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Productivity Changes in Indonesian Banking: Application of a New Approach to Estimating Malmquist Indices

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ABSTRACT:

In this study, we utilise a new, non-parametric efficiency measurement approach which combines the semi-oriented radial measure data envelopment analysis (SORM DEA) approach for dealing with negative data (Emrouznejad et al., 2010) with the slacks-based efficiency measure of Tone (2001, 2002), to analyse efficiency and productivity changes for Indonesian banks over the period Quarter I 2003 to Quarter IV 2007. Using quarterly data based on supervisory data provided by Bank Indonesia we find that, under the intermediation-based approach to efficiency estimation, average Indonesian bank efficiency somewhat declined during the sample period, from 73% to 63%, reaching a nadir of 53% at end-June 2007. With respect to the bank groupings, Indonesian 'state-owned' banks were the most efficient at the beginning of the sample period (with average efficiency of 92%) but, by the end of the sample period, they had been usurped by the 'joint-venture' and 'non-foreign exchange private' banks. The regional government-owned banks were found to be the least efficient throughout. Finally, Malmquist results for the Indonesian banking 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.

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

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1. Introduction

Indonesia has had little extensive research conducted on its financial system relative to other emerging economies around the World. This is surprising considering it's growing importance, particularly to the USA. As Friend argued back in 1998, "Indonesia's turbulence must engage America if for no other reason than it is a nation-state twice the area of Texas, stretched into an elongated archipelago as wide as the United States and sitting astride the shipping lanes that bear Mideast oil to all of East Asia" (Friend, 1998, p. 387). Furthermore, as a growing economy (GDP equal to US$511 billion in 2008), it is doubly important to US interests (Indonesia is the United States' 30th largest trading partner; in 2008, two-way exported trade and services equalled US$5.8 billion and US$1.6 billion respectively; and U.S. foreign direct investment in Indonesia was equal to US$10 billion in 2007, primarily in the mining sector (US$7 billion) (Office of the United States Trade Representative, 2009). In addition, as a key member of the ASEAN group of countries (which also includes Brunei, Darussalam, Cambodia, Indonesia, Laos PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam) - the group has a combined population of 583 million and a nominal GDP in 2008 of US$1,5 trillion – and also as a member of the G20 Group of Nations, it plays an important role in policy deliberations at both regional and global levels. Therefore, its banking system merits serious analysis given its interconnections with the global economy.

As far as the Asian Financial Crisis (AFC) is concerned, Indonesia was by far the worst affected economy (Djiwandono, 1999; IMF, 2007a), experiencing, like Thailand and Korea, a mixture of currency, banking and debt crises. Moreover, under the terms of the IMF assistance it received, it had to agree to undertake financial sector "restructuring", including the closure of financial institutions (Jao, 2001, Chapter 2). The economic crisis led, in turn, to a social and political crisis, the latter resulting in the resignation of President Suharto in May 1998. The rapid propagation of the crisis was

largely due to weak domestic economic and financial structures, including "crony capitalism" (see Kenward, 2002 and Enoch et al ,2003).

With respect to financial restructuring, the measures agreed with the IMF comprised, inter alia, the closing down of insolvent institutions, the provision of conditional emergency liquidity support to all commercial banks (through overdraft facilities), the establishment of an Indonesian Bank Restructuring Agency (IBRA) to act as an asset management company and restructure problem bank assets, the transfer of institutions to IBRA for "special surveillance", the merger of state-owned banks, preparation of state banks for privatisation, relaxation of the limits on private ownership of banks and the external audit of most major banks by overseas auditors. After the adoption of the IMF restructuring plan, the consolidation of the Indonesian banking Industry continued apace, with the number of banks down to 130 from a pre-crisis figure of 237 by June 2003. Then, in 2004, the authorities revealed a "masterplan" for the financial sector which called for a further reduction in the number of banks from 130 to 60-70. And finally, in June 2005 Bank Indonesia revealed that "consolidator/"anchor" banks (i.e., those allowed to acquire other institutions) would be required, *inter alia*, to satisfy the following criteria: a minimum tier 1 capital adequacy ratio of 6%; a minimum capital adequacy ratio of 12%; a minimum return on assets ratio of 1.5%; a NPL ratio of under 5%; and a minimum annual credit growth figure of 22%. All other banks would be expected, by the year 2010, to have a minimum paid up share capital of RP 100 billion (Rp 80 billion by 2007), and a minimum capital adequacy ratio of 10%. Around 16 banks were subsequently earmarked for closure/merger or a downgrade to rural bank status during 2007, with a similar number to face the same fate in 2008.

The strategic programme to reduce the number of banks in Indonesia was implemented in three different ways. The first, as was noted above, was to raise capital requirements; hence, many small private banks would be priced out of the market and would have to merge.[1] 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

[1] 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.

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 was hoped that the 'single presence policy' would lead to further consolidation within the industry in future 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 was hoped that investors would be more selective in their choice of bank, leading to a natural consolidation in the financial services industry in Indonesia.

Today, Indonesia is in much better shape than immediately post-AFC. An accumulation of foreign exchange reserves - in 2008 they stood at US$51 billion, up from US$43 billion in 2006 - has allowed for the early repayment of IMF loans (the last repayment was made in October 2006). The current account is in surplus and the currency has appreciated, despite a "mini crisis" in August 2005, fuelled by loss of market confidence in monetary policy and concerns over the increasing oil price – the current exchange rate against the dollar is Rp 9,700. Positive growth has been recorded since the second quarter of 2006, when it was 5.2% at an annualised rate, reaching 6.3% in 2008. The stock market has risen, with the JCI currently standing at 2,457 (as at 22nd September 2009). Public debt is under control. Interest rates and inflation have both fallen from their highs, the latter moving into single digit territory from 18.38% in November 2005 to 2.75% in August 2009. And FDI has increased from US$596 million in 2003 to US$7,918 million in 2008. However, not everything is rosy. Unemployment is still too high, with the national average declining from 9.1% in 2007 to 8.4% in 2008. Furthermore, private investment and FDI are still below pre-crisis levels.

The above discussion highlights why this study is both a timely and warranted analysis into the efficiency and productivity changes taking place in Indonesian banking. We utilise a new, non-parametric modelling technique and a data set compiled by Bank Indonesia 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 summarise and conclude in Section 5.

