

PRODUCTIVITY GROWTH OF MALAYSIAN BANKS: FOREIGN-OWNED ISLAMIC BANKS AND ISLAMIC BANK SUBSIDIARIES

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ABSTRACT

The paper examines the productivity of a sample of Islamic and conventional banks in Malaysia for the period 2000 to 2008, using a generalised Malmquist productivity index, and mainly focuses on the foreign-owned Islamic bank and Islamic banking subsidiaries. We decompose productivity change into efficiency, technical, and scale change. Both foreign full-fledged Islamic banks and conventional banks with Islamic bank subsidiary exhibited negative productivity change, attributed to negative rate of technical change and scale change effects. Despite the flexibility in operation, the newly converted bank subsidiary may need sometimes to develop technology, while foreign Islamic banks may need more time to overcome their output disadvantages.

Keywords: Malmquist productivity index; Islamic banking; productivity

INTRODUCTION

Over the past 20 years, many countries liberalised bank activities that traditionally had been operating conventional banking and was heavily regulated as well as protected from competition. Consequently, Islamic banks and foreign banks which had previously played a marginal role as a division, branch banking or representative office, established a significant presence in several countries. These raise new questions about its effectiveness in increasing competition hence improving the efficiency and productivity of a banking system.

In contrast to the growing literature on the mode of foreign bank entrance into local market (branch, subsidiary, representative office) which can affect efficiency, little attention has been given on the mode of local bank entrance into the market. In addition, numerous studies are available related to the association between foreign banks and efficiency but are lacking on foreign Islamic banks. The current study contributes to the literature in exploring the impact of converting a branch or division into bank subsidiary in local banks on the productivity of banks in the country. Furthermore, it adds Islamic banking perspective into the long-standing debate on the association between foreign banks and efficiency. In particular, this paper tries to reduce the above gaps by examining the productivity of a sample of Islamic and conventional banks in Malaysia for the period 2000 to 2008, using a generalised Malmquist productivity index, and particularly focuses on foreign-owned Islamic bank and Islamic banking subsidiaries.

There is at least one reason why bank customers, bankers and policy makers should concern on the effect of converting a branch or division of a bank into a subsidiary. Subsidiaries typically involve different legal entity, hence are responsible for the assets or liabilities as they have different set of statutory accounts. In addition, subsidiary can be registered under different act, hence could have different nature of operation. Furthermore, subsidiary could have extensive networks as they are in direct competition with other banks for clients. These can have implications not only for the banks but local supervisory body who concerns about the competitive structure of the banking system, hence efficiency and productivity level of banks of a country. There is also at least one reason why they should concern on the consequence of foreign banks operate in host markets. The organizational structure of foreign bank operations may change the competitive form of the local banking system, pressurise the profits and market segment of domestic banks and have an effect on the price and quality (Cerutti et al., 2007) hence efficiency of banking services in the host country.

An output-oriented efficiency measure compares the observed level of output with the maximum output that could be produced with given inputs. The estimated function and inefficiency estimates are

then employed to calculate Orea's (2002) generalised Malmquist Productivity Index and decompose into technical efficiency change (TEC) and technical change (TC) and scale change effects (SCE). The productivity change are then analysed focusing on foreign Islamic banks and banks with Islamic bank subsidiary.

The findings from this paper can be summarized as follows. There would appear to be little prospect for foreign full-fledged Islamic banks to overcome the output disadvantages given their higher input requirements and slow growth in efficiency. In contrast, domestic full-fledged Islamic banks have potential to overcome their output disadvantages as they have both considerable rate of technical change and efficiency growth despite higher input requirements. Furthermore, conventional banks with Islamic bank subsidiary have been able to improve efficiency levels but fail to improve current technology. However, Islamic banking window in conventional banks has been efficient and able to improve efficiencies in their operation as well as successful in developing new output enhancing products and technologies particularly in domestic banks.

