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On productivity performance gains of Indonesian firms

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On productivity performance gains of Indonesian firms

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Abstract

Purpose – The purpose of this paper is to develop a methodology to study profit vs non-profit seeking firms usefully to compare corporate performance. It aims to apply the methodology to measure if state vs non-state firms with different objectives are comparable in performance. If relevant, the paper also aims to comment on the applicability of this method to analysis of other firms, e.g. Islamic banks in Indonesia.

Design/methodology/approach – The paper applies Malmquist data envelopment analysis method to different classes of firms: state vs non-state firms; aggregated at the industry and at national levels; and develop appropriate time trend analysis as well.

Findings – The common belief that all state firms are inefficient is not upheld by test results: in some sectors (agriculture and chemicals) state firms are more efficient than private firms. Efficiency is very low, but did improve over time across all sectors and types of firms particularly before the 1997-1998 and in recent years. Efficiency is mostly achieved through technology adoption (technological change) accounts for most efficiency gains.

Research limitations/implications – This study overturns findings of many accounting performance based studies and revisits policy implications.

Practical implications – No one policy fits all in Indonesia for privatization programme.

Originality/value – The paper provides more valid methodology to compare state firms with non-state firms for the first time.

Keywords Productivity rate, Process efficiency, Small enterprises, Business performance, Privatization, Indonesia

Paper type Research paper

1. Introduction

This study compares the productivity performance gains of public-sector and private-sector firms in Indonesia over a recent ten-year period that includes four years of economic reforms by international Monetary Fund (IMF). The motivations for this investigation are: to determine if private sector firms were more or less or equally efficient during the observation periods, by measuring gains in performance; and identify performance differences, if any, in the two sectors. The novel idea here is to use total factor productivity (TFP) measure instead of the entrenched but increasingly-questionable financial performance measures so far used in performance studies. In particular, non-conventional firms such as state firms (or even Islamic banks vs

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conventional banks, where such variables as profits and interest costs/revenues) do not lend themselves for comparison across different forms of organisations, our proposed method of analysis is very well suited, and yields accurate results, besides identifying the slack in efficiency against the capacity potential.

Indonesian state-owned enterprises (SOEs) experienced low-efficiency performance than its private sector firms (a widely held claim) which caused no serious problem prior to 1984 since state firms received subsidies from the revenue-rich government. Similarly, recent findings using financial ratios show also superior performance of private sector firms. However, as oil prices began to decline in the early 1980s, the government subsidies got reduced from 0.51 per cent of the state budget in 1983 to only 0.13 per cent of gross domestic product (GDP) in 1993 (Hill, 1996; Anwar, 1994). The decline continued during and after the 1997-1998 Asian financial crisis that riddled Indonesian businesses since then.

Thus, the government's largesse as capital participators in state firms has dwindled to a mere 0.005 per cent in 1999 (BPS, 2001). This situation namely declining support for SOEs in state budget led to a substantive but creeping reform of the SOEs. However, in 2000/2001, more weakened firms were taken into the state sector through the Indonesian Bank Restructuring Agency (IBRA) working with the IMF, taking over the liabilities of potential failing firms, which amounted to US $25,777 million in 1997 (The IBRA Annual Report, 2000). This resulted in a sudden reversion of private firms to the state ownership. This also included banks. However, that policy action led to increases in government liabilities and thus SOEs have become a larger burden on government budget since then. These later-day developments signify the need for a study of efficiency of SOEs. Hence, our search for more accurate method of comparing two unlike entities with different objectives, thus not comparable if only financial ratios relying on profitability are used.

Finding the comparative efficiency of corporations is perhaps a necessary research topic to formulate viable policies as to the future of government's capital participation as well as public policy on the sale of state-owned firms and banks that is draining the state resources. Islamic banks which number about 32 in Indonesia as at 2006, are set to increase in number as this form of non-conventional banking-cum-finance operation is expected to not only spur local savings, but also is thought to be more suited to financing entrepreneurial activities at community levels by profit-sharing intermediation instead of fixed interest-based lending contracts. Here, again the Islamic entities are not comparable with conventional banks as the base of operations are different, and need to be studied with newer methods not relying on profitability.

This study employed data envelopment analysis (DEA) and Malmquist indices to consider the efficiency of samples of firms, and also examined productivity change after the financial crisis. The results show that both public and private sector firms experienced productivity declines during the study period. The declines were primarily due to technological regression, which arose from the inability of firms to adopt newer and better technology, we assume, given the scarcity and high cost of capital in the economy particularly after the financial crisis. The state sector firms were suffering more on these grounds than their private counterparts, perhaps because of the entrenched monopoly positions of some private firms. However, there was a catching-up effect in both sectors over time during the 11-year study period.

