Measuring the efficiency of sharia business units of Indonesian private banks: a data envelopment analysis approach

M. Mujiya Ulkhaq

Universitas Diponegoro Semarang, Indonesia
Corresponding author: ulkhaq@live.undip.ac.id

Abstract

With the development of sharia banks, one of the effects is the existence of competition among sharia banks. This study analyses the efficiency of sharia business units of private banks in Indonesia. Understanding efficiency is essential because if banks perform consistently with total efficiency, the fewer inputs they use, the larger their output. Total earning assets measure the output, while the inputs used are total deposit and total operating costs. A data envelopment analysis with input-oriented and variable returns-to-scale is used to accomplish the objective. The result shows that three of the seven sharia business units under investigation are considered the most efficient. This indicates that the sharia business unit does not have to have the highest output value to be the most efficient one. It also must have low values of inputs.

Keywords: data envelopment analysis; efficiency; Indonesian private bank; sharia business unit.

Introduction

With the amendment of Undang-Undang Number 7 of 1992 into Undang-Undang Number 10 of 1998 about Indonesian banking, which allows conventional banks to operate by applying sharia principles or conducting operations in sharia and conventional ways (dual banking system), the growth of Islamic banks has experienced a significant acceleration since the sharia unit can offer separate sharia banking products. The primary difference between these two types of banking lies in the returns and profit sharing provided by customers to financial institutions and financial institutions to the customers. In conventional banking, profits are distributed based on the principle of interest. In contrast, in sharia banking, profits and losses are distributed based on profit sharing.

With the development of sharia banks and the strength of conventional banks, one of the effects is the existence of

competition between conventional banks and sharia banks, as well as among sharia banks. The concern now is the performance of these banks. Bank performance is essential for stakeholders because they can evaluate the performance while applying prudential principles, complying with regulations and implementing risk management. One of the essential aspects of measuring bank performance is efficiency. Arafat (2006) stated that bank efficiency is essential now and in the future with increasingly fierce competition, problems that can arise due to lack of resources, and increasing customer satisfaction standards.

This study analyses the efficiency of sharia business units of private banks in Indonesia. Understanding efficiency, defined as the ratio of output to input (Cooper, Seiford, & Tone, 2006), is essential because if banks perform consistently with total efficiency, the fewer inputs they use, the larger output they achieve. A data envelopment analysis (DEA) with input-oriented and variable returns-to-scale (VRS) is used to accomplish the objective. The rest of the paper is structured as follows. The following section shows the data used in this study, including inputs and output. The third section describes the empirical model of this study, i.e., input-oriented DEA with the VRS approach. The fourth section shows the result of this study, while the last section concludes. Therefore, a problem formulation is obtained regarding analysing the efficiency of private bank business units in Indonesia.

Literature review

Research conducted by Cahyono and Rani (2017) researched the technical efficiency of the Sharia business unit of the Regional Development Bank on Sumatra Island. Non-parametric Data Envelope Analysis method research approach. The research results show that the efficiency performance of sharia business units of regional development banks on Sumatra Island has generally reached a good efficiency level in 2016. Only 1 BPD UUS has not achieved efficiency, namely Bangka Belitung BPD UUS.

Research conducted by Salami and Adeyemi (2015) investigates the level of efficiency of sharia banking in Malaysia, whether in the form of sharia business units in conventional banks or those that have fully developed into sharia banks—Non-parametric data envelope analysis method research approach. The research results show that sharia banking in Malaysia shows an

increase from year to year. The comparison between the efficiency of sharia business units and fully developed sharia banks is higher for sharia business units.

Research conducted by Syairozi et. al. (2017) researched the efficiency analysis of sharia banking in Indonesia in 2013-2015. Non-parametric Data Envelope Analysis (DEA) method research approach. The research results show that, in general the efficiency of sharia business units in Indonesia during 2013-2015 showed better development. However, it can be seen that, on average none of the input and output variables showed 100% efficiency. Meanwhile, if it is prioritized, from the output side, the operating income variable is the variable that achieves the highest efficiency, namely 97,33%, and the lowest is financing at 89,80%, while from the input side, the variable that achieves the highest efficiency is the profit sharing distribution variable at 95,91%. and the lowest is deposits at 89,14%.