This paper builds on the existing literature of associating bank efficiency with foreign-owned banks in Malaysia (e.g., Abdul-Majid et al., 2009; Mokhtar et al., 2008; Sufian, 2009) as well as in other countries (e.g., Kraft et al., 2006; Lin and Zhang, 2009), while another strand of studies suggests that foreign bank entry could reduce efficiency (e.g., Chang et al., 1998; Rao, 2005). As there is a lack of study on local banks related to the association between bank subsidiary and efficiency (as far as the author is aware of), the closest studies to this paper is on the foreign banks where mixed results were found of whether operating abroad through branches or subsidiaries improve efficiency (e.g., Pasiouras, 2008). While the paper's analysis of the impact of foreign ownership on Islamic and conventional banking efficiency contributes to the policy debate in relation to foreign bank entry, the study on the effect of local Islamic bank subsidiary on efficiency innovates.

The remainder of the paper is organized as follows. Section 2 gives background of the Malaysian banking. Section 3 presents the methodology including dataset collected. Section 4 discusses the empirical results before conclusion is offered in the final section.

MALAYSIAN BANKING SECTOR

Traditionally, Malaysian banking system is comprised of the Central Bank of Malaysia (BNM), commercial banks, Islamic banks, finance companies, and merchant banks. It includes the representative offices of foreign banks and offshore banks in Labuan. BNM is responsible for the supervision of the banking system except for the offshore banks as they are regulated by the Labuan Offshore Financial Services Authority (Central Bank of Malaysia, 1999).

Commercial banks are the main component of the Malaysian banking system. Traditionally, foreign banks played a significant role in the Malaysian banking system as domestic banks were not well developed. Therefore, domestic banks accounted for less than 10 percent of all commercial bank deposits and loans in 1957. However, foreign banks were restricted from opening new branches in Malaysia starting 1966 and only forty years later they were allowed to open additional branches (Central Bank of Malaysia, 2005).

Consolidation of Malaysian commercial banks has started in early 1990s. The East Asian financial crisis further pushed the industry to consolidate which completed in 2002. In an effort to increase the capacity and capability of domestic financial institutions, commercial banks started to merge with finance companies in the following year (Central Bank of Malaysia, 2004). As a result, the number of domestic banks declines substantially since 1996. Nonetheless, the number of foreign banks has remained almost the same until early 2000s before increases in the succeeding years. Malaysian banking system is now comprised of the BNM, commercial banks, Islamic banks and investment (merchant) banks.

Malaysian banking experiences further significant growth with the implementation of a dual system where the Islamic banking system operates side by side but separately from the conventional banking system. The most important features of Islamic banking are the prohibition of interest payment in transactions, and the prohibition of financing unethical behaviour such as gambling and pornography. The 1983 Islamic Banking Act (IBA) governs Islamic banking, and the first Islamic bank was set up in 1983.¹

Further important development in Islamic banking was triggered a decade later, when BNM allowed three conventional banks to offer Islamic banking products through the Islamic Banking Scheme (IBS). In operating an IBS Islamic window, commercial banks must have a separate Islamic Banking Division and a dedicated Islamic Banking Fund, although personnel and physical capital may be shared

with conventional banking (Rosly and Bakar, 2003). BNM requires banks operating IBS to submit separate Islamic and conventional statistical reports. In facilitating the parallel operation of the Islamic and conventional banking systems, BNM has further set up an Islamic cheque clearing and settlement system, as well as an Islamic inter-bank money market system, which operates alongside but separately from conventional banking systems. The importance of IBS in Malaysian banking can be seen through the establishment of the second full-fledged Islamic bank in 1999 where it is the separation of IBS assets from a conventional bank's assets. In 2004, 90 percent of domestic commercial banks provided Islamic banking products through IBS and Islamic banking assets were 8 percent of the total Malaysian banking system assets (Central Bank of Malaysia, 2004).

Malaysian Islamic banking came into a more advanced stage in its development in 2005, when BNM approved a further ten full-fledged Islamic banks. Of these, six were established as full-fledged Islamic bank subsidiaries by separating existing IBS assets from conventional assets. Its establishment is to encourage more flexible operations, which will enable the new Islamic banks to engage in an array of activities similar to those of commercial and investment banks. The additional two new Islamic banks resulted from the entry of foreign full-fledged Islamic banks. BNM attracts full-fledged foreign Islamic banks in order to enhance the competitiveness of domestic Islamic banking industry and to further expand global linkages (Central Bank of Malaysia, 2005).

