The Analysis of the Efficiency of BPR-S: Production Function Approach Vs Financial Ratios Approach

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Abstract

Indonesia has long history of microfinance (MFI) services in both rural and urban areas. Access to financial services has allowed many low-income families to make significant progress in their own efforts to escape poverty. The government supports the growth of MFI services through many instruments, such as regulations, subsidy, and directed credit policies. Currently, there are two broad classification of microfinance institutions in Indonesia, i.e., bank-MFIs such as BRI’s Unit Desa and rural banks (Bank Perkreditan Rakyat-BPR), and non-bank MFIs such as credit cooperatives (Koperasi), Islamic microfinance (such as Baitul Maal wat Tamwil, BMT), rotary-club saving (arisan), etc. As a business unit, the MFIs must follow the principle of efficiency to survive. The objective of this study is to evaluate the efficiency of one type of the MFI in Indonesia, namely Syariah rural banks (BPR-S). The common approach to measure the level of efficiency of a business unit used by management is financial approach, such as ratio of operating expenses to operating income. However, economists normally use production function approach or its derivation to measure the efficiency. We are comparing the two approaches to evaluate the efficiency levels of the BPR-S. The results show that the efficiency levels of the BPR-S are generally operating in a good efficiency. Efficiently ratios of BPR-S during the sample period of time have been mostly above 90%. The efficiency based on the financial ratios confirms the finding from the production function approach.

Keywords: BPR-S; islamic-rural bank; stochastic production function; technical efficiency, financial ratio based-efficiency

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1. Background

Indonesia has a long history of microfinance (MFI) services in both rural and urban areas. Access to financial services has allowed many low-income families to make significant progress in their own efforts to escape poverty. Currently, there are two broad classifications of microfinance institutions in Indonesia, i.e., bank-MFIs such as BRI’s Unit Desa and rural banks (Bank Perkreditan Rakyat-BPR), and non-bank MFIs such as credit cooperatives (Koperasi), Islamic microfinance (such as Baitul Maal wat Tamwil, BMT), rotary-club saving (arisan), etc.

According to Law No.10/1998, the BPR is a bank conducting conventional or syariah-based activities and does not provide services in the payment mechanism system. BPRs are not allowed to receive demand deposit. Like other banks, the BPR function as financial intermediaries from the surplus of fund unit in the economy to the shortage of fund unit. The target market is low-income people, micro and small enterprises. The mission of government to establish the BPR is a tool to develop rural or lack-behind areas and as a tool to alleviate poverty.

This paper focuses on BPR-Syariah (BPR-S), one type of rural banks (Bank Perkreditan Rakyat-BPR). The BPR are mainly located in sub-district areas. The market segment of the rural bank is shared with several formal banks, especially BRI unit and other banks offering microcredit. As of January 2013, the BPR have distributed fund to debtors only about 1.5% of all fund distributed by the banking system (i.e., Rp 4,199,332 billion), but in terms of number of bank, the BPR comprise of 93% of number of bank in total, which was 1,773 units (BI 2013b). Within the BPR segment, BPR-Syariah still takes a small portion in collecting depositor funds, which was only Rp 2,984 billion compared to Rp 45,152 billion collected by conventional BPR (BI 2013a, 2013c).

The government supports the growth of MFI (including BPR-S) services through many instruments, such as regulations, subsidy, and directed credit policies. However, as a business unit, the BPR-S must follow the principle of efficiency to survive. The BPR-S have to keep its operating cost for a given activities. To compete in highly competitive atmosphere, efficiency is very important and not only for commercial (conservative) banks but also for the BPR-S. They must be competitive, grow and be able to contribute more optimally to national development. As a business entity, the BPR-S are required to always work efficiently to compete with other BPR-S and conservative BPR. In addition, the BPR-S loan officers have to select good potential debtors to avoid a large portion of non-performing loan (NPL). The problem of loan is an important issue facing management of the BPR-S in order to avoid bankruptcy.

Both efficiency and NPL are two important issues in the literature of bank survival. According to Berger (1997) that failing institutions have large proportions of nonperforming loans prior to failure and the average institution incurs high costs and generates low profits relative to institutions on the 'best-practice' efficient frontier. While the former applies financial ratio approach, the latter applies the production or cost function approach. Theoretically, the use of production or cost function approach is better to estimate efficiency of a firm. According to Bauer et al. (1998) for regulatory purposes or most other purposes, the frontier efficiency is superior to the standard financial ratios from accounting statements - such as return on assets (ROA) or the cost/revenue ratio. This is because frontier efficiency measures try to remove the effects of differences in many exogenous factors affecting the standard financial ratios.