The rest of the paper is organised as follows: section 2 provides a brief literature review of previous studies that have considered research on productivity growth, and the efficiency of Indonesian firms. It also includes a brief description of Islamic banking

in this country with the hope that these banks can be studied using this methodology. Section 3 will discuss the data and methodology employed, which is follows by the discussion of the results in section 4. The final section concludes the paper.

2. Production efficiency literature

2.1 Firm's efficiency using DEA Malmquist index

Today's increasingly-popular measure of microeconomic efficiency measurement at firm level began from early works of Farrell (1957), which, with the later day works of other scholars has been refined as productivity-based measure of performance. This adds a newer battery of performance measurement especially, when the very well-established financial measures are increasingly cast aside as being biased measure, especially to measure state firms with monopoly character or state firms that are operating without the objective of profits as the motive[1]. Farrell defined a simple measure of firm's production efficiency that could deal with multiple inputs, not at a time, but over a period of time. One such approach in measuring firm's production efficiency is the DEA. This approach was first applied by Charnes *et al.* (1978) for measuring efficiency of not-for-profit organisations in US programmes, using constant returns to scale (CRS) model. Banker and Duncan (1984) proposed the variable returns to scale (VRS) model. Consequently, after Charnes *et al.*'s (1978) work, DEA was widely used by many scholars to measure efficiency and productivity. DEA, for instance, is commonly applied to measuring bank efficiency (Rebelo *et al.*, 2000; Tser-Yirth and Tsai-Lien, 2000; Drake and Howcroft, 2002; Isik and Hassan, 2003). This method was also used in investigating/calculating the efficiency scores in various industries such as transportation, hospitals/health and manufacturing, as well as in education and service sectors (Odeck, 1999; Chirikos and Sear, 2000; Mahadevan, 2002, 2002a; Illueca and Lafuente, 2003; Boussofiane *et al.*, 1991; Abott and Doucouliagos, 2002; Galagedera and Silvapulle, 2002).

There is also empirical literature on productivity and efficiency gains, using other approaches such as stochastic frontier, fisher index, Tornqvist, random coefficient frontier production function and the growth accounting approach (Bartolloti *et al.*, 2002; Eckel *et al.*, 1997; Megginson *et al.*, 1994; Boubakri and Cosset, 1998). Despite a number of literatures on productivity performance (also Fare *et al.*, 1995; Arcelus and Arozena, 1999; Kim *et al.*, 1999, Fare *et al.*, 2001) however, as of now, there is a dearth of literature using this approach in comparing Indonesia's public and private sector firm's productivity using the DEA – Malmquist approach. This is the apparent gap in the existing literature that this present research will attempt to address.

A commonly used tool to assess the firms' financial performance is also the financial ratio analysis. Ratios provide tools for managing information in order to analyse a firm's financial condition and performance. These ratios could provide a profile of a firm's economic characteristics, competitive strategies, operating, financial and investment decisions relating to other firm or industry. Necessarily, there must be a relationship between the production efficiency and the financial performance of the firm. This aspect of a possible connection between the two approaches to performance has still not been sufficiently studied. However, this study employs the productivity performance gains since the financial measures have produced inconsistent results, and importantly, such analyses are increasingly being questioned as being unsuitable for judging the performance of not-for-profit nature of state firms.

Efficiency is a summary of the functional relationship between the maximum quantities of output produced from a given combination of inputs. Total product (TP) is

a term usually used for the total output. Marginal product (MP) is the increase in TP due to a one-unit increase in labour or $\Delta TP/\Delta L$. The average product (AP) is an output per unit of labour or TP/L.

Firms may operate at any one of three stages of production as a firm's management learns to combine inputs to produce outputs more efficiently over time. Hence, the issue in efficiency is the distance a firm is travelling in the production efficiency over time. This determines three different behaviours of MP and AP:

(1) If MP > 0, AP is said to be rising and therefore, MP > AP;

(2) If MP > 0 but AP is falling and thus MP < AP although TP is increasing;

(3) If MP < 0 then TP is falling.

In two of these stages, a profit-maximising producer would not choose to produce any outputs as there is no profits to be made. In one of these three stages, a producer can increase the average efficiency of all units by adding one more unit of input, such as labour, to obtain a MP of labour higher than the cost of employing that labour. This is the stage (2), which is economically meaningful range. Stage (3) is a stage with no profit, because a producer can increase total output while saving the cost of a unit of labour by reducing the labour input. Thus, stage (2) is the economically meaningful range of increasing returns to scale. For a non-for-profitable state firm, such a condition also means that the firm produces zero profits when all its costs are recovered when the before-tax-income (not net profit after tax) is zero. Besides, state firms do not pay taxes, and pay dividends to the state for the capital if they make profits. Hence, before-tax-income of either firm is maximised if the value of the MP equals the price of firm's inputs, hence, we use this variable in preference to the more common net income or returns on capital ratios.