This rapid growth of Islamic bank subsidiaries caused the number to reach 12 in 2008 and of these, only three is the subsidiary of foreign-owned banks. On the contrary, there are five full-fledged Islamic banks and three of them are the foreign-owned banks. Thus, while full-fledged Islamic banking has grown from 0.7 to 12 percent of all banking assets between 1988 and 2007 (Aziz, 2007; Bank Islam Malaysia Berhad, 1989; Central Bank of Malaysia, 1999), this share nearly reaches 20 percent in 2010.

METHODOLOGY

OUTPUT-ORIENTED DISTANCE FUNCTIONS

Distance functions are useful in describing multi-input, multi-output production processes without having to specify strong behavioural objectives such as cost minimisation or profit maximisation. With given inputs, an output-oriented efficiency measure compares the observed level of output with the maximum output that could be produced. The production technology can be represented by a technology set, which is the technically feasible combination of inputs and outputs (Fare and Primont, 1995). If the vector of K inputs, indexed by *k* is denoted by $X=(X_1, X_2, \dots, X_K)$ and the vector of M outputs, indexed by *m*, is denoted by $Y=(Y_1, Y_2, \dots, Y_M)$, the technology set can be defined as:

$$T = \{X, Y\} : X \in R_+^K, Y \in R_+^M, X \text{ can produce } Y \} \tag{1}$$

Where R_+^K and R_+^M are the sets of non-negative, real K and M-tuples respectively. For each input vector, X, let P(X) be the set of producible output vectors, Y, that are obtainable from the input vector X:

$$P(X) = \{Y : (X, Y) \in T\} \tag{2}$$

The output distance function can be described in terms of the output set, P(X) as:

$$D_o(X, Y) = \min \left\{ \varpi > 0 : \left(\frac{Y}{\varpi} \right) \in P(X) \right\} \tag{3}$$

The output distance function is non-decreasing, positively linearly homogeneous and increasing in Y, and decreasing in X. It is defined as the maximum feasible expansion of the output vector given input vector and the efficiency lies between zero (inefficiency) and one (efficiency).

THE ECONOMETRIC SPECIFICATION

Following Fare and Primont (1995) and Cuesta and Orea (2002), and allowing for exogenous factors, the general form of a stochastic output distance function is shown as follows:

$$1 = D_o(Y_{n,t}, X_{n,t}, Z_{n,t}, \beta) h(\varepsilon_{n,t}) \quad (4)$$

where $h(\varepsilon_{n,t}) = \exp(u_{n,t} + v_{n,t})$, $Y_{n,t}$ is a vector of outputs, $X_{n,t}$ is an input vector, $Z_{n,t}$ is an exogenous factor vector and β is a vector of parameters. Inefficiency is accommodated in the specification of $h(\cdot)$ because $\varepsilon_{n,t}$ is a composed error term comprised of $u_{n,t}$, which is assumed to be attributable to technical inefficiency and $v_{n,t}$ which represents random uncontrollable error that affects the n-th firm at time t.

The authors follow the common practice of imposing homogeneity of degree one in outputs on the distance function, which implies that $D_o(Z, X, \pi Y) = \pi D_o(Z, X, Y)$, $\pi > 0$. By arbitrarily choosing the M-th output, the authors can then defines $\pi = \frac{1}{Y_M}$ and write:

$$D_o\left(Z, X, \frac{Y}{Y_M}\right) = \frac{D_o(Z, X, Y)}{Y_M} \quad (5)$$

From Equation 4 and after assuming $Y_{n,t}^* = (Y_{1,n,t}/Y_{M,n,t}, Y_{2,n,t}/Y_{M,n,t}, \dots, Y_{M-1,n,t}/Y_{M,n,t})$ and rearranging terms yields the general form:

$$\frac{1}{y_{M,n,t}} = D_o(Y_{n,t}^*, X_{n,t}, Z_{n,t}, \beta) \cdot h(\varepsilon_{n,t}) \quad (6)$$

