

## EFFICIENCY ANALYSIS OF ISLAMIC BANK USING Data Envelopment Analysis and Stochastic Frontier Approach

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**Abstract:** Efficiency is one of the performance parameters which theoretically this is one of the basic valuation to accomplishment of an organization. The issue in this study is the market share of Islamic banking in Indonesia has not achieved its full potential, so in this research method to be used is the Stochastic Frontier Approach (SFA) and Data Envelopment Analysis (DEA). By using the SFA method is the efficiency of Islamic banking during the years 2007-2010 had an average efficiency of 94.37% per year and profits of Islamic banking is highly influenced by the finance provided and placements with Bank Indonesia. The study uses the DEA method showed that Islamic banks are still experiencing 100 percent efficiency is on the BUS Muamalat Indonesia, whereas other Islamic banks tend to fluctuate and inefficiency during the years of observation.

**Keywords:** DEA, SFA, Bank Syariah, Efficiency

**Abstrak:** Efisiensi merupakan salah satu parameter kinerja yang secara teoritis yang merupakan salah satu dari penilaian dasar suatu organisasi. Masalah dalam penelitian ini adalah pangsa pasar perbankan syariah di Indonesia belum mencapai potensi penuh, sehingga dalam metode penelitian ini penulis menggunakan Pendekatan Stochastic Frontier (SFA) dan Data Envelopment Analysis (DEA) untuk melihat efisiensi bank syariah. Dengan menggunakan metode SFA, efisiensi perbankan syariah selama tahun 2007-2010 memiliki efisiensi rata-rata 94,37% per tahun, Laba perbankan syariah sangat dipengaruhi oleh keuangan yang tersedia dan penempatan pada Bank Indonesia. Dengan menggunakan metode DEA menunjukkan bahwa bank syariah mengalami efisiensi 100 persen pada BUS Muamalat Indonesia, namun bank-bank Islam lainnya cenderung berfluktuasi dan inefisiensi selama tahun pengamatan.

**Keyword:** DEA, SFA, Bank Syariah, Efficiency

### INTRODUCTION

The existence of Islamic banks have emerged since 1992 that Bank Muamalat Indonesia (BMI). The presence of BMI appeared after the application of Law no. 7 of 1992 on the banking system to apply for the results. Determination of the legislation also marks the entry into force of the legal basis for the operation of Islamic banking as well as the beginnings of a dual banking system in Indonesia. Performance of Islamic banking is relatively well helps its development through the launch of the dual banking system by the issuance of Law no. 10 of 1998. Further developments, there are also the concept of branching office which stated that conventional banks are allowed to open a counter sharia in its business operations.



In fact, sharia banking development has not been able to achieve the desired target. At the end of 2009, sharia banking is yet to achieve market share of 5 percent. Bank Indonesia in 2009 recorded the new sharia banking achieve range of 2-3 percent among several indicators of total assets, financing and third party funds, although data surveys 2000-2009 states that Bank Indonesia. Islamic Banking potential large enough to condition the population Muslims and the development of sharia financial institution in the rapidly growing internationally

Islamic banks need to achieve improvement performance from existing targets. Efficiency is one popular way of measuring performance in financial institutions, including Islamic banking. Efficiency can be measured include technical efficiency, allocation / prices and the economy. This study only measure and analyze the efficiency of the technique, this is due to the method of analysis used is DEA. (*Data Envelopment Analysis*). DEA is an optimization method of mathematical programming techniques to measure the efficiency of the Unit of Economic Activities (UKE) and compare it relative to other UKE (Charnes et al. 1978; Banker et al. 1984 in Etty Puji Lestari, 2003).

This study uses input variables which include: first, saving significant amounts of public funds both individuals and legal entities that can be collected by Islamic banks. Second, the assets of Islamic banks, third, the cost of labor / personnel are defined as costs of salaries and welfare payments, education expenses of employees of Islamic banks. The output variables include: first, the definition of financing products of Islamic banks lending funds to communities using the agreement, "*akad-akad muamalah*". The Second, operating income is earned income from operations of Islamic banks. DEA method in this study using the assumption *Constant Return to Scale* (CRS). The orientation of the model output will be used in this study.