2. Non-parametric modelling methodology

Estimation of a bank's level of efficiency involves a comparison of its actual and best possible performances, given the inputs and outputs specified. In this study, we utilise Data Envelopment Analysis (DEA), which is a non-parametric method to construct a relative efficiency frontier through the envelopment of the Decision Making Units (DMUs) where the 'best practice' DMUs form the frontier. It originated from Farrell's (1957) seminal work and was later developed by Charnes et al. (1978), Banker et al. (1984) and Färe et al. (1985). However, the traditional DEA models require the non-negativity of inputs and/or outputs, and several ways have been suggested for dealing with negative data in construction of the non-parametric DEA frontier. For example: data can be transformed, or 'translated', where a sufficiently large scalar is added to the data (Ali and Seiford (1990), Pastor (1996)); absolute negative inputs or outputs can be treated as output or input respectively (Scheel (2001)); or various range directional measures can be used (Silva Portela et al. (2004), Sharp et al. (2006), Kenjegalieva et al. (2009)). Our preference, because it allows for use of the data directly, is for a recent technique based on the semi-oriented radial measure for dealing with negative data (SORM DEA) proposed by Emrouznejad et al. (2010), the first time, we believe, such an approach has been adopted in banking efficiency analysis. Using the slacks-based efficiency measure of Tone (2001), in recognition of Fried et al's (1999) critique of the standard DEA model, we focus on input-reduction strategies and evaluate input-oriented efficiency measures estimating by how much banks could reduce the usage of their resources (inputs) given the outputs they produce. In addition, we employ the super-efficiency SBM model proposed by Tone (2002) combined with SORM DEA. And finally, we also utilise SORM SBM and Malmquist indices (initially defined by Caves, Christensen and Diewert (1982) and extended by Färe et al., (1992)), to analyse the productivity of Indonesian banks.

Formally, the optimum level of inputs is given by the relevant frontier which represents the common technology T banks use to transform positive and negative inputs X ($m \times n$) into positive and negative outputs Y ($s \times n$), given by equation (1):

$$\hat{T} = \{(X,Y) \mid \quad X \quad can \quad produce \quad Y\}. \tag{1}$$

It is assumed that $\hat{T}$ is a consistent estimator of the unobserved true technology set.

Given these conditions, the individual input-oriented efficiency for each DMU in period t is computed relative to the estimated frontier of period t by solving the following input-oriented SORM SBM linear programming problem[2]:

$$\hat{\rho}(x_o^t, y_o^t \left| T^t(x)) = \arg\min \left\{ \rho = 1 - \frac{1}{m}\sum_{k=1}^{m} s_k^- / x_{ko}^t \right| \begin{array}{l} x^t{}_o = X^t\lambda + s^-; y_o^t \le Y^t\lambda \ ; \\ y_o^{1,t} \le Y^{1,t}\lambda \ ; y_o^{2,t} \ge Y^{2,t}\lambda \ ; \\ \sum \lambda = 1; \lambda \ge 0; \quad s^- \ge 0. \end{array} \right\} \tag{2}$$

and negative outputs Y_{sj}^1 and Y_{sj}^2 are defined as

$$Y_{sj}^1 = \begin{cases} Y_{sj} & if \quad Y_{sj} \ge 0, \\ 0 & if \quad Y_{sj} < 0, \end{cases} \quad and \quad Y_{sj}^2 = \begin{cases} 0 & if \quad Y_{sj} \ge 0, \\ -Y_{sj} & if \quad Y_{sj} < 0. \end{cases}$$

where $\hat{\lambda}$ is the estimated intensity variable and represents the peers of the considered bank.

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

[2] Although, the linear programming problem (2) can be solved without including the SORM inequalities by translating negative variables, the inclusion of the former allows for the use of the data directly.

$$\hat{\delta}(x_0^t, y_0^t \left| T_*^t(x)) = \arg\min \left\{ \delta = \frac{1}{m}\sum_{k=1}^{m} \bar{x}_k / x_{k0}^t \right| \begin{array}{l} \bar{x} \ \geq \sum_{j=1,\neq 0}^{n} \lambda_j x_j^t; \bar{y} \ \leq \sum_{j=1,\neq 0}^{n} \lambda_j y_j^t; \\ \bar{y}^1 \leq \sum_{j=1,\neq 0}^{n} \lambda_j y_j^{1,t}; \bar{y}^2 \geq \sum_{j=1,\neq 0}^{n} \lambda_j y_j^{2,t}; \\ \sum \lambda = 1; \lambda \geq 0; \ \ \bar{x} \geq x_0; \\ \bar{y} = y_0; \ \ \bar{y}^1 = y_0^1; \ \ \bar{y}^2 = y_0^2. \end{array} \right\} \quad (3)$$

An estimation of the productivity change of a bank involves evaluation of the bank's performance with respect to the frontiers of previous and subsequent years in addition to the frontier of the current year. Unlike traditional DEA models, to estimate the slacks-based measure of the bank relative to the frontier other than the current frontier of the bank, constraints of the linear programming models need to be adjusted. In particular, the bank under question is also included in the production possibility set (for more details see Tone (2004) and Liu and Wang (2008)). 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*:

$$\hat{\rho}(x_o^t, y_o^t \left| T^{t+1}(x)) = \arg\min \left\{ \rho = 1 - \frac{1}{m}\sum_{k=1}^{m} s_k^- / x_{ko}^t \right| \begin{array}{l} x^t{}_o = \sum_{j=1}^{n} x_j^{t+1}\lambda + x_o^t \lambda_{n+1} + s^-; \\ y^t{}_o \leq \sum_{j=1}^{n} y_j^{t+1}\lambda + y_o^t \lambda_{n+1}; \\ y^{1,t}{}_o \leq \sum_{j=1}^{n} y_j^{1,t+1}\lambda + y_o^{1,t} \lambda_{n+1}; \\ y^{2,t}{}_o \geq \sum_{j=1}^{n} y_j^{2,t+1}\lambda + y_o^{2,t} \lambda_{n+1}; \\ \sum_{j=1}^{n+1} \lambda_j = 1; \Lambda \geq 0, S^- \geq 0, S^+ \geq 0, l > 0 \end{array} \right\} \quad (4)$$