Finally after assuming the standard translog functional form² to represent the technology, the output distance can be represented as:

$$\begin{aligned} -\ln Y_{M,n,t} &= \varphi_o + \sum_{k=1}^K \alpha_k \ln X_{k,n,t} + \sum_{m=1}^{M-1} \beta_m \ln Y_{m,n,t}^* + 0.5 \sum_{k=1}^K \sum_{s=1}^K \alpha_{k,s} \ln X_{k,n,t} \ln X_{s,n,t} \\ &+ 0.5 \sum_{m=1}^{M-1} \sum_{j=1}^{M-1} \beta_{m,j} \ln Y_{m,n,t}^* \ln Y_{j,n,t}^* + \sum_{k=1}^K \sum_{m=1}^{M-1} \theta_{k,m} \ln X_{k,n,t} \ln Y_{m,n,t}^* \\ &+ \sum_{k=1}^K \delta_{k,t} \ln X_{k,n,t} t + \sum_{m=1}^{M-1} \psi_{m,t} \ln Y_{m,n,t}^* t + \lambda_1 t + 0.5 \lambda_2 t^2 + \sum_{h=1}^H \xi_h Z_{h,n,t} + v_{n,t} + u_{n,t} \quad (7) \end{aligned}$$

where, $Y_{m,n,t}^* = Y_{m,n,t} / Y_{M,n,t}$, $k=1,2,\dots,K$ and $s=1,2,\dots,K$ are indices for inputs; $m=1,2,\dots,M$ and $j=1,2,\dots,M$ are indices for output; $h=1,2,\dots,H$ is an index for environmental variables, and the Greek letters (except v and u) denote unknown parameters to be estimated. Standard symmetry is imposed to the second order parameters: $\alpha_{k,s} = \alpha_{s,k}$ and $\beta_{m,j} = \beta_{j,m}$ in Equation 7. $v_{n,t}$ is assumed to be normally distributed with zero mean and variance, σ_v^2 . $u_{n,t} \geq 0$ is drawn from a one-sided distribution and is assumed to follow a normal distribution with zero mean and variance, σ_u^2 (e.g. Berger and Mester, 1997; Kasman, 2005;

Mertens and Urga, 2001). Hence, the approach of Jondrow, Lovell, Materov, and Schmidt (1982) is followed to obtain the log likelihood for inefficiency which is expressed in terms of the two variance parameters, $\sigma^2 = \sigma_v^2 + \sigma_u^2$ which captures the variance of composed error and $\lambda = \sigma_u / \sigma_v$, which is a measure of the amount of variation originating from inefficiency relative to statistical noise. The parameters in the translog function as defined in Equation 7 as well as σ^2 and λ are estimated using maximum likelihood estimation (MLE) techniques.

Following from Equation (4), an estimate of output distance can be derived as $D_o(Y_{n,t}, X_{n,t}, Z_{n,t}, \beta) = \exp(-\mu)$. However, as it relies on the unobservable inefficiency, $u_{n,t}$, the authors follow the approach of Jondrow, et al. (1982) who employ the conditional expectation of $u_{n,t}$ given the observed value of overall composed error term, $\varepsilon_{n,t}$.

As firms are assumed to operate with the same production technology in SFA, it is necessary to control for differences in characteristics and the operating environment that may influence the efficient level of output. If we do not control for differences between bank groups, it may lead to inappropriate conclusions about a bank's performance (Bos et al., 2009; Bos and Kool, 2006). Therefore, environmental variables are often included directly in the estimated distance function to control for these differences. Nevertheless, the resulting efficiency scores must be cautiously interpreted as estimates of net efficiency after accounting for the impact of environmental influences on potential output (Coelli et al., 1999).