Beside use of DEA, this study also used the method of measuring the efficiency of banking with Stochastic Frontier Approach (SFA), it is the efficiency of banking with profit approach which is basically influenced by the profit function of input variables and output variables. The SFA method is a function of log of input variables and output variables. In this study the output (Y) that is used is Placements on Bank Indonesia (PBI), Placements to other banks (PBL), Financing provided (PD). While the input (X) that is used is the Third Party Funds (TPF), paid-in capital (MDS). With the following assumptions: a) third-party funds affect earnings, b) Paid up capital affects earnings, c) Placements to Bank Indonesia effect on earnings, d) placements to other banks effect on earnings, e) Funding provided influential to earnings. Hence, the issues in this study are as follows: (1) How does the level of technical efficiency of Islamic banking in Indonesia by using the DEA; (2) How does the level of technical efficiency of Islamic banking in Indonesia by using the SFA.

**Characteristics of Bank Sharia.** Islamic sharia law in managing stressed assets on the balance between the individual and society. Therefore, the required the intermediate institution to connecting of society (owners of funds) and entrepreneurs in need of funds (fund manager). One of the board of bank intermediaries are engaged in efforts based on sharia. Sharia bank is the bank which is operated based on the basis of partnership, fairness, transparency, and are universal, and it runs a business accordance with sharia principles. Islamic banks operate on the basis of the concept of sharing. Sharia bank does not distinguish between the monetary and so that its activities can perform transactions. This real sector, such as sale and lease. Sharia bank can also get rewarded for banking



services which are not contrary to the sharia. With a ban on interest on banking transactions, the bank sharia in its operation undertake to use profit sharing that is free from interest income.

In executing transactions of Islamic banks have general principles to be followed, namely: first, the prohibition of “*Riba*” in the form of the transaction. Second, business activities and trade based on the legitimate gains. Third, give “*zakat*”. Islamic banks have the function and role as an investment manager who manages the investment of customer funds, investors who own funds or funds entrusted to clients, providers of financial services and payment, and implementing social activities that are characteristic inherent in Islamic finance entities (*zakat* , *infak*). The relationship between Islamic banks to their customers, both as investor and executor of the investment, is partnership.

**Data Envelopment Analysis (DEA) Concept.** According to Ahmad Syakir Kurnia (2004), DEA is one of non-parametric analysis tool to measure the relatively efficiency of both inter-profit business organization (profit oriented) and between organization or institution of economic activity that is not profit-oriented are in the process or activity involving the use of certain input to produce specific outputs. DEA focuses its purpose, namely to evaluate the performance of the Unit of Economic Activities (UKE). The analysis is based on the evaluation of the relative efficiency of comparable UKE, moreover, they will form the efficient *frontier line*. Where is the line of frontier UKE, UKE can be said to be relatively efficient compared with other UKE in the sample. DEA can also show the UKE that it is reference for inefficient UKE ( Ascarya, Diana Y and thunder SR, 2008).

**Stochastic Frontier Analysis (SFA) Concept.** To measure the efficiency of the SFA approach, can be done via the *output-oriented approach* for the measurement of technical efficiency, and *input-oriented* for the measurement of cost efficiency. Technical efficiency is measured by the production frontier, while cost efficiency is measured by the cost frontier (Kumbhakar, 2000). Calculation efficiency using parametric methods require an estimate of the cost function as a frontier to determine the efficiency of a bank. But before determining the cost function is used, input and output of the bank should be determined in advance (pre-determined).

Input on Islamic banking consists of three parties. The first party funds is derived from funds from the investors, shareholders. The second party is a fund of funds derived from loans of financial institutions (banks and non banks), loans from Bank Indonesia. Third party funds are funds derived from savings, savings and time deposits. After the input collected at the banks, Islamic banks can then generate output. Output will be lent to whom need in form of financing, loans and services.

This study uses Intermediary Approach is the determination of the input variables and output variables with respect to the function of a bank as intermediary. *User-Cost Approach* is the determination of input variables and output variables based on bank's functions as a determinant of the market price, and the *Value Added Approach* is the determination of input and output variables based on the destination banks to generate value added (profit) is maximized.

**Previous Researchers.** Basically the difference with the previous study, that according to the researcher's knowledge no studies have analyzed the efficiency of using the DEA and



SA simultaneously, whereas this study tried to implement efficiency using DEA and SFA methods simultaneously, although the two methods can not be compared.