Research methods

Efficiency refers to the ability of a decision-making unit; in this study, it is a sharia bank in Indonesia to minimize input used in the production of a given output or the ability to obtain maximum output from a given inputs (Cooper et al., 2006). Consequently, a decision-making unit (DMU)—in this study is the sharia bank—is entirely technically efficient if it produces the maximum possible output from a fixed level of inputs (in an output orientation) or if it uses the minimum possible inputs to produce a given level of output (in an input orientation).

This study uses DEA to assess efficiency. It is a non-parametric approach that requires few assumptions in estimating technical efficiency compared to the parametric approach, such as the stochastic frontier analysis (SFA). In SFA, one has to define a functional form a priori and estimate the finite set of unknown parameters from the data. In addition, due to the use of the maximum likelihood method, the inefficiency distribution must be defined a priori. In DEA, we do not consider those issues.

Let M be the number of inputs and N be the number of DMUs (in this study, $M = 2$ and $N = 7$). Efficiency can be estimated by solving the mathematical linear programming as follows:

Min θ

Subject to $\theta \, x_o - \mathbf{X} \, \lambda \geq 0$

    $\mathbf{Y} \, \lambda \geq y_o$

    $\mathbf{e} \, \mathbf{Y} = 1$

    $\lambda \geq 0, \quad (1)$

where $1 \geq \theta \geq 0$ is the efficiency, X represents the M × N input matrix, Y is the 1 × N output vector, λ is N × 1 vector of constants, and e is 1 × N vector of ones, xo and yo are inputs and output of DMU under consideration. Whenthe efficiency score is 1, the corresponding DMU is considered efficient; otherwise, when the efficiency score is less than 1, the corresponding DMU is considered inefficient.

The methodology is completely deterministic in that it attributes all the deviation from the frontier to inefficiency; no random error is estimated. The input-oriented model of DEA is used, where it attempts to minimize input while satisfying a given output level. In addition, the assumption of variable returns to scale (VRS) is used, as this assumption is relevant to the Indonesian economy characterized by many distortions.

The data used in this study consists of seven sharia business units of private banks operating in Indonesia. The data is taken from quarterly financial reports (December 2021) published by the Financial Services Authority (Otoritas Jasa Keuangan/OJK).

Output and input used in this study follow the study of Masrizal et. al. (2022). The output is measured by total earning assets (in million rupiahs). It is the total sum of placement accounts with Bank Indonesia, placements with other banks, receivables (or equivalently, *murābaḥah*, *istiṣnā'*, *qarḍ*, and multiservice), lease financing (or equivalently, *ijārah*), and profit-sharing financings (or equivalently, *muḍārabah*, *mushārakah*, and other financings). *Murābaḥah* is a scheme used for short-term financing. Under this scheme, the seller discloses the real cost and profit of the products to the buyer. Negotiating a profit margin is possible, and installment payments are everyday (Dhumale & Sapcanin, 1999). *Istiṣnā'* is a type of sale transaction where the buyer places an order with the seller to manufacture a certain asset, and the sale is completed upon delivery of the asset to the buyer (Ayub, 2007). *Al-Qarḍ al-hasan* is the only loan permissible under the Islamic finance scheme. This

scheme is a zero-return loan. However, administration and transaction costs are permissible (as long as there is no relationship between the maturity and amount of the loan) (Dhumale & Sapcanin, 1999). *Ijārah* is a (pure) lease transaction (Obaidullah, 2008). In the *muḍārabah* contract, one party provides all the capital for the business called *ṣāḥib al-māl* while the entrepreneurs or *muḍārib* contribute effort and time to the project. The profits will be shared in a fixed ratio, and losses will be borne by the financial institution. In *mushārakah* contract, profits are shared based on an agreement, whereas losses are shared based on equity participation (Fianto et al., 2018).

