables. The literature provides two main approaches in identifying inputs and outputs namely production approach and intermediation approach [14]. The production approach defines the bank activity as production of services and views the banks as using physical inputs such as labor and capital to provide deposits and loans accounts. In other hand, intermediation approach views banks as the intermediary of financial services and assumes that banks collect deposits, using labor and capital, then intermediate those sources of funds into loans and other earning assets. Intermediation approach is more suitable and most widely used in the banking literature [8]. In line with this, this paper uses intermediation approach for identification of inputs and outputs.

This paper specifies three inputs and three outputs. The inputs are total deposits, interest expenses, and other operating expenses; while the outputs are total loans, interest income, and other operating revenues. We use consistent data for 70 banks from 1994 to 2008. It consists of 3 government-owned, 24 local government-owned, 34 private-owned, and 9 joint venture and foreign-owned. Data is obtained from Indonesian Banking Directory, various

editions, published by the Indonesian central bank, Bank Indonesia; and Indonesian Banking Indicators & Financial Performance Rating, CD Rom, various editions, published by Ekofin Konsulindo.

Table 1 shows the descriptive statistics of DEA inputs and outputs used in this study, including mean, standard deviation, minimum and maximum. Table 1 illustrates the disparity of the operations of various commercial banks during 1994 and 2008 time period. While some banks were large there were very small banks as well. This disparity of the scale of operation may play an important role in the determination of the performance. However, this study does not explicitly account for the scale effect on performance.

To give illustration on the representativeness of the sample, Fig. 1 provides comparison between sample assets with total assets of the banking sector. Although the percentage of sample assets to total assets significantly declined after 1998, it kept more than 60%.

TABLE I. DESCRIPTIVE STATISTICS OF MAIN VARIABLES

Variable	Mean	Std. Deviation	Min	Max
Loans	4,689,335	12,540,479	8,084	161,061,059
Interest income	1,065,099	2,761,625	1,384	28,076,399
Other operating revenues	149,905	417,207	13	6,066,730
Deposits	3,500,219	8,640,759	1,148	73,519,757
Interest expenses	650,143	1,956,426	563	31,005,886
Other operating expenses	476,628	1,968,324	349	40,555,255

N=1050

## IV. RESULT AND DISCUSSION

Fig. 2 shows mean variable return to scale (VRS) technical efficiency from 1994 to 2008, reflecting the development of efficiency of the Indonesian commercial banks. Before the crisis, the efficiency was consistently increased from 0.883 in 1994 to 0.939 in 1997. During the crisis, it slumped from 0.939 in 1997 to 0.854 in 1998 and 0.812 in 1999. After significant improvement from 0.812 in 1999 to 0.876 in 2000, the efficiency was fluctuated with

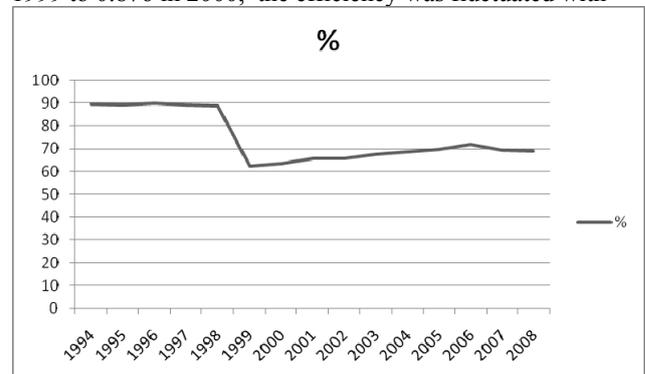


Figure 1. RATIO OF SAMPLE ASSETS TO TOTAL ASSETS

declined figure during mini financial crisis (2004-2005) and global financial crisis (2007-2008).

As mentioned before, efficient firm will have score of 100% or 1.00. Fig. 3 identifies the percentage of efficient banks during the covered period. We can notice that the dynamics of the percentage of efficient banks was parallel with the dynamics of efficiency. Before the crisis, the percentage of efficient banks was steadily increased from 34% in 1994 to 40% in 1997. During the crisis it slumped from 40% in 1997 to 37% in 1998 and 1999. The highest percentage during the after crisis period was 44% in 2003, and the lowest was 36% in 2004 and 2007. In terms of ownership, the highest percentage of efficient banks belonged to government owned, followed by joint venture and foreign owned, local government owned, and private owned.

This sequence was consistent with the mean of efficiency as shown in Table 2. During the covered period, government owned banks outperform all other groups of banks, in which the mean efficiency of state owned banks was 0.953. Following government owned are joint venture and foreign owned (0.943), local government owned (0.915), and private owned (0.803).

This finding is very interesting as it is different with common believe as well as many previous studies that came up with the conclusion of inferiority of government owned. However, this finding is not exclusive, considering some other studies found the same result. For example, study of [15] found that during the period of 2001-2003, government owned was the most efficient banks in Indonesia. Another study [16] analyzing the level of efficiency of commercial banks in Indonesia during 2007 also found that the most efficient bank group was government owned.