The previous research result as follows:

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#### **DEA Method**

1. Donsyah Yudhishtira (2003); The purpose of this study was to determine and analyze the efficiency of 18 Islamic banks in the world during and after the economic crisis in 1998. This study in 2003 using DEA technique that uses three input variables consisting of: total savings, labor costs, and fixed assets. Output variables in the form of financing, current assets (liquid assets) and other operating income. The results of this study illustrate that Islamic banking has experienced inefficiencies in 1998-1999, while the condition of Islamic banking in 1997-2000 is more efficient. The amount of inefficiency in 1998-1999 is more influential in engineering.
2. Fadzlan Sufian (2006); This study aims to measure and analyze the efficiency of Islamic banks both foreign and domestic in Malaysia, during the observation period 2001-2004. DEA analysis method used in this study, with input variables consisting of: total savings, labor costs, and assets. Financing and operating income variables as output. The results of this study states that make a total efficiency of Islamic banks in Malaysia have increased. This study revealed that the foreign bank syariah average lower than the inefficient domestic banks during the years of observation of sharia.
3. Harjum Pusvitasari Muharam and Rizki (2007); This study has the objective, namely to measure and analyze the efficiency of Islamic banks in Indonesia in 2005. DEA analysis method used in this study. The savings and other operational costs as input variables, while the financing, current assets

#### **SFA Method**

1. Muliaman D. Hadad, et al (2003); The study is titled "Parametric Approach to Efficiency of the Banking Indonesia ". The research was conducted using the approach Stochastic Frontier Analysis (SFA) and Data Frontier Analysis (DFA). Determination of input-output variables in this study is to use cost frontier approach. Variables used in this study include the cost of labor, price of funds as a variable input and related party loans with banks, credit given on the other hand, securities held as variable the output. The results of this study do not suggest merger it increases efficiency, foreign banks mixture into bank The most efficient and the period of 2002 using the DFA bank national private bank foreign exchange is the most efficient
2. Izah Mohd Tahir and Sudin Haron (2008); This study measures the technical efficiency of commercial banks in Malaysia period 2000-2006. The study uses stochastic methods Frontier Analysis (SFA) with input variables, output use the intermediation approach. Variables in this research that total deposits and total overhead expenses as a variable input, while total earning assets consist of financing, dealing securities, the investments securities and placements with other banks as its output variables. The results suggest that the efficiency of the Malaysia bank rises each period and the efficiency of domestic banks more efficient than foreign banks.
3. Arif Rahman Hakim (2009); This study analyzed the comparison of the efficiency of the foreign bank and



- (liquid assets) and other operating income as a variable output. The results revealed that during the period of observation (2005) of the twelve banks surveyed, only three banks which achieved an efficiency of 100 percent (BTN Syariah, Bank Niaga Syariah, and Bank Permata Syariah). Nine other banks in the sample fluctuations in the achievement levels of efficiency throughout 2005.
4. Hamim S. A Mokhtar, Naziruddin Abdullah and Syed M. Al Habshi (2008); This study has a purpose, namely to measure and analyze the efficiency of Islamic banks in Malaysia during and after the economic crisis (1997-2003). DEA analysis method used in this study. The variable total savings, labor costs and other operating costs as input variables. Variable costs and other operating income as a variable output. During the observation period of 1997-2003, the average efficiency of Islamic banks in Malaysia as a whole continue to increase. This study illustrates that the average efficiency of Islamic banks (BUS) is relatively better than conventional banks to open services Sharia (UUS).
  5. Priyonggo Suseno (2008); This research study aims to measure and analyze the efficiency and the relationship between the level of efficiency and economies of scale in Islamic banking in Indonesia during the years 2000-2004 (the study of the 10 Islamic banks). The variables used are cost-sharing, other expenses and total assets as an input, while the variable-sharing revenues, other operating income and the amount of funding as the output. These results indicate the average general level of efficiency of Islamic banking in Indonesia in 2000-2004 is quite efficient, there was no significant difference between the level of limited company in Indonesia 2005-2008 period using the method Stochastic Frontier Analysis (SFA) in determining the inputoutput variables use the intermediation approach. Input variables are used in this study, namely savings and other operating expenses, while the output variables in this study that is credit and income other operations. The results of this study are: (1) the foreign bank have this level of comparison between the assets and deposits with assets with assets greater than the bank limited company, (2) credits divided limited company bank assets larger than the foreign banks, and income compared with other operational assets in foreign banks greater on the bank of the limited company, (3) bank limited company is more efficient than the bank foreign.
  4. Shamsheer Muhammad Taufiq Hasan, and Muhammad Badar Khaleq (2008); They research on comparative cost and profit efficiency of banks Islamic and conventional in 21 countries Organization of Islamic Conference (IOC) by using the SFA. This study uses a labor, fixed assets, total input and total funds as loans, earning asset others, off-balance sheet items as outputs. The results of this study There is no significant difference between the efficiency of Islamic banks with conventional Endri (2008); He examines the relative efficiency level of Islamic banking in Indonesia using the SFA. This study uses a variable input in the form of fixed assets, third party funds, and labor costs working. While the output variable in the form of financing. Results of This study is the variable input-output simultaneously have influence on the efficiency and partially the influence on the efficiency of third party funds is
  5. Rino Adi Nugroho (2011); He studied