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

$$\hat{\delta}(x_0^t, y_0^t \left| T^{t+1}(x)) = \arg\min \left\{ \delta = \frac{1}{m}\sum_{k=1}^{m} \bar{x}_k \,/\, x_{k0}^t \right| \begin{array}{l} \bar{x} \;\geq \sum_{j=1}^{n} \lambda_j x_j^{t+1}; \bar{y} \;\geq \sum_{j=1}^{n} \lambda_j y_j^{t+1}; \\ \bar{y}^1 \leq \sum_{j=1,\neq 0}^{n} \lambda_j y_j^{1,t+1}; \bar{y}^2 \geq \sum_{j=1,\neq 0}^{n} \lambda_j y_j^{2,t+1}; \\ \sum \lambda = 1; \lambda \geq 0; \bar{x} \geq x_0; \bar{y} = y_0; \\ \bar{y}^1 = y_0^1; \bar{y}^2 = y_0^2. \end{array} \right\} \quad (5)$$

The SORM slacks-based performance measures $\hat{\rho}(x_o^{t+1}, y_o^{t+1} \left| T^t(x)\right.)$ and $\hat{\delta}(x_0^{t+1}, y_0^{t+1} \left| T\ (x)\right.)$ can 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):

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

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:

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

(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

As shown in Table 1, at the end of 2007 there were 130 banks operating in Indonesia with a combined balance sheet of over IDR 1,986 trillion (US$ 213 billion). This comprised 5 state-owned banks, 35 foreign exchange private banks, 36 non-foreign exchange private banks, 26 regional government-owned banks, 17 joint-venture banks and 11 foreign banks. This number compares with a total of 222 banks which were in existence at the end of December 1997 and reflects a post-Asian financial crisis policy of consolidation through liquidation and suspension, as agreed with the IMF following the country's bailout (see Section 1), and, more recently, through officially-encouraged mergers.

INSERT TABLE 1

It is also important to recognise the increasing role played by Islamic banks in an Indonesian 'floating market' of a possible customer base consisting of at least 75% of the population. This increasing role began with the passing of the Banking Act No. 7/1992, with Bank Muamalat being established as the first bank to offer Shari'ah compliant services. This was subsequently followed by Banking Act No. 10/1998, which allowed domestic and partly-foreign owned banks to open Islamic subsidiaries (recently, HSBC opened up a Shari'ah head office in Jakarta). And, finally, the switch from civil courts to religious courts to take over adjudication of Islamic banking disputes (Law No. 3/2006),

further encouraged the development of Islamic banking. In 2000, the total deposits held in Islamic banks equalled Rp1.03 trillion increasing to Rp36.85 trillion in 2008, and financing increased from Rp1.27 trillion to Rp38.2 trillion over the same period. Although the share of total banking assets accounted for Islamic banks is still small (1.67% in March 2007), this belies the aims and growth targets set by Bank Indonesia. Moreover, Islamic banking in the last 5 years has seen annualised growth rates exceeding 60%.[3]

In modelling the intermediation approach, we specify 3 outputs and 4 inputs, in line with Sealey and Lindley (1977). Quarterly data is based on the monthly supervisory data provided by Bank Indonesia. 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 net off-balance-sheet income' (income form dividends/fees/commissions/provisions + income from forex/derivative transactions + securities appreciation - securities depreciation - losses from forex/derivative transactions - losses from commission/provisions). The third output variable set is included in the analysis to reflect banks' diversification away from traditional financial intermediation (margin) business and into "off-balance-sheet" and fee income business. 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); and 'total provisions' (allowances for loan losses). With respect to the last-mentioned input variable, 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

[3] It is interesting to note that Indonesia has the aim of becoming a leading Islamic banking centre in the ASEAN region by 2010 (Bank Indonesia, 2008).

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). Indeed, non-performing loans (NPL) have led to problems in Indonesian banking during our sample period.[4] For example, 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 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. Indeed, Bank Mandiri saw an 88% slide in earnings in 2005 due to the NPL regulation. Hence, due to the changing nature of NPLs and its links with LLPs, we incorporate provisions as an input/cost in the relative efficiency analysis of Indonesian banks.

INSERT TABLE 2

Summary statistics on the data are given in Table 2. The sample includes a balanced panel of 129 Indonesian banks covering the time span from 2003 quarter 1 to 2007 quarter 4[5]. In the estimation period, observations totalled 18,060. It must be noted that separate frontiers were estimated for each time period to allow for comparisons with the Malmquist Index.

4. Results

The efficiency and productivity measures of Indonesian banks are presented below. A detailed analysis of bank efficiency performance, by type and ownership

[4] The aggregate NPL ratio before the Asian Financial Crisis 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 back to a level of 8.8%.

[5] One state-owned bank is dropped from the sample due to the extremely volatile changes in its off-balance-sheet items.

groups, is given in Section 4.1. We then discuss productivity growth, technological progress and the efficiency catching-up of banks in Section 4.2.

4.1. Intermediation efficiency of Indonesian banks

Table 3 and Figure 1 provide a summary of SORM SBM efficiency scores for Indonesian banks. As can be seen from the table and the top graph, the average efficiency scores of Indonesian banks were rather stable during the period Q1 2003 – Q4 2005 for the total sample, lying between 70% and 77%. The relatively-low figure, by international standards-a comparative ASEAN study is planned by the authors to check relative efficiency from a regional perspective-probably reflects the banks' low, post-crisis loans-to-deposits ratio (which has averaged at around 65%) and their excess liquidity [which is mainly held in BI certificates] [IMF,2007a]. The former are matched by a low private credit to GDP ratio-26% in 2005-compared to a regional average of over 90%. These institutional features reflect the regulatory environment [strengthened prudential standards to meet international "best practice"], the nature of the post-crisis bank clean-up operation [banks' commercial NPLs were transferred to the government at book value and replaced with government “recap” bonds, thereby "crowding out" private sector credit], and weaknesses in information infrastructure which make it difficult to assess borrower creditworthiness (the credit information bureau introduced by BI in June 2006 only covers 0.1% of the population and does not include information on prospective borrowers' standing with non-bank institutions). And, on the demand side, credit demand has been dampened by high real lending rates, rising unemployment and the trend in corporate deleveraging. As for the stability demonstrated, this is likely to be due to improvements in the macroeconomic environment (stronger exchange rate, lower inflation and declining interest rates)[6].