On the other hand, accounting-based efficiency is easy to calculate and understand. In the case of some commercial banks in Indonesia, there are no evidence of disagreement on efficiency between financial ratio measures and production/cost function approach (Septrina W. 2007).

The objective of this study is to evaluate the efficiency of BPR-S. We are comparing the two approaches to evaluate the efficiency levels of the BPR-S. That is, economic-based measures (stochastic production function) and accounting-based (financial ratios) efficiency.

2. The Concept of Efficiency: Production Function

A production process is technically efficient if it is producing as much output as possible it possibly can given the amount of input it employs (Besanko and Braeutigam 2008, p.187). Figure 1 shows the technical efficiency and inefficiency. At point C and D, the firm is technically efficient. It is producing as much output as it can with a production function \( Q=f(L) \) given the quantity of labor it employs. However, at point A and B, the firm is technically inefficient since it producing output less than the maximum output it possibly can produce. In practice,
the maximum output a firm can produce is benchmarked to the best practice firm within an industry. When a firm is operating at the best practice level, it is said to be 100% technically efficient. If it is operating below the best practice levels, then the firm is technically inefficient. The technical efficiency is expressed as a percentage of the best practice.

Managerial experiences, scale of production, and the degree of competition may have effects on technical efficiency. This efficiency is based on technical (engineering) relationships and on input prices or cost of production.

A production process could be technically efficient, but not allocative efficient, which refer to the least cost input combination. That is, the use of combination of input in such a way so that the cost of hiring inputs is at the minimum level.

Figure 2 depicts the two concepts of efficiency. Following Farrell (1957), a production process employs two inputs (x1 and x2) to produce a single output (y), under an assumption of constant returns to scale. Curve SS’ is an isoquant representing a fully technical efficient firm producing a given output y. Points along the curve indicates the minimum amount of combination of the two inputs required to produce the known level of output y. The isoquant is also known as efficient frontier (Bhagavath 2006). A smooth isoquant represent theoretical best engineering
practice, where a firm is able to gradually change the input combinations given current technology. Line AA’ is an isocost representing combination of the use of input resulting in the same level of cost. The closer isocost to the origin, the lower the cost in producing a target of output level. The least input combination (or allocative efficiency) is indicated by point Q’ where the isocost tangent of the isoquant. As an isoquant also represent the fully technical efficiency to produce a target production level, it means it is also the locus of technical efficiency. At this point both technical and allocative efficiencies are attained.

Suppose that to produce a given output indicated by isoquant SS’, a firm use the combination of point Q. this point result in technically efficient but not allocative efficient since the isocost to to hire the inputs at this point are higher (further away from the origin).

How to measure the efficiency or inefficiency? To answer this, we follow Farrell (1957). Again, suppose that to produce a given output level indicated by isoquant SS’ (technically efficient firm), a firm use the combination of point Q. The combination of inputs used in this point is the same ratio as the combination at point Q or R. It can be seen that the firm produces the same output as Q, but using more inputs. Thus, the technical inefficiency of the firm could be represented by the distance QP, which is the amount by which the two inputs could be proportionally reduced without a reduction in output. The distance is usually expressed in percentage terms by the ratio QP/OP. This represents the percentage by which all inputs could be reduced. The technical efficiency (TE) of a firm is most commonly measured by the ratio TE=OQ/OP, which is equal to one minus QP/OP. It takes a value between zero and one. A value of one indicates the firm is fully technically efficient and value of zero indicates fully technically inefficient. For example, the point Q is fully technically efficient and the value of technical efficiency is unity or 100 per cent because one minus QP/OP, which takes a value of zero, is unity or 100 per cent. Moreover, so long as SS’ has a negative slope, an increase in the input per unit output of one input will, ceteris paribus, imply lower technical efficiency.