efficiency and UUS BUS, efficiency has continued to rise from year to year and there is no level of efficiency of the banking relationship sharia with economies of scale.

6. Etty Puji Lestari (2003); This study aims to measure, analyze and compare the efficiency of conventional banks in Indonesia before and during the economic crisis (1995-1999). Variable used is the cost of labor, capital and operating costs as input, while the variable costs and savings as output. The results of this study indicate the general banking in Indonesia has decreased during the crisis with the calculation of the efficiency of the DEA. The study also revealed that foreign banks are relatively more efficient than domestic banks.

the comparative analysis of the efficiency of Islamic Banks (BUS) with Sharia (UUS) with Stochastic Frontier Approach (SFA) period (2005-2009). This study uses a variable input in the form of savings, operating costs, and operating costs other. Variable output in the form of financing. The results of this study is variable operating cost savings and have a positive influence and significantly to the financing. While the variable operating costs have a positive effect and no significant effect on the financing. In addition, the efficiency and UUS BUS no difference

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## METHODS

**Population and Sample.** Population is the sum of all the individual objects that have certain characteristics, clear and complete to be investigated. The population in this study is whether Islamic banks which include BUS registered in the Bank Indonesia in 2007-2010. The sample in this study were classified as either Islamic banks nationwide BUS registered in the Bank Indonesia in the year of observation, that in the year 2007-2010.

The criteria in the sampling include: (1) Islamic banks nationwide are consistently listed as the presenting bank's annual financial report for the period 2007-2010.; (2) Islamic banks nationwide are consistently listed as a foreign exchange bank and non-bank foreign exchange and includes a national bank or private limited company in the observation period, i.e. 2007-2010.

**Operational of Variables and Data Analysis Methods. DEA method.** Input variables used in this study is the deposit (I1), assets (I2), and the cost of labor / personnel (I3), in order to obtain a shared understanding of the concepts in this study required the following explanation:

- a. Deposits (I1) is the amount of public funds both individuals and legal entities that have been collected by Islamic banks mobilize funds through the product in units of millions of dollars. Total deposits of public funds collected are divided into several types, namely: (i) Giro Sharia, known in banking applications that run a current account with the principles and "*wadi'ah mudaraba*"; (ii) Islamic deposits, the product is there are two main principles, namely "*mudharabah mutlaqah*" and "*mudaraba muqayyadah*"; (iii) Islamic savings, the banking application known as savings products based on the principles and "*mudaraba mutlaqah wadi'ah*".



- b. Assets (I2) is the sum of total assets owned by Islamic banks is measured in millions of rupiah.
- c. Labor costs (I3) or personnel costs are salary costs, tuition fees and bank employee welfare benefits measured in millions of rupiah.