Malmquist productivity indices are commonly used in the literature because they require neither price information nor restrictive behavioural assumptions such as cost minimization or profit maximization. Following Orea (2002)'s approach of generalized Malmquist Productivity Index, the authors therefore employ previously estimated output distance function and inefficiency estimates to calculate Total Factor Productivity Change (TFPC) and decompose it such that, $TFPC = TEC + TC + SCE$. Thus, for any given periods t and t+1, a generalised output-oriented Malmquist Productivity Index can be expressed as:

$$\begin{aligned}
 TFPC &= \ln(TFP_{n,t+1} / TFP_{n,t}) \\
 &= \ln(D_{0,n,t+1} / D_{0,n,t}) - 0.5[(\partial \ln D_{0,n,t+1} / \partial t) + (\partial \ln D_{0,n,t} / \partial t)] \\
 &\quad + 0.5 \sum_{k=1}^K [(SCALE_{OM,n,t+1} - 1)\Omega_{n,t+1} + (SCALE_{OM,n,t} - 1)\Omega_{n,t}] \ln\left(\frac{X_{k,n,t+1}}{X_{k,n,t}}\right) \tag{8}
 \end{aligned}$$

where;
$$\Omega_{n,t} = \frac{-\partial \ln D_{0,n,t} / \partial X_k}{SCALE_{OM,n,t}}$$

The first term on the right hand side of Equation (8) is TEC, which measures the contribution of efficiency change to productivity. The second term is TC, which measure the contribution of technical change. The final term is SCE, which measures the contribution of changes in scale to productivity change. With IRS (DRS), increases in scale result in increased (decreased) productivity, while under CRS, this final term, SCE vanishes and TFPC is equivalent to a standard Malmquist Productivity Index.

THE DATA AND EMPIRICAL SPECIFICATIONS

Data on 30 banks was drawn from banks' annual reports as well as Bureau van Dijk's (BvD's) BankScope database for the period 2000-2008. Table 1 shows the sample of Malaysian banking institutions by type of bank for each of the year under study. Due to incomplete information in some banks, it has resulted in an unbalanced panel of 218 observations. The sample is representative and covers 80 percent of all Malaysian banks. The table illustrates the trends in the number of banks in several alternative categories and shows the increasing preponderance of foreign banks over time. It further reveals a significantly greater preponderance of conventional banks with Islamic bank subsidiary in domestic banks rather than in foreign-owned banks and particularly at the end of the sample period, a considerably greater preponderance of Islamic banks attributed to foreign-owned group.

Similar to (Abdul-Majid et al., 2010), the intermediation approach is employed to define bank output, as it is the most suitable with the concept of Islamic banking. The selection of the input and output variables follows the existing literature (e.g., Sturm and Williams, 2008). The outputs are loans (Y_1) and total other earning assets (Y_2), and the inputs are labour (X_1), capital (fixed assets) (X_2), and deposit (X_3). X_1 is the expenses on labour, X_2 is value of fixed assets, and X_3 is the interest expense³. It is noted that linear homogeneity in outputs is imposed using Y_2 as a numeraire and these variables have been mean-corrected prior to estimation.

RESULTS

PRODUCTIVITY CHANGE AND ITS DECOMPOSITION

Table 2 gives average estimated productivity change across all banks. It also decomposes the productivity change into efficiency change, technical change and scale change. Average productivity change was 0.84 percent per year over the sample period. As technical change increased 1.46 percent, productivity change is largely driven by technical change.⁴ However, as estimated average technical change declined from 10.19 percent in 2001 to -7.24 percent in 2008, the trend decrease in overall productivity change can also be attributed to decreasing rates of technical change.

The negative average scale change effect of 0.51 is consistent with the result of average decreasing returns to scale. Between 2001 and 2004, scale change contributed 0.9-2.91 percent increase in productivity change, and this may be attributed to mergers between banks which were completed in 2002.⁵ The succeeding years saw negative scale change effects of 0.90-2.99 percent, which possibly signals that the mergers between commercial banks and finance companies have not contributed to productivity increase during the sample period.

Average productivity change which is influenced by the technical change illustrates a descending trend with efficiency change varies around this trend. The pattern of annual efficiency is quite unpredictable. Its contribution to productivity change is positively large in 2003 and 2004, but big negative effects in 2001 and 2007. While, efficiency change contributed 4.14 and 3.65 percent in 2003 and 2004 respectively to the average productivity change, efficiency change reduced the average productivity change by 1.83 percent in 2005 before increased by 2.71 percent in the following year and reduced again by 3.6 percent in 2007. Overall, the decline in productivity was caused by a decline in technical change and scale effect as well as efficiency change towards the end of the sample period.