These efficiency measures mentioned above are based on the assumption that the efficient production function is known. Thus, the problem is now how to estimate an efficient production function from a sample or observed inputs and outputs data. In other words, how to estimate an efficient production function or an isoquant from a scatter diagram. The use of a regression technique using ordinary least square is not appropriate since the regression is basically an average of data in the sample. This means efficiency of a firm is compared with the average efficiency. This is not suitable because the benchmark should be the best practice firm. According to Aigner et al. (1977) this technique had been used by economist for long time before the work of Farrel (1957). This led to a frontier approach to approximate the best practice in the sample (Bhagavath 2006). There two techniques used to estimate the frontiers (Aigner and Chu 1968; Aigner, Lovell, and Schmidt 1977; Charnes, Cooper, and Rhodes 1978), i.e., Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA).

The differences between the two approaches are (Costantin, Martin, and Y Ribera 2009):
- The SFA approach uses an econometric technique and the DEA uses a linear programming technique,
- The SFA has a stochastic frontier with a probability distribution, while DEA has a non-stochastic (deterministic) frontier,
- SFA has one output, or an a priori weighted average of multiple outputs, while DEA often has more than one output, no a priori weights, but assumes input-output separability.

3. The Concept of Efficiency: Financial Ratios

Like other banks, the BPR has evolved in funding and lending activities. This is of great importance in improving the livelihood of low income group. This causes many researcher, policy makers, and practitioners view that banks are “special” and therefore banks may deserve a “unique” regulatory treatment (Carletti, Hartmann, and Ongena 2007; Goodhart et al. 1998). Financial institutions (especially in banking) are attempting to promote financial stability and economic development to adopt and then implement appropriate regulations and supervisory practices for their financial sectors. As a intermediaries institution, banks receive much monitoring intervention from public that tends to bring about cautious or even negative attitudes towards competition in this sector (Hellmann, Murdock, and Stiglitz 2000; Keeley 1990).

BPR or banks in general play important role to the economy of a country as it serves as an intermediation between the households and the economy or finance sector. Therefore, the best financial system is that which the
mediator performs efficiently. The need for scale efficiency, fee income, balance sheet and capital strength and deposit liquidity further powers the shift to consolidate, to capitalize on combined market coverage, talent and benefits of scale. Higher competition and consolidation generally makes banking industry are in better pricing, cheaper cost of funds as well as product reach.

Up to now, the discussion of efficiency is taken from production function literature. However, there is another strand of literature on efficiency using financial ratios based on a financial statement or comparing the two approaches (see for example, Bauer et al. 1998; Rhoades 1998; Sathye 2003).

Financial ratios are other tools to analyze efficiency. The ratios are based on accounting measurement. Financial ratios is a time-tested method of analyzing a business, including bank. Investors, bank loan officers and owners use financial ratio analysis to learn more about a company’s financial health as well as its potential.

They are easy to understand and generally accepted in reflecting the financial performance of banks. Each financial ratio plays different roles in explaining different information with regard to the performance and financial condition of banks. Financial ratios examine the current performance in comparison to past periods of time, from the prior quarter to years ago. Company’s problem can be detected from the ratios. By comparing the financial ratios, one is not only to report a bank performance, but he/she also to deliver supplementary information such as which bank has better performance than others. Comparisons of financial ratio are intended to light on how well a bank is achieving its objectives. In spite of certain limitations, financial ratios are still considered as a convenient and reliable analytical tool. Ratio analysis, being a time-tested technique, is most frequently employed in all financial decision-making processes.

In banking industry, cost efficiency is often measured by using a cost to income ratio. Efficiency ratio is a ratio used to calculate a bank’s efficiency. Not all banks calculate the efficiency ratio in the same way. The ratio can be calculated one of four ways: (1) noninterest expense divided by total revenue less interest expense, (2) noninterest expense divided by net interest income before provision for loan losses, (3) noninterest expense divided by revenue, (4) operating expenses divided by fee income plus tax equivalent net interest income. In all four methods, an increase means the company is losing a larger percentage of its income to expenses. If the efficiency ratio is getting lower, it is good for the bank and its shareholders. Also referred to as the overhead burden or overhead efficiency ratio.

Regardless of which ratio calculation method is used, the efficiency ratio's purpose is to evaluate the overhead structure of a financial institution. Banking is no different from any other industry, i.e., banks have to keep their costs down to survive. The efficiency ratio measures how effectively a bank is operating and how profitable it is. According to Bank of Indonesia, the efficiency ratio can be measured by, namely, BOPO† ratio. That is:

\[
BOPO = \frac{\text{Non - Interest Expense}}{\text{Net Interest Income} + \text{Non - Interest Income}}
\]  

BOPO ratio measures the cost spending per generated rupiah’s income. That is, how expensive the bank for producing one unit of income. The higher the BOPO ratio, the higher the cost for generating one unit of income. This means higher BOPO ratio indicates a lower efficiency of the bank (Putri and Lukviarman 2008). Other things being equal, a decrease in the efficiency ratio is viewed as a positive while a rising efficiency ratio is generally undesirable. The efficiency ratio might rise temporarily when a bank expands facilities.