This study also uses a variable output which consists of financing and operating income. These variables are described, as follows:

- a. Financing (O1) is a product of Islamic banks in funding funds, either individual or legal entity using the contract-the contract "muamalah" in units of millions of rupiah. This variable in the application of Islamic banking products are known by-products that use the contract following the contract, namely: (i) Financing with the principle of buying and selling (*tijarah*); (ii) With the principle of lease financing (*ijara*); Financing with the principle of profit sharing (*shirkah*); (iii) Supplementary financing agreement (*hiwalah, rahn, qardh, power of attorney, kafalah, and others*).
- b. Operating Income (O2) is the result of income from operations of Islamic banks either. Operations of Islamic banks, including: (i) Revenues from the distribution of funds, namely: the income from sale of ("mudaraba", "Salam", and "istishna"), lease (*ijara*), profit sharing ("mudaraba" and "musharaka"), and; (ii) Other operating income, namely: revenue administration services, ATM services, special financing, service commissions, net income (loss) on foreign exchange transactions, online-payment system fee point.

Efficiency of the banking technique is measured by calculating the ratio between output and input. DEA will calculate banks using n inputs to produce a different output m (Miller and Noulas, 1996 in Adrian Sutawijaya and Etty Puji Lestari, 2009). Where:

$h_s$  = bank s efficiency

$m$  = bank s output is observed

$n$  = the bank s observed input

$YIS$  = amount of output  $i$  produced by the bank  $s$

$XJS$  = amount of input  $j$  used by the bank  $s$

$u_i$  = weight of output  $i$  produced by the bank  $s$

$v_j$  = weight of input  $j$  is given by the bank  $s$  and  $i$  counted from 1 to  $m$  and  $j$  count from 1 to  $n$

The equation above shows the use of one input and one output variable. Efficiency ratio ( $h_s$ ), then maximized with the constraints as follows (Adrian Sutawijaya and Etty Puji Lestari, 2009):

$$\text{memaksimumkan } h_s = \frac{\sum_{i=1}^m u_i y_{is}}{\sum_{j=1}^n v_j x_{js}} \leq 1 ; r = 1, \dots, N.$$

dimana  $u_i$  dan  $v_j \geq 0$  .....

Equation, where  $N$  represents the number of banks in the sample and  $r$  is the type of bank sampled in the study. The first inequality is clear that the ratios for other UKE not more than 1, while the second non-equation weighted non-negative (positive). The ratio will vary between 0 and 1. Bank is categorized in efficient operation, if they have the ratio close to 1 or 100 percent, whereas if the bank is close to 0 indicates that the



lower the efficiency. At the DEA, each bank can determine their respective weights and ensure that the selected of their weight will produce the best performance measure (Adrian Sutawijaya and Etty Praise Lestari, 2009).

Methods of analysis in the above equation can also be explained that the efficiency of a bank as UKE ( $n$ ). Each bank uses  $n$  type of input to produce  $m$  output type, if the  $X_j$  is the amount of input  $j$  used by the bank while  $Y_i > 0$  is the number of output  $i$  produced by the bank. Decision variables (decision variables) of these explanations is the weight that should be provided on each input and output banks.  $v_j$  is the weight given to input  $j$  by bank and  $u_i$  is the weight given to output  $i$  by the bank, so that  $v_j$  and  $u_i$  are a decision variable. The value of this variable is determined by iterating linear programs, and then formulated in a number of fractional linear program (fractional linear programs). Each bank sample will use linear programming formulation. The objective function of any fractional program linear is weighted in the ratio of output to input ratio of the weighted (weighted total output / total weighted input) from the bank (Harjum Muharam and Pusvitasari, 2007).

#### **SFA method**

1. Placement on the Bank Indonesia (PBI) is the current account balances of Islamic banks in rupiah and foreign currencies at Bank Indonesia. (Muhammad, 2004: 123).
2. Placement on Other Bank (PBL) is the investment of funds in other Islamic banks both at domestic and abroad in the form of, for example, “*Sertifikat Investasi Mudharabah Antar Bank*”, “*deposito mudharabah*”, “*tabungan mudharabah*”, “*giro wadiah*”, and “*tabungan wadiah*” intended to optimize the management funds. (Muhammad, 2004: 123).
3. Financing provided (PD) is the provision of funds and/or claims based “*mudharabah*” and / or “*musharaka*” and / or other financing on the basis of the results or sharing profit sharing.
4. Third Party Funds (TPF) is the sum of the “*deposito mudharabah*”, “*tabungan mudharabah*”, “*giro wadiah*”, Variable definitions are: (a) “*Giro Wadiah*” the withdrawal of deposits can be made at any time by issuing a check for cash or demand deposit withdrawals for transfer, while the “*giro*” or check can be used as payment on the principle of profit sharing by owner or holder of “*Giro Wadiah*”; (b) Savings deposits (“*tabungan mudharabah*”) with the principle of “*Mudaraba*” is the result of withdrawal can be done with certain agreed conditions.; (c) “*Deposito mudharabah*” is deposits on the basis of the results or profit sharing that withdrawal can only be done at certain times in accordance with the agreement.
5. The paid up capital (MDS) is the capital of banks that have effectively accepted at face value the stock. (Muhammad, 2004: 128).
6. The efficiency of Islamic banking is the ability to generate profits with the input and output has been defined and measured relative to time.