A commonly used production function, as a measure of efficiency is the Cobb-Douglas equation (or production function) dating back to 1928. In its simplest form, it relates to an output Q with two inputs, labour L and capital K. It can be written as

$$Q = AL^{\alpha}K^{\beta} \tag{1}$$

Our review of the production theory includes Cobb-Douglas production function as a basic theory for measuring a given firm's production efficiency. A is a constant that depends on the units of measurement of output Q, labour is indicated by L and capital by K. The coefficient α and β are the elasticities of outputs with respect to labour and capital inputs, respectively. Furthermore, α and β can measure returns to scale. If $\alpha + \beta = 1$, then output is not increased nor decreased, hence such efficiency indicates CRS. If $\alpha + \beta < 1$, output is less than input values, an indication of decreasing returns to scale. If $\alpha + \beta > 1$, then output is higher than inputs resulting in increasing returns to scale (Ibid, 1989, p. 79) which is a condition needed for production efficiency to occur. Firms operating in stage (2) of efficiency in the model of efficiency frontier are able to achieve increasing returns to scale, and such a measure enables a researcher to identify production efficiency. One could achieve a measure of production efficiency of an individual firm applying the DEA-Malmquist productivity index and the Stochastic Frontier approach.

Data envelopment analysis, the measure used in this study, is a non-parametric "... linear programming method used for evaluating the efficiency of decision-making units or firms, where the presence of incommensurate inputs and outputs makes the

measurement of overall efficiency difficult" (Boussofiane *et al.* in Martin and Parker, 1997, p. 127). It uses value data of individual firms observed at end of each year as inputs and output quantities of a group of firms to construct a piece-wise frontier over the data points. This frontier is constructed by the solution of a sequence of linear programming problems, one for each firm in the sample. Efficiency measures are then calculated relative to this frontier, which represents an efficient technology. Hence, this method is an ideal measure for broad measurement of efficiency. Moreover, it "... allows efficiency to be measured without having to specify either the form of production function or the weights for inputs and outputs used"[2]. Charnes *et al.* (1978) first used the DEA CRS model[3] to measure the efficiency of not-for-profit entities in the US public programmes. However, where CRS do not prevail, it can be argued that these units should be compared given their scale of operations. At least, it would be useful to know the extent to which any inefficiency of a unit can be decomposed into its pure, technical and its scale efficiency (Charnes *et al.*, 1978, p. 11). These methods are now widely used for measuring performance of firms.

Fare and Roberts (1994) identify the Malmquist productivity index change as

$$m_0(y_{t+1}, x_{t+1}, y_t, x_t) = \left[\frac{d_0^t(x_{t+1}, y_{t+1})}{d_0^t(x_t, y_t)} x \frac{d_0^{t+1}(x_{t+1}, y_{t+1})}{d_0^{t+1}(x_t, y_t)} \right]^{1/2} \quad (2)$$

The Malmquist performance index (m_0) measures the change over time of input-output (x_{t+1}, y_{t+1}) in the next period $t+1$ relative to input–output at a starting point (x_t, y_t). It is a ratio of the distance of each point to serve as a benchmark to compare a certain bundle of input (x) and output (y). A value of m_0 greater than one indicates an improvement in efficiency growth from period t to period $t+1$, while a value less than one indicates a TFP decline (Coelli *et al.*, 1998). The Malmquist productivity index is an index of the geometric mean of two outputs-based TFP indices, where one index uses period t technology and the other uses the period $t+1$ technology (Coelli *et al.*, 1998).

DEA does not require any assumptions regarding the production technology or a firm's behaviour such as cost minimisation or profit maximisation. Therefore, DEA can deal either with input-orientated or output-orientated efficiency measure for an entity (Coelli *et al.*, 1998, pp. 134-40). In the input-orientated case, DEA frontier seeks the maximum possible proportional reduction in inputs used while maintaining the number of outputs produced from each firm. In the output-orientated case, this method seeks the maximum proportional increase in output produced, with a certain levels of inputs used.

Productivity measurement consists of measuring the change in ratio of outputs used in a production process over time. Since many inputs are used, and shared output may be produced, a number of procedures have been developed to combine inputs and outputs and then measure changes. DEA method allows us to decompose productivity growth into two components: the technical efficiency change and technological change (Malmquist, 1953), the latter being the effect of adoption of newer ways of doing things from changes in technology over time. Caves *et al.* (1982) introduced the Malmquist index for the first time in productivity analysis. This method defined the index as a ratio of two distance functions, which are representing of multiple inputs and multiple outputs technology without need to specify a firm's behavioural objective such as profit maximisation or cost minimisation.