Other efficiency ratio is Bank Non-Performing Loans (NPL), which is the value of bank non performing loans divided by the total loan. In BPR-S this term is known as Non-Performing Funds (NPF hereafter). NPL or NPF refer to those financial assets from which banks no longer receive interest or installment payments as scheduled. Non-performing means the loan ceases to perform or to generate income for the bank. The higher the NPF, the lower the income generated by a bank. Thus, higher NPF potentially reduces the efficiency of a bank.

† BOPO stands for Biaya Operasional per Pendapatan Operasional (operation cost to operating income ratio)
4. The Methods to Estimate the Efficiency

To estimate the technical efficiency, we use the frontier Cobb-Douglas production function. Usually the frontier is applied to cross-section data or panel data. This means the frontier is applied to capture production process of many firms. By applying a production function, one assumes that the technology used in these firms is similar or identical. The estimated frontier production function is to seek the technical efficiency of a firm compared to the most efficient firm in the sample data. In this paper we apply it in time series data of and industry, i.e., the BPR-S. This also assumes that all BPR-S applies an identical technology in production process. The estimated frontier production function is to seek the technical efficiency of the BPR-S in a certain point of time compared to the time at which the BPR-S achieve the most efficient production process. A Cobb-Douglass production function is in the form of (Belotti et al. 2012; STATA 2013):

\[ y_t = A k_t^{\beta_k} l_t^{\beta_l} \]  

(2)

Where \( y \) is output, \( k \) and \( l \) are capital and labor respectively. Stochastic frontier analysis assumes that a firm potentially produces less than it might due to a degree of inefficiency. Specifically,

\[ y_t = A k_t^{\beta_k} l_t^{\beta_l} \varepsilon_t \]  

(3)

where \( \varepsilon_t \) is the level of efficiency of a firm at time \( t \); the value of \( \varepsilon_t \) ranges from 0 to 1, i.e., \( 0;1 \]. If \( \varepsilon_t = 1 \), a firm is achieving the optimal output with the technology embodied in the production function \( y_t = A k_t^{\beta_k} l_t^{\beta_l} \). When \( \varepsilon_t \) is less than 1, the firm is not making the most of the inputs given the technology embodied in the production function. Because the output is assumed to be strictly positive (that is, \( q_i > 0 \)), the degree of technical efficiency is assumed to be strictly positive (that is, \( \varepsilon_t > 0 \)).

Output is also assumed to be subject to random shocks, implying that: \( y_t = A k_t^{\beta_k} l_t^{\beta_l} \varepsilon_t \exp(v_t) \), taking natural log of the equation:

\[ \ln y_t = \ln A + \beta_k \ln k_t + \beta_l \ln l_t + \ln(\varepsilon_t) - v_t; \text{ and define } \ln(\varepsilon_t) = -u_t, \text{ to get:} \]

\[ \ln y_t = \ln A + \beta_k \ln k_t + \beta_l \ln l_t + v_t - u_t. \]  

(4)

The last equation is stochastic frontier Cobb-Douglass production function used in the estimation. The frontiers consist of two error component, i.e., random shocks and inefficiency components. The frontier estimation reduces to OLS estimation if the inefficiency components are not significantly different from zero. \( \ln y_t \) is natural logarithm of output, which is approximated by credit disbursed by BPR-S, \( \ln k_t \) is natural logarithm of capital, and \( \ln l_t \) is natural logarithm of labor. Subscript \( t \) refers to time. The credit and the capital are in constant price January 2009, i.e., adjusted by CPI. Labor is number of employee working at the BPR-S. All data are taken from the website of Bank Indonesia (BI 2013c). \( v_t \) is a random variable and is assumed to be an iid (identically independently distributed), \( N(0, \sigma_v^2) \), and independent from \( u_t \), which is a non-negative random and is assumed to be independently half-normal distribution, \( N^+(0, \sigma_u^2) \). This term is assumed to indicate a technical inefficiency of a production process.
Based on the frontier production function, the technical efficiency is estimated by a formula: \( \exp(-u_t) \) (Battese, Coelli, and Colby 1989; Tasman 2008). Meanwhile, the efficiency based on financial ratio is approximated by BOPO equation formulated in the previous section.