However, after Q4 2005 and till near the end of the analysed period, banking performance deteriorated, with average bank efficiency reaching a nadir of 53% at end-Q2 2007 before recovering to 63% by end-2007. The worsening of banking efficiency could be due to Bank Indonesia’s ‘consolidation’ plan (see Section 1), largely effected

[6] A detailed analysis of the impact of macroeconomic and other ‘external’ (including regulatory) factors on the efficiency scores is beyond the scope of this paper but will be the subject of a future paper by the authors.

through increased capital requirements (which, *ceteris paribus*, reduce profitability and lending capacity, thereby reducing intermediation-based efficiency). Furthermore, this period was marked by an unprecedented series of challenges facing Indonesia, such as terrorist attacks, a tsunami, earthquakes and avian influenza. Budgetary outlays to address these issues led to upwards pressure on price (Dowling and Chin-Fang, 2008), although, according to these authors, with reference to IMF (2007 a, b), Indonesia has weathered the disturbance in the US credit markets relatively well while remaining susceptible to the risk of contagion (page. 484). The sharp drop of about 12% in banking efficiency in Q2 2007 (which occurred despite the easing of prudential regulations relating to capital adequacy, loan loss provisioning and loan classification – IMF, 2007a), soon recovered to 63% in the following quarter as credit provision was boosted by a cut in BI's policy rate and the lagged response to the earlier relaxation of prudential regulations (Bank Indonesia, 2007, page. 126).

When analysing the results by type of bank (i.e., listed/Islamic), similar trends are exhibited with the former, on average, experiencing a fall in efficiency from 80% at the beginning of the sample to 56% at the end, having reached a nadir of 47% at end-June 2007. Similarly, average Islamic bank efficiency declined from 76% to 58% over the sample period, with a nadir of 56% again being recorded at end-June 2007.

INSERT TABLE 3

INSERT FIGURE 1

Average efficiency scores among the different bank groupings – see lower graph of Figure 1 and Table 3 - vary substantially and range between 40% in Q2 2007 for regional government-owned banks and 93% in Q4 2003 for state-owned banks. Although the state-owned banks were the most efficient group at the beginning of the sample, with an average efficiency of about 90%, their average efficiency after Q1 2004 declined sharply, and was 61% in Q4 2007, below the industry average. To a lesser extent, a similar pattern of decline was observed in the efficiency trends for most of the other groups. The exceptions were the non-foreign exchange private and joint-venture banks, whose efficiency trends were the most stable, and whose average efficiency, at

70% and 76% respectively, was the highest by the end of the sample period. Regional government-owned banks were the most inefficient banks throughout the sample, with average efficiencies ranging between 65% and 40%. These findings are in line with Margono et al. (2009) - who also found that the joint-venture and foreign banks were the most cost-efficient banks in Indonesia and that the small provincial banks owned by the local governments were the least efficient – see Appendix 1. Another study on South East Asian banking undertaken by Williams and Nguyen (2005) also reported similar results. Using a SFA approach – like Margono et al. (2009) - foreign banks in South East Asia were found to be more profit efficient than domestic private banks, whereas there was no difference between state-owned and privately-owned domestic banks. In addition, they found that the average financial sector-owned private Indonesian banks achieved better profit efficiency than the average family-owned or company-owned bank.

4.2. Productivity growth in Indonesian banking

With respect to the Malmquist productivity analysis, Figures 2 and 3 show, respectively, the dynamics of the average Malmquist productivity index and its decomposition into technical efficiency change and frontier shift components, by type and groups of banks. As can be seen, the average productivity of the sampled banks was relatively stable during the analysed period. However, at the beginning of the considered period, state-owned and foreign banks (as well as Islamic banks) experienced volatile productivity, which was mainly caused by shifts in the technological frontier. The productivity decomposition results generally attribute productivity changes mainly to a deterioration/improvement in financial intermediation technology. Interestingly, in 2007 however, all banks experienced unstable patterns of technical efficiency change and frontier shift, with the two balancing out to more or less maintain stable productivity growth.

INSERT FIGURES 2 AND 3

The finding that the main driver of the productivity change in the financial intermediary activities of Indonesian banks was the improvement in their intermediation

technology is consistent with those of other studies on East Asian banking – see Appendix 1. For instance, Park and Weber (2006) found that during 1992-2002 banking productivity in Korea improved mainly due to technological progress. Williams and Nguyen (2005) also found that the productivity of East Asian banks improved over time and that technological change was the main instigator of productivity change. Finally, with respect to technical efficiency change (i.e., the catching-up effect), there appears to be a relatively stable pattern excepting the year 2007. This suggests that, although the efficiency levels of banks were at different levels, the relative efficiency position of banks had a tendency to remain unchanged.

5. Summary and Conclusions

In one of the first stand-alone analyses of Indonesian banking efficiency, we have estimated efficiency scores and Malmquist productivity indices for Indonesian banks over the period Q1 2003 and Q4 2007 using the non-parametric, slacks-based, semi-oriented radial measure approach for efficiency and super-efficiency estimation suggested by Tone (2001, 2002) and Emrouznejad et al. (2010). We used a unique dataset based on monthly data provided by the Central Bank of Indonesia, Bank Indonesia, to carry out this analysis.

Our results show a steady performance in average intermediation-based efficiency by the banks in the period 2003 to 2005 which may be linked to improvements in the macroeconomic environment. However, after Q4 2005 and till near the end of the analysed period, banking performance typically deteriorated. Average efficiency scores among the different groups of banks varied substantially and ranged between 40% in Q2 2007 for regional government-owned banks and 93% in Q4 2003 for state-owned banks. Although the state-owned banks were the most efficient group at the beginning of the sample, with average efficiency of about 90%, their average efficiency declined sharply after Q1 2004, subsequently reaching 61% in Q4 2007, below the industry average. Non-foreign exchange private and joint-venture banks were shown to have had the most stable efficiency trends, becoming the most efficient group of banks by the end of the sample period, whereas regional government-owned banks were shown to be the most inefficient

banks throughout the sample. The latter finding probably reflects the degree of 'policy lending' still demanded by the owners.