This study used the calculation of the efficiency of Islamic banks in terms of profit by using an alternative approach to profit efficiency, while the calculations using the method of approach to Stochastic Frontier Approach (SFA) to calculate the deviation of the estimated profit function with profit its frontier in advance.

In the alternative approach to bank profit efficiency will maximize profits by choosing output prices ( $y$ ) and the number of inputs ( $X$ ), for a number of output ( $Y$ ) and input prices



( $r$ ) which has been set. The corresponding indirect profit function is referred to as alternative indirect profit function which is a solution of the following optimization problem: (Astiyah Siti and Jardine A. Husman, 2006; 535).

$$MAX\pi = PQ = (p,r)(y,-x)$$

In line with this discussion above, suppose the alternative profit function as follows:

$$\log\pi = f(x, y) + \log u + \log v$$

Dimana :

$\pi$  = laba atau efisiensi

$x$  = jumlah input

$y$  = jumlah output

$u$  dan  $v$  = error

Then the alternative profit efficiency can be written as follows:

$$\pi_{Alt}EFF_n = \frac{\hat{\pi}_n}{\hat{\pi}_{max}} = \frac{\exp[\hat{f}_\pi(x^n, y^n) + \log(\hat{u}_{\pi_n})]}{\exp[\hat{f}_\pi(x^n, y^n) + \log(\hat{u}_{\pi_{max}})]} = \frac{\hat{u}_{\pi_n}}{\hat{u}_{\pi_{max}}}$$

## RESULTS AND DISCUSSION

**DEA method.** Based on calculations using the DEA method assuming Constant Return to Scale (CRS) with DEAWIN software, can be seen the level of technical efficiency BUS in Indonesia in table 1. The results of these calculations illustrate the achievement of value for the efficiency of each bank is very diverse.

BUS is not yet reached the level of 100 percent technical efficiency (inefficiency) in the year 2007 include BSM (99.57 percent) and BSMI (69.79 percent), while the BUS which has reached the level of technical efficiency of 100 percent (efficient) there are only BMI. Achievement BUS DEA inefficiency in particular in 2008, occurred in BSM. BSM IS technically efficiency level of only 93.06 percent. This is in contrast to BMI and BSMI that has been efficient in that year. The following year i.e. 2009, the level of technical efficiency BSM also only reached 95.64 percent (inefficiency). This is in contrast to BMI and BSMI is still efficient as the previous year, i.e. 2008. In 2010, the number two UKE BUS increases the BRI Sharia and Bukopin Sharia. These conditions make the changes in the efficiency of the existing BUS. BUS inefficiency of BSMI (99.15 percent) and Bank Sharia Bukopin (95.47 percent), while the BUSES which has been efficiently contained BMI, BSM and BRI Sharia. Furthermore Actual, Target, To gain, and Input-Output Achieved for BUS inefficiency can be seen in appendix 1.

**SFA method.** In this study used monthly data of sharia banking in Indonesia (not including SRB) in the period January 2007 through December 2010. Stochastic approximation method with Frontier Approach (SFA) to calculate the level of efficiency on Islamic banking in Indonesia, and profit from Islamic banks are modeled to deviated of its profit efficient frontier due to random noise and inefficiency. While the determination of input and output using the approach of Value Added Approach.