The inputs used in this study are total deposit and total operating costs. The total deposit consists of the total sum of wadiah savings accounts and non-proft-sharing investments (consisting of current account, savings, and deposit). Total operating costs consist of sum of personnel costs and other operational costs. Wadiah is trust or savings; the trusted party is not responsible for the loss unless the negligence stems from it (Ayub, 2007). The data of inputs and output used is shown in Table 1.

Table 1. Inputs and output used (in million rupiahs)

Sharia business units	Total earning asset	Total deposit	Total operating costs
PT Bank Danamon Indonesia (Tbk)	8,800,649	4,428,416	130,161
PT Bank Permata (Tbk)	20,305,411	24,048,807	597,622
PT Bank Maybank Indonesia (Tbk)	30,890,521	31,042,536	807,687
PT Bank CIMB Niaga (Tbk)	49,125,943	41,511,993	183,030
PT Bank OCBC NISP (Tbk)	3,960,131	3,290,471	99,688
PT Bank Sinarmas	7,098,426	6,791,300	208,159
PT Bank Jago (Tbk)	2,141,412	515,326	26,721

In DEA, the influence of inputs on output cannot be investigated—whether the inputs significantly affect the output; thus, the selection of inputs only depends on the literature without knowing whether the selected inputs significantly influence the output. However, Ferrera et. al. (2010) argued that inputs must fulfil the requirement of isotonicity (i.e., ceteris paribus, more input implies an equal or higher level of output); hence, the selected inputs should present a significant positive correlation with the output in addition to having theoretical support from previous works

Mujiyu Ulkhaq

(Ferrera et al., 2011). The result shows that the correlation coefficients between the output and the first and the second input are 0.979 and 0.4385, respectively.

Results and discussion

The result of the DEA is shown in Table 2. According to input-oriented VRS-DEA, three sharia business units have an efficiency score of 1, indicating the most efficient DMUs. They are PT Bank Danamon Indonesia (Tbk), PT Bank CIMB Niaga (Tbk), and PT Bank Jago (Tbk). The other sharia business units are considered inefficient since their efficiency scores are less than one. We also provide a rank for each DMU.

PT Bank CIMB Niaga (Tbk), which is located at the frontier, has the highest value of total earning assets among others (i.e., 49,125,943 million rupiahs, see again Table 1). Note that the high output value does not guarantee that the efficiency score will be 1 (one). The second and the third highest output values belong to PT Bank Maybank Indonesia (Tbk) and PT Bank Permata (Tbk), which have total earning asset of 30,890,521 and 20,305,411 million rupiahs, respectively (see again Table 1). However, those banks have efficiency scores of less than 1, meaning that all of them are inefficient. It is of interest viewing banks having the lowest output values, i.e., PT Bank Jago (Tbk) is located at the frontier (efficient). This indicates that to be the most efficient one, the sharia business unit does not have to have the highest output value; it also must have low values of inputs.

Table 2. Result

Sharia business units	Efficiency score	Rank	Reference set
PT Bank Danamon Indonesia (Tbk)	1.000	1	$\lambda 1 = 1.000$
PT Bank Permata (Tbk)	0.624	5	$\lambda 1 = 0.7147$ $\lambda 4 = 0.2853$
PT Bank Maybank Indonesia (Tbk)	0.797	4	$\lambda 1 = 0.4522$ $\lambda 4 = 0.5478$
PT Bank CIMB Niaga (Tbk)	1.000	1	$\lambda 4 = 1.000$
PT Bank OCBC NISP (Tbk)	0.510	6	$\lambda 1 = 0.2228$ $\lambda 4 = 0.0071$ $\lambda 7 = 0.7700$
PT Bank Sinarmas	0.505	7	$\lambda 1 = 0.7444$ $\lambda 7 = 0.2556$
PT Bank Jago (Tbk)	1.000	1	$\lambda 7 = 1.000$

Table 2 also shows the reference set for each sharia business unit for benchmarking. For instance, the reference set for PT Bank Permata (Tbk) is {1, 4}, which is PT Bank Danamon Indonesia (Tbk) and PT Bank CIMB Niaga (Tbk); and the values of λs are $\lambda_1 = 0.7147$ and $\lambda_4 = 0.2853$. They show the proportions contributed by PT Bank Danamon Indonesia (Tbk) and PT Bank CIMB Niaga (Tbk) to the point used to evaluate PT Bank Permata (Tbk). Hence, PT Bank Permata (Tbk) is inefficient. Note that the reference set for the efficient sharia business units is themselves.