As for the Malmquist analysis, the dynamics of the average productivity of banks were shown to be relatively stable during the analysed period, with the results suggesting that the main driver of the productivity change in the financial intermediary activities of Indonesian banks was the improvement in their intermediation technology.

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Table 1

The Structure of the Indonesian Banking Industry at end-December 2007

Type of Bank*	Number of Banks	Total Assets (TA) (IDR tn.)		TA Share to the Banking Industry TA (%)	
State-owned banks	5 (4)	742.0	(538.0)	36%	(30%)
Foreign exchange private national banks	35 (35)	768.7	(768.7)	39%	(43%)
Non-foreign exchange private national banks	36 (36)	39.0	(39.0)	2%	(2%)
Regional government-owned banks	26 (26)	170.0	(170.0)	9%	(10%)
Joint venture banks	17 (17)	90.5	(90.5)	5%	(5%)
Foreign banks (branching)	11 (11)	176.3	(176.3)	9%	(10%)
Total	130 (129)	1986.5	(1782.4)	100%	(100%)

Note. * There are also 24 (23) listed banks, comprising 17 (17) foreign exchange private banks, 2 (2) non-foreign exchange private banks, 1 (1) regional government-owned bank, 1 (1) joint venture bank, and 3 (2) state-owned banks. As well as this there are 3 (3) Islamic banks, which comprise 2 (2) foreign exchange private banks and 1 (1) non- foreign exchange private bank. [Numbers in parentheses are the number of banks and their total assets of the sample – see footnote 5].

Table 2.

Summary Statistics for Indonesian Banks. Inputs and Outputs in IDR tn: Q I 2003 - Q IV 2007

Variable	Mean	Minimum	Maximum	Std.Dev.
Inputs:				
Total non-employee expenses incurred during the given quarter	31626	81	2239957	93928
Total consumer deposits and commercial borrowing	7428589	66	231144394	21834002
Total employee expenses incurred during the given quarter	34186	247	1200971	103956
Total provisions made during the given quarter	275747	51	11682029	1125093
Outputs:				
Total loans	3706760	0	79290094	9714219
Other earning assets	6755394	2508	345617374	25344522
Net total off-balance sheet income earned during the given quarter	23494	-1750422	11151124	240206

Table 3.

Summary of SORM SBM Efficiency Scores for Indonesian Banks - Q I 2003 - Q IV 2007

	Q1 2003	Q2 2003	Q3 2003	Q4 2003	Q1 2004	Q2 2004	Q3 2004	Q4 2004	Q1 2005	Q2 2005
Listed Banks	0.80	0.78	0.80	0.77	0.75	0.73	0.69	0.68	0.69	0.70
Islamic Bank	0.76	0.80	0.79	0.83	0.90	0.81	0.93	0.73	0.73	0.83
State Owned Banks	0.92	0.87	0.90	0.93	0.92	0.84	0.71	0.71	0.71	0.69
Foreign Exchange Private Banks	0.73	0.73	0.75	0.72	0.73	0.69	0.70	0.70	0.69	0.71
Non Foreign Exchange Private Banks	0.74	0.84	0.82	0.84	0.82	0.83	0.80	0.74	0.72	0.78
Regional Government Owned Banks	0.63	0.64	0.65	0.58	0.61	0.57	0.60	0.55	0.57	0.58
Joint Venture Banks	0.83	0.82	0.87	0.84	0.84	0.84	0.82	0.81	0.84	0.87
Foreign Banks	0.73	0.78	0.73	0.72	0.65	0.81	0.68	0.69	0.77	0.86
Total sample average	0.73	0.76	0.77	0.75	0.74	0.74	0.72	0.70	0.70	0.74
	Q3 2005	Q4 2005	Q1 2006	Q2 2006	Q3 2006	Q4 2006	Q1 2007	Q2 2007	Q3 2007	Q4 2007
Listed Banks	0.74	0.71	0.66	0.65	0.63	0.64	0.59	0.47	0.56	0.56
Islamic Banks	0.78	0.67	0.74	0.75	0.74	0.72	0.70	0.56	0.67	0.58
State Owned Banks	0.81	0.75	0.75	0.64	0.65	0.65	0.70	0.58	0.64	0.61
Foreign Exchange Private Banks	0.72	0.70	0.66	0.67	0.66	0.66	0.60	0.45	0.56	0.59
Non Foreign Exchange Private Banks	0.79	0.80	0.74	0.73	0.72	0.75	0.67	0.58	0.67	0.70
Regional Government Owned Banks	0.60	0.56	0.59	0.57	0.52	0.52	0.55	0.40	0.51	0.47
Joint Venture Banks	0.86	0.83	0.75	0.77	0.75	0.77	0.79	0.68	0.77	0.76
Foreign Banks	0.75	0.79	0.76	0.79	0.71	0.86	0.77	0.66	0.74	0.65
Total sample average	0.74	0.73	0.69	0.69	0.66	0.69	0.65	0.53	0.63	0.63

Figure 1.