In this study, the efficiency of Islamic banks are based on the ability of Islamic banks generate profit (profit) of the input and output are used, thus the term profit or efficiency in this study is to have the same meaning. While the output (Y) used in this study is the placement of the Bank Indonesia, placements with other banks, financing provided. While the input (X) that is used is the Third Party Funds (TPF consists of “depostio wadiah, “tabungan mudaraba”, dan “deposito mudharabah”), and paid-up capital. With regression for SFA models are formulated as follows:

$$\log \pi_i = f(\log X_i, \log Y_i) + e_i$$

Meanwhile for the calculation of efficiency, researchers are using alternative profit efficiency approach is formulated as follows:

$$\pi_{All}EFF_n = \frac{\hat{\pi}_n}{\hat{\pi}_{max}} = \frac{\exp[\hat{f}_\pi(x^n, y^n) + \log(\hat{u}_{\pi_n})]}{\exp[\hat{f}_\pi(x^n, y^n) + \log(\hat{u}_{\pi_{max}})]} = \frac{\hat{e}_n}{\hat{e}_{max}}$$

By entering the input variables and output variables that have been specified into the regression model, SFA equation can be rewritten as:

$$\log LR = \beta_0 + \beta_1 \log DPK + \beta_2 \log MDS + \beta_3 \log PBI + \beta_4 \log PBL + \beta_5 \log PD + e_i$$

- LR = Profit or loss of banking
- DPK = third parties fund, that consist of “Giro Wadiah”, “Tabungan Mudharabah”, “Deposito Mudharabah”
- MDS = Paid In Capital
- PBI = Placement on Bank Indonesia
- PBL = Placement on other bank
- PD = Funding to third party or financing provided

Regression estimation results can be seen in appendix 2, so the regression equation is as follows:

$$\log (LR) = 4.5911 + 1.9604 \log (DPK) - 1.9961 \log (MDS) + 0.7186 \log (PBI) - 0.0529 \log (PBL) + 2.871 \log (PD)$$

In the regression equation above, the LR is constant at 4.5911. This means that if the input variables and output variables (deposits, paid-in capital, placements on Bank Indonesia, placements on other banks, financing granted) was constant (fixed or considered to be 1), the Islamic banking will have a profit of 39003.1785 billion ( anti log 4.5911 = 39003.17845). Anti-log equation then becomes:

$$LR = 39003,1785(DPK)^{-1,9064}(MDS)^{-1,9961}(PBI)^{0,7186}(PBL)^{-0,0529}(PD)^{2,8271}$$

Next through the following equation

$$\pi_{All}EFF_n = \frac{\hat{\pi}_n}{\hat{\pi}_{max}} = \frac{\hat{f}(LR) + \log(\hat{e}_{\pi_n})}{\hat{f}(LR) + \log(\hat{e}_{\pi_{max}})} = \frac{\hat{e}_{\pi_n}}{\hat{e}_{\pi_{max}}}$$

The efficiency of banks will shows on table is as follows table 2 :

According to the above table, it can be seen that in general the average efficiency of Islamic banking has increased annually



## CONCLUSIONS AND RECOMMENDATIONS

**Conclusion.** (1) According to calculations from DEA, Islamic banks are experiencing inefficiencies and BSMI BSM in 2007, BSM in 2008, BSM in 2009, and BSMI and Bank Sharia Bukopin in 2010. Inefficiency of input variables (deposits, assets and labor costs). Input inefficiency savings and assets do not occur every year, while the labor cost of inefficiency is experienced every year. (2) According to the SFA method, During the study period of Islamic banking in Indonesia has experienced an average total efficiency of 94.37% per year. With an average efficiency rate of degradation in the year 2010 amounting to 98.29% and the lowest occurred in 2007 in the amount of 90.12%.

**Suggestion.** (1) Through DEA methods, policies related to input inefficiency is to allocate the excess savings deposits input to the input of total assets, especially assets that are productive. This method can be carried out by Islamic banks to increase the amount of funds / financing (such as sale and purchase financing, leasing, profit sharing, etc.) to the community. Further inefficiency attempt to do is first, an increasing number of financing (product innovation) and the cost of services related to input savings. Second, the larger portion of the amount of productive assets from total assets to increase the amount of additional financing and operating income consists of revenues and other operating funds. Third, improving the quality of human resources for the increase in operating income, as it relates to labor productivity in managing existing input (certain) to produce the maximum output. (2) Through the SFA method, to obtain maximum profits should further improve the financing provided and placements with Bank Indonesia as it also affects the profits of sharia banking in Indonesia and reduce third-party funds, paid-up capital, and placements with other banks.

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