Fare and Roberts (1994) defined an output distance function can be defined at a time t as follows:

$$D_0^t(x^t,\ y^t) = \min\{\theta : (x^t, y^t/\theta) \in S^t\} \quad (3a)$$

$$= \max\{\theta : (x^t, \theta y^t) \in S^t\}^{-1} \quad (3b)$$

This shows how much outputs (y) can be increased, given a quantity of inputs (x) used, such that x and θy remain the production set over time 0 and 1. An input distance function can similarly be defined under CRS: the value would be equal to the earlier distance function. In particular, the distance function is $D_0^t(x^t,\ y^t) \leq 1$ if and only if the output vector, y, is an element of the feasible set, $S(x)$ (Figure 1).

In addition, the distance functions $D_0^t(x^t, y^t) = 1$ if and only if y is located on the frontier technology of the feasible production set. This is likely to occur when production is technically efficient (Farrell, 1957), i.e. the production efficiency arises from employing technology that enables efficiency change over −1 to 1 period.

The observed production at t is interior to the frontier technology at t: that is the production at $(x^t,\ y^t)$ is not technically efficient. The distance function tries to find the reciprocal of the greatest proportional increase in outputs given the inputs. The maximum feasible production, given x^t, is at (y^t/θ^*). Moreover, the value of the distance functions for the observation in terms of distance s on the y-axis (o_a/o_b), which is less than one.

2.2 The efficiency of Indonesian firms

The important aspect in evaluating firm's performance is its performance gains over time. In the case of Indonesian firms, since public and private sector firms cover different purposes, therefore, they are different in various management styles and regulations, which often lead to different goals and thus performance differences. Given the current thinking widely disseminated in the literature about how to assess

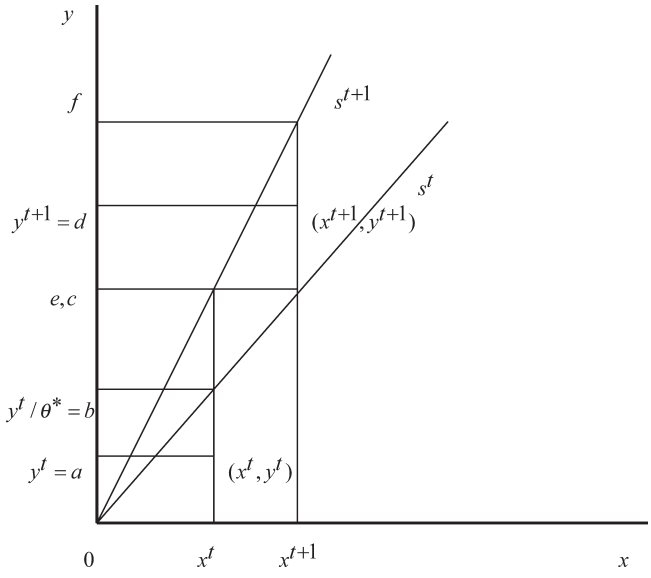

Figure 1.
The Malmquist output-based index of TFP and output distance functions[4]

the performance of economic entities, performance of the state enterprises has been measured according to the same criteria as that of a private sector firm. There appears to be two separate lines of assessment in practice, which is patently wrong-footed as measures such as profits (example return on equity) are biased against finding efficiency of state firms since the state firms are organised without the objective of profits, although it can be said that both state and private firms must recover all costs. That is, the before-tax profits must be equal to zero for state firms to be financially efficient as such firms are required to earn a rate of return on investment. The accounting-financial performance applied by accountants and financial professionals is based on the very old returns on capital and cost of sales measures (or some variants of these measures. We assume this approach to be a wrong research process. The other measures increasingly gaining attention is based on the production efficiency literature based on some variant of Cobb-Douglas production function, and addresses the performance issue without considering profits.

In practice, improving performance of the public firms is a critical component of any systematic reform package in this economy to improve the operating efficiency of both state and public sector firms. Without a careful evaluation of the status of the efficiency and performance issues, one cannot provide incentives or delegate autonomy (Jones, 1991, p. iii) to the firms especially in this crisis-ridden economy burdened with firms that have returned to state ownership in 1998-2003. Furthermore, profit maximisation is widely regarded as the appropriate goal for private firms, especially from the standpoint of the owners of firms, in the current situation that may include the state as well. In the case of SOEs, profitability is not emphasised as an important goal though, while providing services at reasonable rates appear to be the goal of SOEs. Public sector firms provide jobs, produce public goods at a subsidized price and sell them at a lower price than the cost of production (Ramamurti, 1987).