FIRM SPECIFIC PRODUCTIVITY CHANGE AND ITS DECOMPOSITION

Table 3 shows productivity change estimates over the sample period and decomposes these rates into efficiency change, technical change, and the scale change effect for all banks and by bank category. Considerable differences exist between average productivity change for various bank categories. Thus, the small group of foreign conventional banks without IBS has the highest average productivity change at 2.36 percent, while the minimum group average of -19.03 is for foreign full-fledged Islamic banks.

The comparatively higher average productivity change (1.33 percent) of foreign banks relative to all domestic banks (0.28 percent) can be primarily attributed to the foreign banks without IBS group.⁶ In contrast, the much lower average productivity change of the domestic banks is attributable to domestic banks without IBS group (-5.68 percent) and domestic banks with Islamic bank subsidiary (-1.82 percent). Domestic banks with IBS have contributed to productivity increase (1.90 percent) primarily through considerable technical change (1.84 percent) and improved efficiency (1.01 percent). The much lower average productivity change for foreign banks with IBS (1.16 percent) relative to foreign banks without IBS (2.36 percent) can be mainly explained by relatively low technical change (1.37 percent), as well as negative scale change effects (-0.30 percent). Coupled with lower input requirement of domestic conventional banks with IBS, these results suggests that while Islamic banking in conventional banks have been efficient and able to improve efficiencies in their operation, they moderately successful in developing new output enhancing products and technologies particularly in domestic banks. In addition, these results imply that IBS operation in foreign banks have been slow to develop new technologies although have become more efficient over time.

Turning to conventional banks with Islamic bank subsidiary, the negative productivity growth (-1.82 percent) can be mainly explained by negative rate of technical change (-5.57 percent) as well as scale

change effects (-0.22 percent). Coupled with sizable efficiency change (3.97 percent), these results indicate that while conventional banks with Islamic bank subsidiary have been able to improve efficiency levels, they fail to develop product innovation and improve current technology.

In contrast to considerable technical change (1.78 percent) in domestic banks, the negative average productivity change of foreign full-fledged Islamic banks is attributable to negative scale change effects (-11.22 percent), as well as negative technical change (-9.28 percent) and slow growth in efficiency (1.46 percent).⁷ Hence, given poor technical change of foreign full-fledged Islamic banks and slow efficiency change, coupled with its higher input requirement, it is less potential to see these banks to overcome their inefficiencies.

The foregoing discussion proposes that both foreign full-fledged Islamic banks and conventional banks with Islamic bank subsidiary may have been unable to allocate adequate managerial effect to developing their operations because their managers were distracted by their newly established bank.

CONCLUSIONS

The study investigates the productivity of a sample of Islamic and conventional banks in Malaysia for the period 2000 to 2008, using a generalised Malmquist productivity index, and particularly focuses on foreign-owned Islamic bank and Islamic banking subsidiaries. In achieving this goal, some significant results with regard to the Malaysian banking sector are found. On average, banks became less efficient between 2000 and 2008, causing an average 0.11 percent decline in productivity change. The scale change contributed a 0.51 percent decrease in average productivity change. As technical change contributed 1.46 percent to average productivity change, it was the main determinant of productivity change which averaged 0.84 percent per year between 2000 and 2008.

The pattern and determinants of overall productivity change also reveals some significant findings. Despite relatively higher efficiency, conventional banks with Islamic bank subsidiary exhibited negative productivity change, which is explained by negative rate of technical change and negative scale change effects. This indicates that while conventional banks with Islamic bank subsidiary have been able to improve efficiency levels, they fail to develop product innovation and improve current technology.

Given significantly higher input requirements, foreign full-fledged Islamic banks shows negative productivity change, which are primarily determined by negative scale change effects and negative technical change. Based on these findings coupled with slow growth in efficiency, there would appear to be little prospect, at least in the short run, for foreign full-fledged Islamic banks to overcome the output disadvantages. In contrast, domestic full-fledged Islamic banks have potential to overcome their output disadvantages as they have both considerable rate of technical change and efficiency growth despite higher input requirements.

The foreign banks with IBS windows (as compared to foreign banks without IBS windows) have exhibited lower productivity change which is explained by relatively low technical change and negative scale change effects. The foregoing discussion implies that IBS operation in foreign banks have been developing new technologies very slowly.