Summary of SORM SBM Efficiency Scores for Indonesian Banks: Q I 2003 – Q IV 2007

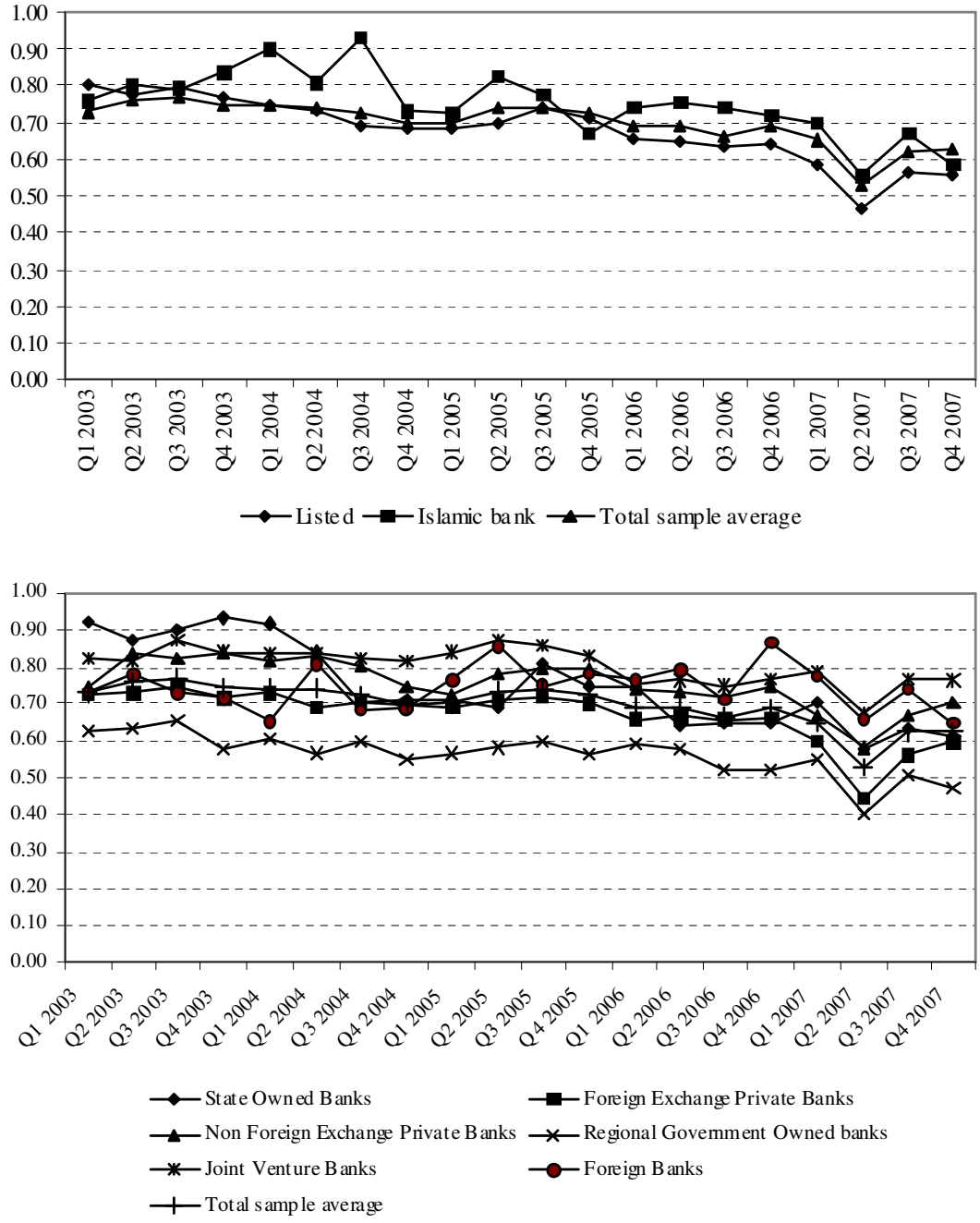


Figure 2.

Dynamics of Indonesian Bank Productivity (Malmquist Representation): Q I 2003 – Q IV 2007

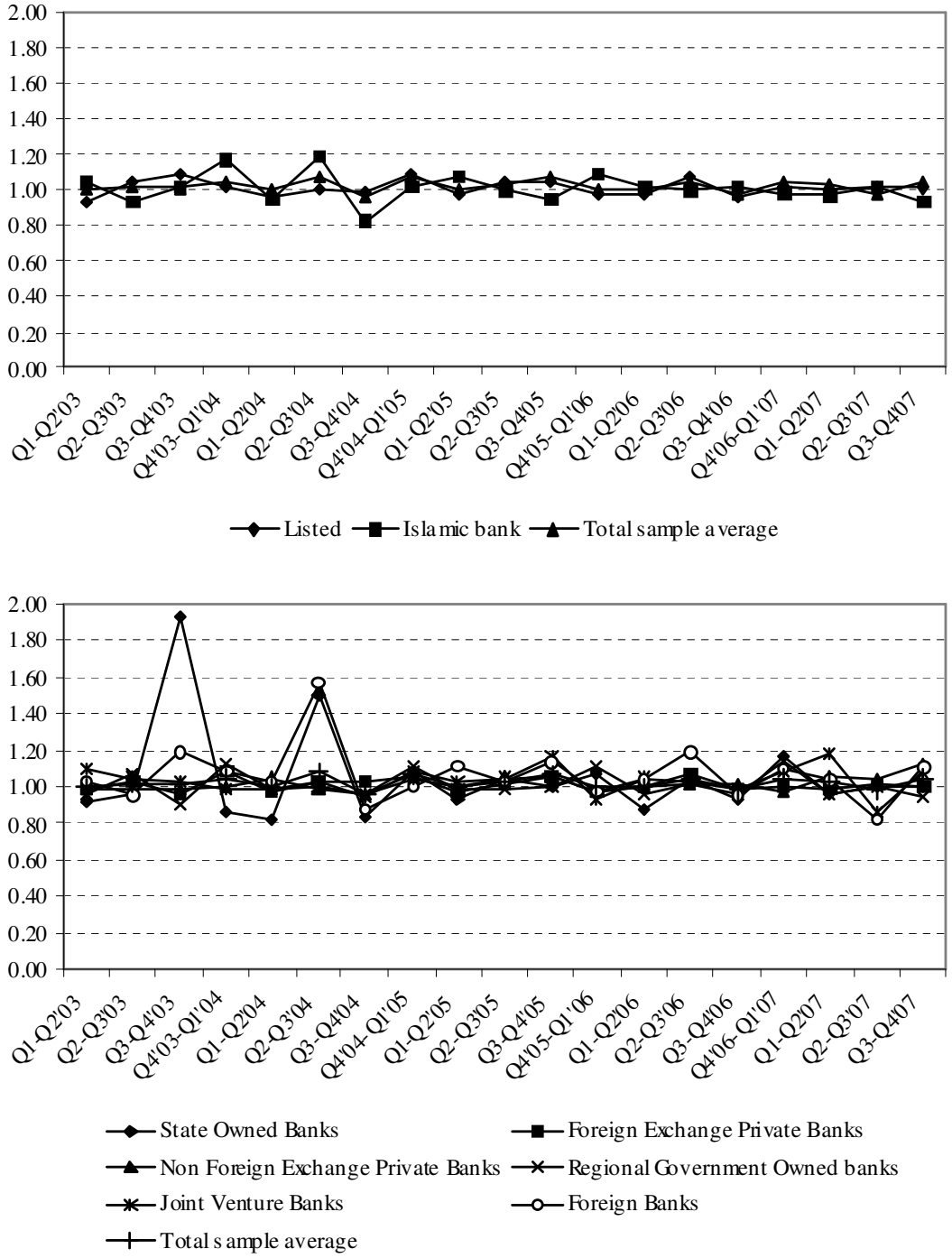


Figure 3

Decomposition of the Malmquist Productivity Index by Type of Bank and Bank Groupings: Q1 2003 – Q4 2007.