In many other developing countries, public sector firms are typically found to be less efficient than their counterparts in the private sector firms, although this conclusion is not yet firmly established in the literature to be a doctrine. For example, in China, SOEs are generally found to be operating inefficiently compared to the public sector enterprises (PSEs) (Huang *et al.*, 1997; Lin *et al.*, 1998; Wu, 1998): similar results are found in countries apart as France, India or Mexico. Therefore, we need a fairer performance measure, which can be used to accommodate multi objectives without reference to profits: i.e. production efficiency performance measure is ideal.

The Indonesian state firms have been subjected to considerable policy changes since the reduction of government subsidies, which bought with them expectations of improved efficiency. However, the literature to-date on this has been relatively sparse. Most study of Indonesian firms' productivity performance has been applied to the agricultural sector (for example, Daryanto *et al.*, 2002; Suhariyanto and Thirtle, 2001). Fuglie (2004) investigated the TFP growth of agricultural sector over 1961-2000. Other studies on were done by Pitt and Lee (1981) and Hill and Kalirajan (1993) applying the stochastic frontier production function to the weaving and garment industries using data back to 1972-1986 period.

Another important sector that has yet been studied rigorously is Islamic financial institutions/firms. With the Financial Regulatory Authority of UK, finally accepting Islamic banking as adding to variety of banking in general, and then approving the licensing of this new form of banking in 2002 in that country, the World seems to be more ready to accept this new non-conventional banking form. As at 2006, there are 272 Islamic banks worldwide with a total capitalisation of about US$250 billion and total assets of

about US$3,000 billion. Compared to the total assets of just only one of top ten conventional banks in the World (of about US$13,000 billion), this new form of Islamic banking has less than 1 per cent share of World. So, these new firms are still a long way to maturity with, of course, potential for explosive growth because of its newness[5]. Other forms of Islamic finance such as *sukuk* bonds add up to US$40 billion (conventional bond market value is huge) and Islamic mutual funds to US$200 billion (conventional market is also huge). There is no information available on the premium cover provided by about a dozen *Takaful* or mutual insurance companies, which is miniscule by the size of the insurance cover of all conventional insurance industry. Indonesia has three Islamic banks licensed as such, but about 30 conventional banks have already started offering financial products that satisfy the regulations imposed under Shari'ah principles. As of 2006, there are about 33 Islamic banks. Islamic insurance, *sukuk* bonds and Islamic mutual funds markets are already being made in this country.

These new organisational forms also need to be examined as to their performance efficiency. Conventional tests based on capital adequacy, non-performing loans or even interest expense/income cannot be used to make a valid conclusion about their performance especially in relation to the significant larger sized conventional banks, etc. It is in this context that the methodology we apply to the study of state vs private firms reported in this paper is suited to address the performance question of very unlike entities by examining the core efficiency of production process. We could compare Islamic bank's technical efficiency, or their efficiency change: the latter is the managerial extraction of efficiency in managing a business. Overall, efficiency could also be studied using the TFP scores of each bank, as is already being done in several reported studies in several countries of conventional banks. The important point is that this paper develops the theoretical literature that enables one to overcome the difficulty of using financial ratios for evaluating performance of firms, when the firms take different forms, such as state vs private firms or conventional banks vs Islamic banks.

3. Method, data and sample

This study measures firm's efficiency performance as its productivity, which is based on its activity of converting inputs into outputs. Performance is to be measured as productivity ratios, which is the ratio of outputs to inputs. The larger ratio is associated with a better performance, showing increasing returns to scale. However, the term performance here is a relative concept, which means that it could be measured relative to the previous year or relative to the performance of other firms. Employing DEA Malmquist indices follows Fare and Roberts (1994). It is a non-parametric linear programming method, which does not require input or output prices in order to identify a best practice production frontier. It measures the TFP change, between two data points over time, by calculating the ratio of distances of each data points relative to a common technology. By averaging the performance over several years in the test period, we judge the actual efficiency score over a time period.

It considers a matched sample of public and private sector firms operating in Indonesia between 1991 and end 2001. The primary data source for this study is the firm's annual reports, which were individually obtained from *the Jakarta Stock Exchange Company Handbooks* 2001, published by the Institute of Economic and Financial Research (ECFIN) for the private firms, and the office of the Indonesian Ministry of SOEs for public firms' data.

In order to calculate the firm' efficiency analysis, inputs and outputs must be specified. The specific data items used in this study are: total assets, sales and earning

before interest and tax (EBIT) as outputs[6], data on production factors such as material used, labour cost and capital cost. These data are expressed in nominal monetary value in a country with a high inflation. Thus, data are adjusted for inflation (Ma *et al.*, 2001, pp. 298-312), using the consumer price index with base year as 1993 prices, to obtain the real values. The theory of firm suggests that firms' aim to create value, which is total assets; maximise sales; and create an annual value, which is net income. Since SOEs often do not have profitability objective, a practical variable is to consider operating income (EBIT) as another output. EBIT is used to replace net income or earning before tax, considering SOEs are not always required to make profit from their operations and these firms are also supported with state funds so these do not incur huge interest costs.