This finding has several potential implications for the Islamic bank subsidiary that were created from the Islamic operations of IBS. The establishment of Islamic subsidiary from IBS may allow the bank to have more flexibility in offering Islamic banking products. Nevertheless, there is the possibility that the new subsidiaries take sometimes to develop technology and innovation. As for the full-fledged Islamic banking, while there is potential for domestic-owned bank to overcome their output disadvantages, little prospect is expected from foreign banks. A study focusing on the factors leading to higher input requirements of full-fledged Islamic banks can be a valuable extension of this paper. A qualitative investigation of the reasons as to why Islamic banking has higher input requirement would also be a worthwhile addition to banking literature.

NOTES

1 This act allows an Islamic bank to operate based on equity participation such as *musharaka* (partnership), which is similar to the activity of merchant banks and cost plus margin of profit financing such as *murabaha* (sale at cost plus margin of profit) and *ijarah* (leasing), which are similar to the activities of commercial banks.

2 The translog function is preferred in estimating a parametric distance function because it allows the imposition of homogeneity and is easy to calculate Fuentes, H. J., E. Grifell-Tatjé and S. Perelman, 2001, A Parametric Distance Function Approach for Malmquist Productivity Index Estimation. *Journal of Productivity Analysis* 15, 79.

3 For Islamic banking, it is the profit distributed to depositors.

4 This result of technological progress as the main determinant of productivity change is also found by Orea Orea, L., 2002, Parametric Decomposition of a Generalized Malmquist Productivity Index. *Journal of Productivity Analysis* 18, 5-22. on Spanish banks, Isik and Hassan Isik, I. and M. K. Hassan, 2003, Financial disruption and bank productivity: The 1994 experience of Turkish banks. *The Quarterly Review of Economics and Finance* 43, 291-320. for Turkish banks. Similarly, Krishnasamy, et al. Krishnasamy, G., A. H. Ridzwa and V. Perumal, 2004, Malaysian Post Merger Banks' Productivity: Application of Malmquist Productivity Index. *Managerial Finance*. 30, 63-74. noted that productivity improvement in 10 Malaysian commercial banks was also primarily determined by technical change during the 2000-2001 period.

5 Sufian and Ibrahim Sufian, F. and S. Ibrahim, 2005, An analysis of the relevance of off-balance sheet items in explaining productivity change in post-merger bank performance: evidence from Malaysia. *Management Research News* 28, 74 - 92. reported average total productivity growth for post-merger Malaysian banks of -1.3 percent for the period 2001-2003 using non-parametric approach.

6 The effect of Islamic subsidiary cannot be determined as available data starts in 2008.

7 Moderate productivity growth is found in Islamic banks for most countries Hassan, M. K., 2005, The Cost, Profit and X-Efficiency of Islamic Banks, 12th Annual Conference (Economic Research Forum, Cairo). but productivity loss is found for Islamic banks in Sudan, Iran and Pakistan Hassan, M. K., 2003, Cost, Profit and X-Efficiency of Islamic Banks in Pakistan, Iran and Sudan, Paper presented at International Conference on Islamic Banking: Risk Management, Regulation and Supervision (Jakarta, Indonesia). and both found productivity change is driven by the technical change .

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TABLE 1: Sample of banks and by category

	00	01	02	03	04	05	06	07	08	All Years
<i>All Banks</i>	24	24	23	24	25	23	23	26	26	218
Without IBS	10	9	9	9	10	10	13	13	18	101
With IBS ^b	12	13	12	13	13	11	9	8	3	94
Islamic	2	2	2	2	2	2	1	5	5	23
<i>Foreign</i>	12	12	12	12	13	13	13	15	15	117
Without IBS	9	8	8	8	9	9	9	8	11	79
With IBS ^b	3	4	4	4	4	4	4	4	1	32
Islamic ^a	-	-	-	-	-	-	-	3	3	3
<i>Domestic</i>	12	12	11	12	12	10	10	11	11	101
Without IBS	1	1	1	1	1	1	4	5	7	22
With IBS ^b	9	9	8	9	9	7	5	4	2	62
Islamic	2	2	2	2	2	2	1	2	2	17