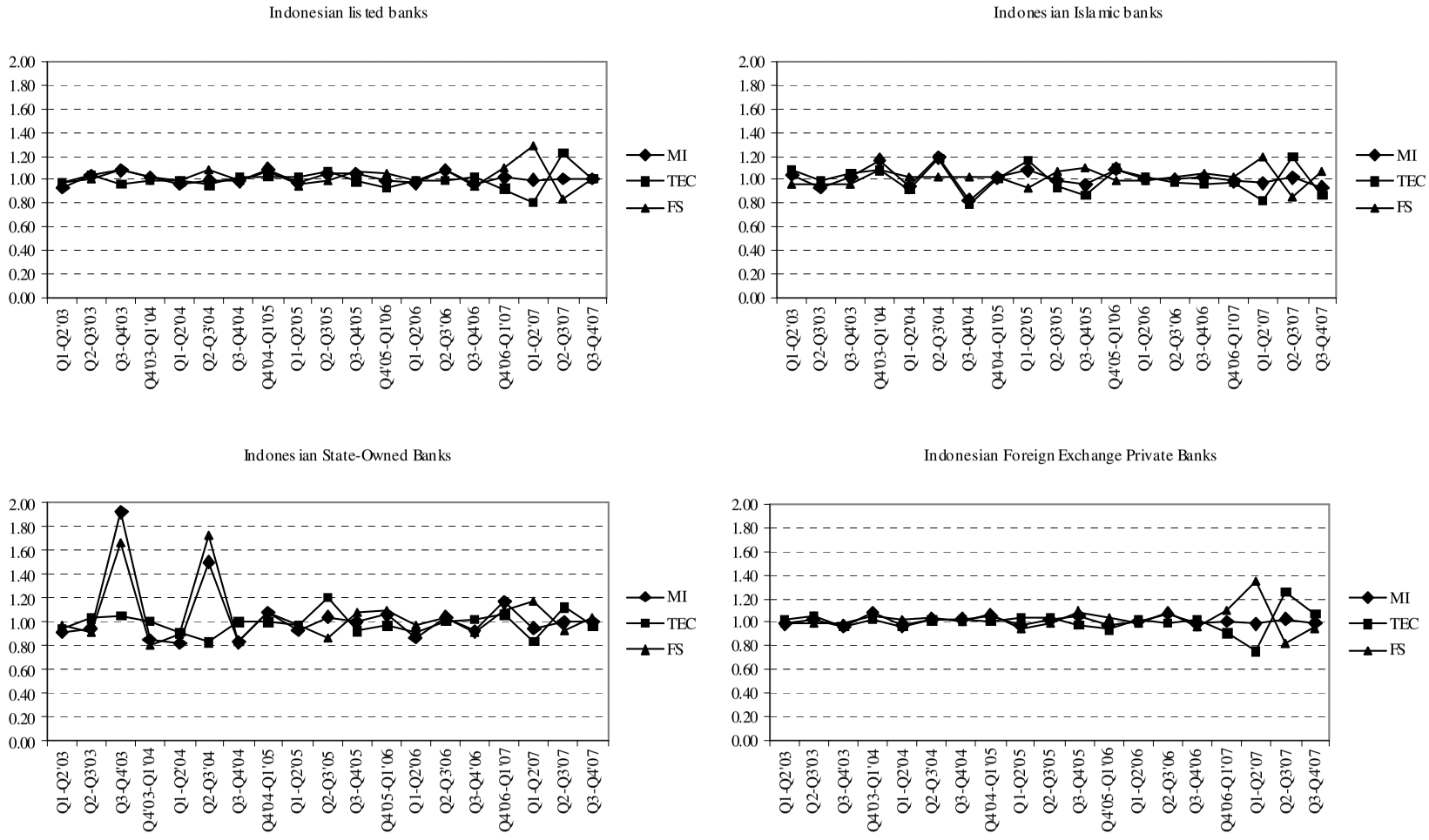


Figure 3 (continued)

Decomposition of the Malmquist Productivity Index by Type of Bank and Bank Groupings: Q1 2003 – Q4 2007.