Table I shows the descriptive statistics for the sample used. All values except employee numbers are in million of Indonesian rupiah. The average values in the table are in line with reported statistics. Notably, the mean and median are not equal, indicating that the variables may not be normal, a problem if ordinary least squares (OLS) regression is applied.

4. Results

This section reports our results on production efficiency performance of SOEs and PSEs. The output-orientated constant return to scale formulation is used to compute the Malmquist index for 141 firms comprising two samples, respectively. Coelli (1996, p. 43) notes that the CRS/VRS options have no influence on the Malmquist DEA because both are used to calculate the various production frontier distances using the Malmquist indexes. Summary of statistics on annual efficiency change, technical change and TFP of all firms as well as for each sector is reported in Table II.

When a value greater than one is obtained in any of the three indices, this implies a performance improvement. A value lower than one indicates decline in performance.

Panel A results: the results show the annual average of technical efficiency changes, technical changes and TFP changes of all firms. The results described here are based on the full set of 141 matched firms with the following inputs and outputs. The inputs measure used are material cost (input 1), labour cost (2) and depreciation expenses (3) The last item is a proxy for capital input, while the outputs are total assets (output 1), net sales (2) and EBIT (the no. 3 output).

It can be seen that on average, the Malmquist TFP for the all firms (both public and private) is 1.7 per cent, i.e. over the test period, there has been only a 1.7 per cent gain in productivity. Further statistics indicate that the TFP growth was driven by 1.1 per cent through technological change and a mere 0.5 per cent via efficiency change

Table I.
Summary statistics of the entire sample

Variables	All samples					
	Mean	Median	SD	Minimum	Maximum	Range
Total assets (billions of rupiah)	1,175.42	281.55	3,366.41	0.045	51,864.92	51,864.89
Sales (billions of rupiah)	588.26	174.16	1,485.97	0.007	19,839.63	19,839.62
EBIT (billions of rupiah)	176.28	45.76	456.52	−96.39	6,777.97	6,874.37
Material inputs (billions of rupiah)	251.58	48.63	1,897.65	0.009	54,906	54,906
Labour inputs (billions of rupiah)	79.62	13.11	783.38	0.007	30,206	30,206
Capital inputs (billion of rupiah)	73.024	5.01	1,091	0.003	43,928	43,928
Employees	3,799.53	1333	7,081.85	160	52,000	51,840
Leverage1 (%)	0.66	0.58	0.72	0.01	13.08	13.07
Leverage2 (%)	6.47	1.36	67.95	−20.28	2,169.12	2,169.12

Year	Efficiency change	Technological change	TFP change
Panel A: all firms			
1992(base)			
1993	1.272	0.765	0.973
1994	1.222	0.757	0.925
1995	0.993	1.058	1.050
1996	1.453	0.816	1.186
1997	0.590	1.879	1.108
1998	0.967	0.926	0.895
1999	1.102	0.649	0.716
2000	1.474	0.666	0.981
2001	0.505	2.942	1.486
Mean[a]	1.005	1.011	1.017
Panel B: SOEs			
1992(base)			
1993	0.896	1.238	1.109
1994	1.028	1.155	1.188
1995	0.709	1.345	0.954
1996	1.159	0.779	0.903
1997	0.837	0.971	0.813
1998	1.134	0.512	0.580
1999	0.947	3.022	2.861
2000	1.254	0.604	0.757
2001	1.734	0.246	0.426
Mean[a]	1.045	0.885	0.924
Panel C: PSEs			
1992(base)			
1993	1.054	1.115	1.176
1994	1.303	0.667	0.870
1995	1.017	0.946	0.963
1996	1.222	1.017	1.242
1997	1.312	0.665	0.873
1998	0.508	2.522	1.281
1999	1.222	0.681	0.832
2000	1.033	0.549	0.567
2001	0.966	1.071	1.035
Mean[a]	1.037	0.922	0.956

Note: [a]Geometric mean

Table II.
Annual mean technical efficiency change, technological change and TFP change of SOEs and PSEs over 1992-2001

(management efficiency). It means that technological innovation is the main contributor to the productivity growth in Indonesian firms rather than the "catching-up" through efficiency change.

In this regard, these firms behave broadly the same manner as reported in other studies covering other countries. It is normal to find the productivity driven by technological change and less by efficiency change. Policy changes introduced in this test case is expected, if all goes well, to make efficiency change to be the main driver of the efficiency. Figure 2 illustrates the Malmquist indices and its decomposition of Indonesian firms over 1992-2001: this further clarifies the results in Panel A.