Conclusion

This study aims to measure the efficiency of sharia business units of private banks in Indonesia. DEA with input-oriented and VRS approach is used to accomplish the study's objective. The result shows that among seven sharia business units of private banks under-investigated, three are considered the most efficient, located at the frontier. The rank for each DMU is also provided. This indicates that the sharia business unit does not have to have the highest output value to be the most efficient one. It also must have low values of inputs.

References

Arafat, W. (2006). *Manajemen Perbankan Indonesia: Teori dan Implementasi*. Jakarta: Pustaka LP3ES.

Ayub, M. (2007). *Understanding Islamic Finance*. New York: John Wiley & Sons.

Cahyono, E. F., & Rani, L. N. (2017). Performa Efisiensi Teknis Unit Usaha Syariah Bank Pembangunan Daerah di Pulau Sumatera. *HUMAN FALAH: Jurnal Ekonomi Dan Bisnis Islam*, *4*(1), 19–33. https://doi.org/10.30829/hf.v4i1.589

Cooper, W. W., Seiford, L. M., & Tone, K. (2006). *Introduction to Data Envelopment Analysis and Its Uses: With DEA-Solver Software and References*. New York: Springer.

Dhumale, R., & Sapcanin, A. (1999). *An application of Islamic banking principles to microfinance*. New York: Technical note, A study by the Regional Bureau for Arab States, UNDP, in cooperation with the Middle East and North Africa Region, World Bank.

Ferrera, J. M. C., Cebada, E. C., Chaparro, F. P., & González, D. S. (2011). Exploring Educational Efficiency Divergences Across Spanish Regions in Pisa 2006. *Revista de Economía Aplicada*, *19*(57), 117–

145. Retrieved from https://www.redalyc.org/articulo.oa?id=96922243005

Ferrera, J. M. C., Cebada, E. C., & Gonzalez, D. S. (2010). Factors Affecting Educational Attainment: Evidence From Spanish Pisa 2006 Results. *Regional and Sectoral Economic Studies*, *10*(3), 56–76.

Fianto, B. A., Gan, C., Hu, B., & Roudaki, J. (2018). Equity financing and debt-based financing: Evidence from Islamic microfinance institutions in Indonesia. *Pacific Basin Finance Journal*. https://doi.org/10.1016/j.pacfin.2017.09.010

Masrizal, Sukmana, R., Fianto, B. A., & Gultom, R. Z. (2022). Does economic freedom fosters Islamic rural banks efficiency? Evidence from Indonesia. *International Journal of Productivity and Performance Management*. https://doi.org/10.1108/IJPPM-11-2021-0660

Obaidullah, M. (2008). *Introduction to Islamic Microfinance*. Jeddah: IBF Net Limited.

Salami, O. L., & Adeyemi, A. A. (2015). Malaysian Islamic Banks Efficiency: An Intra Bank Comparative Analysis of islamic Windows and Full-Fledged Subsidiares. *International Journal of Business and Society*, *16*(1), 19–38. https://doi.org/10.33736/ijbs.551.2015

Syairozi, M. I., Zulyanti, N. R., & Handayati, R. (2017). Analisis Efisiensi Perbankan Syariah (Unit Usaha Syariah) Indonesia Periode 2013-2015: Pendekatan DEA (Data Envelopment Analysis). *Economic: Jurnal Ekonomi Dan Hukum Islam*, *8*(2), 93–105. Retrieved from http://ejournal.kopertais4.or.id/tapalkuda/index.php/economic/article/view/2985