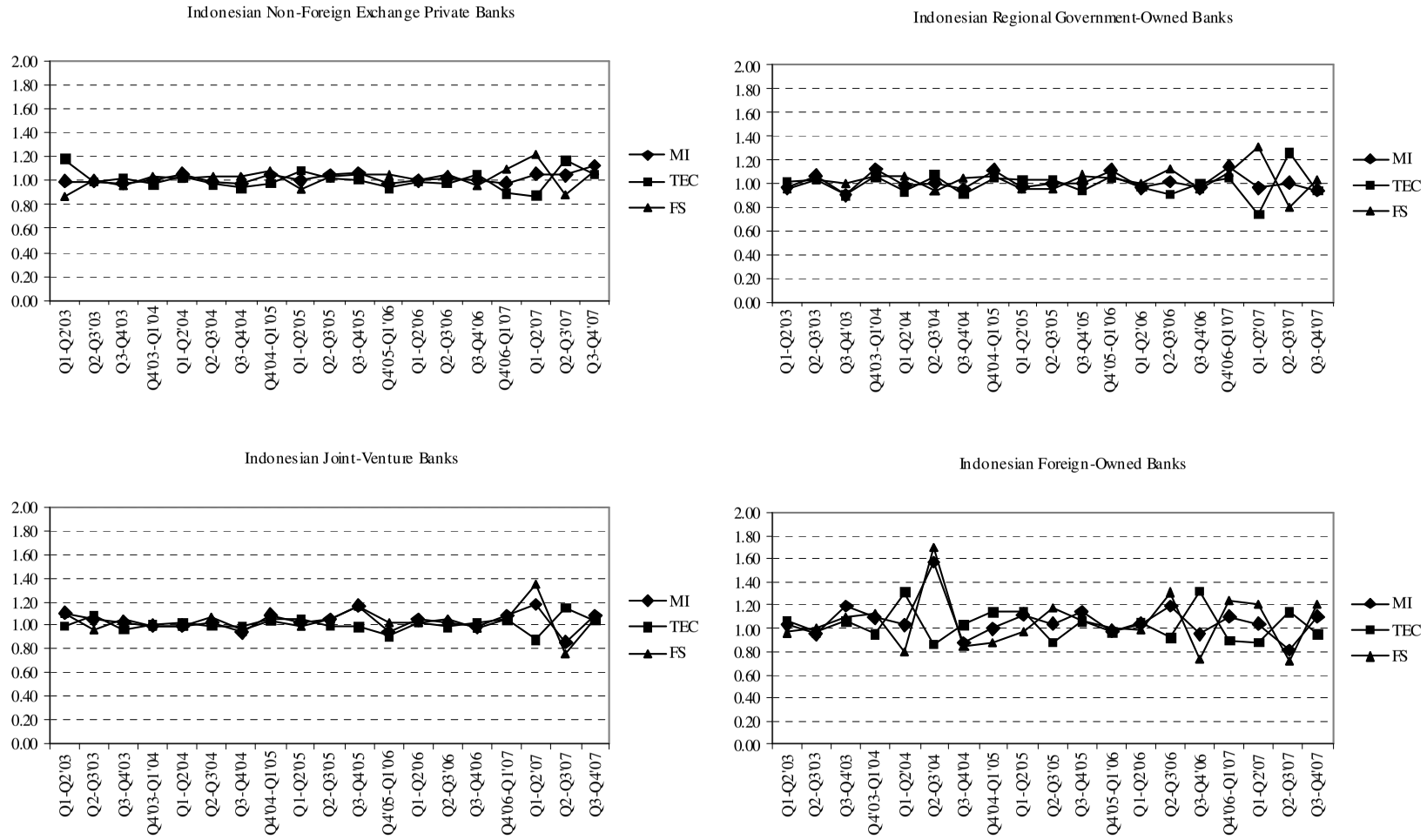
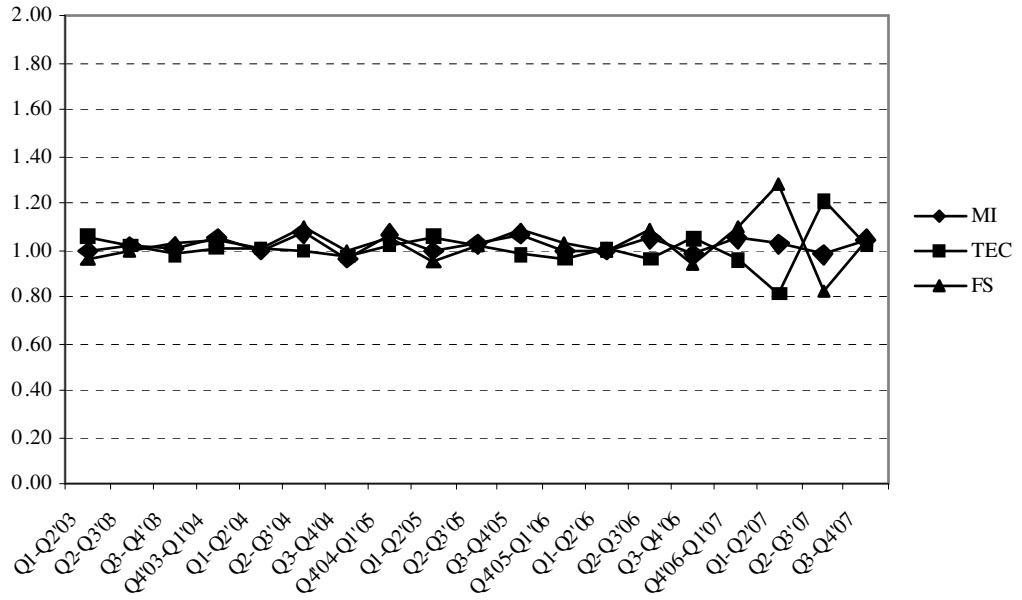


Figure 3 (continued)

SBM Malmquist Productivity of Indonesian Banks



Appendix 1.

Brief Overview of Recent Empirical Literature on East Asian Banking Productivity

Authors	Country	Time Period	Methodology	Main findings
Fukuyama and Weber (2002)	Japan	1992-1996	DEA, Malmquist indirect productivity index	• output of Japanese banks could be increased the most by reallocating inputs; • input technical efficiency and output allocative efficiency increased from 1992 to 1996; • Japanese banks experienced significant declines in total factor productivity growth throughout the period.
Williams and Nguyen (2005)	Malaysia, Indonesia, Korea, Thailand and Philippines	1990-2003	SFA, Fourier flexible form	• state-owned banks underperformed; • privatisation enhanced banks' performances; • foreign acquisition did not lead to performance improvement at the same level as privatisation.
Park and Weber (2006)	Korea	1992-2002	DEA, Luenberger productivity	• increased inefficiency before the Asian crisis and decline of inefficiency after; • banking productivity improvement mainly due to technical progress (i.e., technological change).
Kumbhakar and Wang (2007)	China	1993 - 2002	SFA, Input distance function	• evidence of modest economies of scale; • joint-equity banks are more efficient than the state-owned specialised banks; • larger banks tend to be less efficient; • deregulation did not improve the performance of banks.
Margono et al. (2009)	Indonesia	1993-2000	SFA, Fourier flexible form	• during pre-crisis period cost efficiency increased from 65% to 91% while post-crisis it decreased to 53%; • joint venture/ foreign banks exhibit greatest cost efficiency; • privately-owned banks are more efficient and productive; • cost efficiency of mid-sized banks is greater than of large and small banks; • evidence of negative productivity growth; • technological progress during pre-crisis period and technological regress post-crisis

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