It shows that the technological change component, i.e. a shift of the frontier technology, displays a trend that is similar to the Malmquist TFP index, indicating that a change in TFP largely consisted of technological change in these firms. Compared to

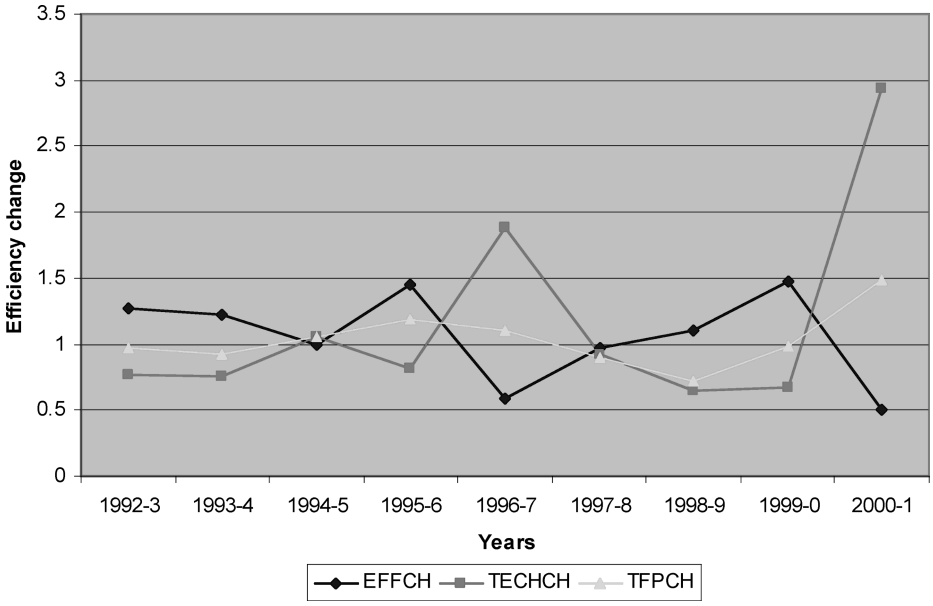

Figure 2.
Efficiency change, technological change and TFP change of Indonesian firms, 1992-2001

the technological change, the change in efficiency was rather small, and was not a major source of productivity growth during the study period. Despite those facts, the TFP change has surged dramatically because of the rescue of the economy with the IMF restructuring program, which injected not just capital but also competition to improve efficiency of the firms.

Panel B results: unlike the overall firms' performance, the average productivity growth of SOEs is less than 1 (0.924) over the observation period. The TFP decline is primarily due to the decline in efficiency change (1.15 per cent). On the other hand, these firms had averages efficiency growth of 4.5 per cent, a good news. It means that on average, there is TFP decline in public sector firms of 7.6 per cent during the ten-year period. However, the internal non-technological efficiency grew by 4.5 per cent during the period, which is marginally higher that that of PSEs (Panel C). Results in Panel C also suggest the same conclusion. Instead of having TFP improvement, private sector firms have also experienced TFP decline of 4.4 per cent, which is mainly due to the decline in efficiency change (1.8 per cent). This result is also consistent with SOEs' efficiency performance, in the case of catching-up (efficiency change).

Figure 3 shows the Malmquist Index decomposition of SOEs and PSEs over 1992-2001.

The result thus indicates that both public and private sector firms experienced TFP declines during the observation period. However, private sector firms have marginally lower TFP regression than the public sector firms. An interesting result is also found in this study, in the way each sector overcomes the effect of the financial crisis as suggested by the TFP declines (see the graphs and the numbers). For example, after the financial crisis in years 1997-1998, the state sector firms have efficiency gain of 1.13 per cent, whereas private firms had a higher (2.52 per cent) gain from the same source. The statistics mean that state firms adjusted to the crisis by increasing efficiency via inputs, while private sector firms applied more new technology in their production processes,

which seems to work better in the case of Indonesian private firms. That is also intuitively the result expected since state firms did not receive as much financial support after the crisis year as did the private sector firms via the IMF restructuring assistance.

Table III reports descriptive statistics for each of Malmquist indices and its components (efficiency change and technological change) of SOEs and PSEs during the period.

It indicates that, there is no strong evidence of differences in overall efficiency between SOEs and PSEs during the study period.