Moreover, Table 2 also shows that the difference of score between government owned and joint venture and foreign owned is very small, meaning that superiority of foreign ownership was still evidenced in this study. As literature tells us, foreign ownership everywhere in developing countries tends to be superior given the fact that they make the least effort to extend the branch network beyond the metropolitan areas, they are entitled with better technologies, and they deal with healthy customers as well as multinational companies [17].

With regard to productivity change, Table 3 reveals that during the covered period, productivity growth increased by 0.5 percent annually. We can note, however, that the productivity growth was declined when the economy was in the severe financial crisis (1997/1998-1998/1999) and mini financial crisis (2004/2005). The decline for those three years was 7.3%, 7.2%, and 12.3%, respectively. The decline of productivity growth during the crisis is consistent with the findings of previous studies, e.g. [6] and [18]. In another hand, the increase of productivity growth after the banking sector restructuring confirms the positive result of the policies implemented by the authorities. This finding can enrich the perspective on the debate—both theoretical and empirical—about the effect of bank restructuring on the bank performance. In the case of Indonesia, some previous

empirical studies show mixed findings, e.g. [19] found positive result, while [20] found negative result.

From Table 3 we also note that the productivity growth during the covered period was supported by technological change that grew 1.7 percent annually; while at the same period efficiency change declined by 1.1 percent annually.

## V. CONCLUSION

The study finds that the efficiency of the Indonesian banking sector during the period of 1994-2008 was relatively high, with the mean of overall industry 0.866. In terms of ownership, the most efficient bank group during the covered period was government owned, followed by joint venture and foreign owned; while local government owned and private owned were in the least efficient places.

However, we should assess this result carefully. Further research by shorten the covered period and distinguish before and after crisis period can be done to check the result consistency. Due to consideration of finding consistent data during covered period, 1994-2008, this study excludes four state owned banks that finally merged into one after the crisis. Including these four banks in the sample might be can change the result.

Another finding of the study is that the productivity change of the Indonesian commercial banks during the covered period was due to technological change instead of technical efficiency change. It implies the importance of developing technology and innovation in achieving productivity of banking sector.

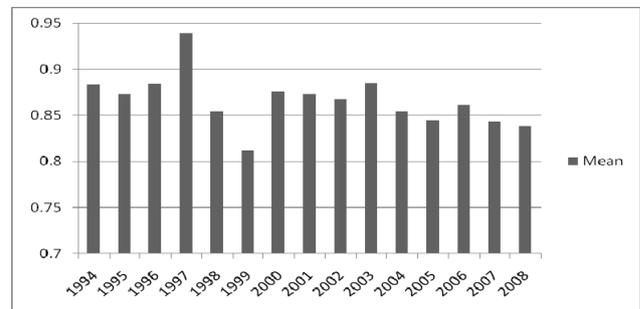


Figure 2. MEAN VRS TECHNICAL EFFICIENCY

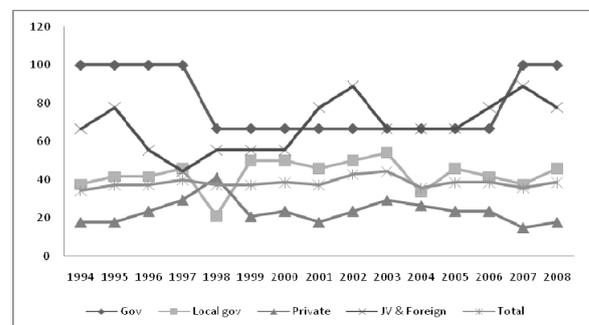


Figure 3. PERCENTAGE OF EFFICIENT BANKS BY GROUP

TABLE II. EFFICIENCY BY GROUP

Bank group	N	Mean	Std. Deviation
Gov	45	0.953	0.1077
Local gov	360	0.915	0.1066
Private	510	0.803	0.1706
Foreign & JV	135	0.943	0.1032
Total	1050	0.866	0.1538

TABLE III. MALMQUIST INDEX SUMMARY OF ANNUAL MEANS

Year	Effch	Techch	Pech	Sech	Tfpch
1994/95	0.983	0.973	0.982	1.000	0.956
1995/96	1.043	1.005	1.020	1.023	1.048
1996/97	1.033	0.975	1.068	0.967	1.007
1997/98	0.778	1.191	0.895	0.870	0.927
1998/99	0.994	0.928	0.939	1.059	0.923
1999/00	1.204	0.852	1.097	1.098	1.026
2000/01	0.982	1.131	0.997	0.985	1.111
2001/02	0.983	1.030	0.989	0.994	1.012
2002/03	1.010	0.993	1.028	0.983	1.003
2003/04	0.924	1.149	0.955	0.968	1.062
2004/05	0.998	0.878	0.992	1.006	0.877
2005/06	1.045	0.992	1.020	1.024	1.037
2006/07	0.953	1.125	0.976	0.977	1.072
2007/08	0.964	1.077	0.989	0.976	1.039
Mean	0.989	1.017	0.995	0.994	1.005

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