<i>All Banks</i>	24	24	23	24	25	23	23	26	26	218
Without Islamic Subsidiary	22	22	21	22	23	19	16	14	11	170
With Islamic Subsidiary ^b	-	-	-	-	-	2	6	7	10	25
Islamic	2	2	2	2	2	2	1	5	5	23
<i>Foreign</i>	12	12	12	12	13	13	13	15	15	117
Without Islamic Subsidiary	12	12	12	12	13	13	13	12	11	110
With Islamic Subsidiary ^b	-	-	-	-	-	-	-	-	1	1
Islamic ^a	-	-	-	-	-	-	-	3	3	6
<i>Domestic</i>	12	12	11	12	12	10	10	11	11	101
Without Islamic Subsidiary	10	10	9	10	10	6	3	2	-	60
With Islamic Subsidiary ^b	-	-	-	-	-	2	6	7	9	24
Islamic	2	2	2	2	2	2	1	2	2	17

Notes:^a Started operation in 2007.

^b Converting IBS into Islamic subsidiary in stages starting 2005 hence, some banks still have both accounts in their financial statements after 2005.

TABLE 2 : Mean Productivity change in Malaysian banking

Period	Mean Changes in Efficiency	Mean Technical Change	Mean Scale Effect	Mean Productivity Growth
2000/01	-7.14	10.19	-2.92	0.13
2001/02	-0.66	7.51	2.91	9.75
2002/03	4.14	5.03	0.90	10.08
2003/04	3.65	2.54	0.98	7.16
2004/05	-1.83	0.31	-1.15	-2.66
2005/06	2.71	-1.53	-0.90	0.27
2006/07	-3.60	-3.86	-2.99	-10.44
2007/08	1.14	-7.24	-1.09	-7.19
Average	-0.11	1.46	-0.51	0.84

TABLE 3 : Summary of Firm Specific productivity growth for all banks and by category

	Mean Efficiency Change	Mean Technical Change	Mean Scale Change Effect	Mean productivity change
<i>Descriptive Statistics: All Banks</i>				
Average	-0.11	1.46	-0.51	0.84
Standard Deviation	14.99	6.51	4.93	18.30
Minimum	-62.34	-14.68	-24.68	-65.76
Maximum	65.56	17.98	22.71	68.76
<i>Average Productivity Change by Category</i>				
<i>All Banks</i>	-0.11	1.46	-0.51	0.84
Without IBS	-1.03	1.56	0.33	0.85
With IBS ^b	0.69	1.67	-0.72	1.64
Islamic	0.04	-0.06	-3.18	-3.21
<i>Foreign Banks</i>	-0.27	1.78	-0.17	1.33
Without IBS	-0.53	2.48	0.40	2.36
With IBS ^b	0.09	1.37	-0.30	1.16
Islamic ^a	1.46	-9.28	-11.22	-19.03
<i>Domestic</i>	0.07	1.10	-0.90	0.28
Without IBS	-3.24	-2.43	-0.01	-5.68
With IBS ^b	1.01	1.84	-0.95	1.90
Islamic	-0.25	1.78	-1.58	-0.04

<i>All Banks</i>	-0.11	1.46	-0.51	0.84
Without Islamic Subsidiary	-0.53	2.32	-0.23	1.57
With Islamic Subsidiary ^b	3.97	-5.57	-0.22	-1.82
Islamic	0.04	-0.06	-3.18	-3.21
<i>Foreign</i>	-0.27	1.78	-0.17	1.33
Without Islamic Subsidiary	-0.33	2.12	0.18	1.97
With Islamic Subsidiary	-	-	-	-
Islamic ^a	1.46	-9.28	-11.22	-19.03
<i>Domestic</i>	0.07	1.10	-0.90	0.28
Without Islamic Subsidiary	-0.85	2.65	-0.90	0.90
With Islamic Subsidiary	3.97	-5.57	-0.22	-1.82
Islamic	1.46	1.78	-1.58	-0.04

Notes; ^a Started operation in 2007.

^b Converting IBS into Islamic subsidiary in stages starting 2005 hence, some banks still have both accounts in their financial statements after 2005.