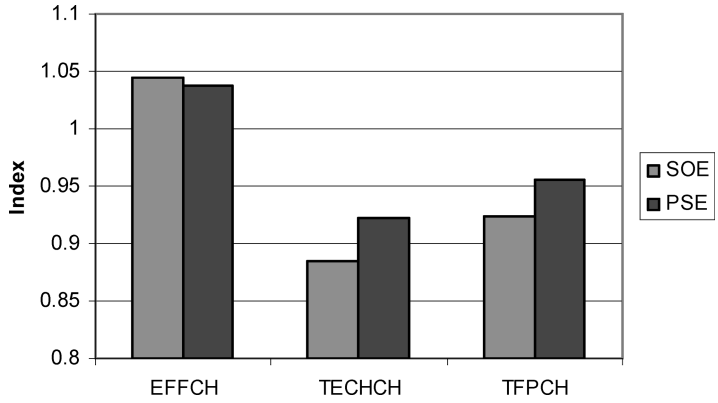

Figure 3.
Decomposition of Malmquist productivity index of Indonesia's SOEs and PSEs

	Efficiency change	Technological change	TFP change
Panel A: SOEs			
Mean	1.078	1.097	1.066
Median	1.028	0.971	0.903
SD	0.299	0.808	0.714
Minimum value	0.710	0.250	0.430
Maximum value	1.730	3.020	2.860
Panel B: PSEs			
Mean	1.071	1.026	0.982
Median	1.054	0.946	0.963
SD	0.248	0.598	0.228
Minimum value	0.510	0.550	0.570
Maximum value	1.310	2.520	1.280

Table III.
Descriptive statistics for DEA efficiency measures

Measures	Mean SOEs	Mean PSEs	Test of significant Mann-Whitney	Remark
1. Efficiency change	1.045	1.037	0.663 (0.508)	Similar values
2. Technical efficiency change	0.885	0.922	0.221 (0.825)	Similar values
3. TFP change	0.924	0.956	0.662 (0.508)	Similar values

Note: ( ) indicates *p*-value, all of which are insignificant

Table IV.
Productivity performance of Indonesia's SOEs and PSEs, 1992-2001

As DEA efficiency measures are not normally distributed, these data are analysed through non-parametric tests. Mann-Whitney rank-sum tests are applied to test the null hypotheses that efficiency statistics are equal between SOEs and PSEs. *Z*-statistic for the null hypotheses of equal efficiencies is reported in Table IV. An examination of Table IV shows that the productivity performance of SOEs is marginally lower than that of PSEs, which is mainly due to the technological regression. However, state sector firms have a higher efficiency growth than their counterparts, although the difference is not statistically significant.

5. Conclusions

This paper provides interesting evidence on relative performance on the TFP trends and their two components of Indonesia's state and private sector firms[7]. The results of the Malmquist productivity measures show that there is productivity improvements in Indonesian firms, which is primarily due to the use of technology, which is the use of new technology made possible by increased use of capital especially by the private sector firms in the test period. Deprived of capital because of budget constraints, the state firms sought and made improvements in efficiency rather than technology. However, if the firms are separated as public and private firms, instead of improvement, there was a productivity decline in both sectors over the whole period, which includes four years of industrial reforms over 1998-2001. The evidence shows that the decline is caused mostly by technological regression, despite smaller efficiency gains in both sectors during the study period. The results are the first to measure performance of corporations using, in our opinion, a bias-free measure of TFP and its components. In some regard, these results are not merely robust, but are also tested appropriately to establish statistical support for the conclusions that the performance of both sectors are broadly similar statistically, although in index value terms private firms are marginally more efficient.

As mentioned in other sections of this paper, these results can be highlighted to show how the method of performance attribution of state vs private firms can be easily applied to the study of conventional banks vs Islamic financial firms. Given the non-comparability of key financial ratios and variables traditionally used for study of Indonesian firms, the ready comparability of technical, efficiency and total factory productivity changes across the firms enables a valid comparison to be made, which we recommend for the study of Indonesian Islamic bank performance as well since the Islamic banks share the same dissimilar characteristics as does the state vs private firms.

Notes

1. Comparing state firms with other than profitability objective with the private firm with profit motive will pre-determine state firms as inefficient when profit ratios are used! Such a comparison is made by almost all studies, and this is essentially fallacious.
2. Data envelopment analysis is a generalised of TFP methods and non-parametric because its flexibility. That is, the nature of the functional form between outputs and inputs is not specified in advance (Boussofiane *et al.* in Martin and Parker, 1997).
3. This model has an assumption that all firms are operating at an optimal scale. Hence, a deficiency can be overcome when we measure TFP from DEA-Malmquist ratios.
4. Sources: Fare and Roberts (1994).
5. "Islamic Banking Grows, With All Sorts of Rules", *Wall Street Journal*, 3 May 2004.

6. Earning before tax and interest is ideally suited as output measure prior to the cost of capital being recovered. Hence, the use of EBIT makes comparisons equitable, if we assume that both state and private firms must at least recover the cost of operating the firm, and that the at the point of the EBIT both sectors are equal.
7. In addition, the productivity and its components of five industrial groups were also found for major industries: these are not shown in this paper. An interesting result is that the state firms in some industries such as chemicals outperformed significantly the private sector firms.

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