5. Results and analysis

Frontiers estimation indicates that inefficiency components of the errors are significantly different from zero at 10% level. This means we can use the frontier estimates for further analyses. The followings are discussion on the efficiency results. The results show that the BPR-S has been generally operating in a good efficiency. The efficiency levels during the sample period have been mostly above 90%. Only within two months that the efficiency levels below 90% (Figure 3). This is actually a promising performance of the BPR-S. This finding is in line with the general performance of conventional BPR. According to Lapenu (1998), the efficiency performance of the BPR in general is promising. From the outset, in general, the BPR were known for offering convenient services. Some of them offering mobile loan officers whose jobs are to visit the clients. Although their efficiency was relatively low compared to BRI village units, they are improving the efficiency very quickly.

There is an interesting trend of the efficiency. The pattern of efficiency during the sample time period was improving during first half period and achieving the maximum level of efficiency and declining afterward. Some factors might have impacts on declining efficiency is competition among firms within an industry. As written in (Besanko and Braeutigam 2008, p.188), (Caves and Barton 1990) shows that a pressure of competition – whether from imports or other firms in the industry- tends to induce firm to move closer to the boundaries of their production sets. However, as the data in BPR industry shows that the numbers of the banks keep increasing during the sample time period, which means the competition increased, we conclude that the decreasing efficiency starting from June 2011 was not from the competition factors. We tried to explain the efficiency pattern from expenditure of training for employees. We found that the training has no impact of the efficiency pattern. We will back to this issue when discussing non-performing funds.

We turn to efficiency based on financial ratios. Figure 4 (Panel A) shows an impressive description of BPR-S efficiency indicated by BOPO ratios, which has been ranged from 75 percent to 80 percent. The range is far below the maximum point indicated by Bank of Indonesia (BI). According to BI (2012), i.e., Regulation No.: 14/26/PBI/2012 on Multiple Licensing, issued on 27 December 2012, the size of BPR-S is under Category 1 and the
BOPO ratio is set at the maximum of 85%. This result confirms the finding from the frontier analysis in previous paragraphs. BOPO ratio decrease (from 77% in 2009 to 75% in 2010 then increased to more than 80% in 2012. Other things being equal, a decrease in the efficiency ratio is viewed as a positive while a rising efficiency ratio is generally undesirable. The rise in the BOPO ratio is as a result of cost inefficiency levels.

![Fig.4 (a) Efficiency of the BPR-S: BOPO](image)

The pattern of BOPO is curving with a minimum point in roughly the middle of the sample time period. The pattern indicates a rise in efficiency ratio, then achieving a best point before it gets worse. This pattern is identical with the pattern of efficiency based on production function analysis.

The BOPO ratios for conventional large size of banks are normally about 60 – 65 per cent. Compared to this, the BOPO ratios for the BPR-S are relatively high. This should not surprisingly as BPR-S are small size of bank. In addition, the BPR-S face high costs than conventional banks. In order to achieve Shariah compliance the BPR-S might incur high salaries for maintaining a Shariah board, high legal costs, higher complexity of Islamic products, the legal ramifications for compliance of Islamic financial products, and economic scale. As we know, BPR-S are new products of banks in Indonesia.

The NPF of the BPR-S also indicates a good sign of efficiency level. During the sample period of time, the NPF keeps decreasing although with a declining rate. This could be one source of the pattern of efficiency mentioned above. When the decline in NPF is flatter, the rise in efficiency is also flatter and it could be declining. We did a regression analysis with efficiency level is set as a dependent variable and NPF as an explanatory variable. The result shows NPF has significantly impact on the efficiency level. This result is in line with (Berger and De Young 1997) saying that Non-performing loans (NPL) is an indicator for efficiency problem in the future.
5. Concluding Remarks

- Based on the production function approach, the results show that the BPR-S has been generally operating in a good efficiency. Efficiently ratios of BPR-S during the sample period of time have been mostly above 90%, which means a promising performance of the BPR-S.
- The pattern of efficiency shows increasing pattern in first half period and achieving the maximum level of efficiency and declining afterward. Normally, competition factors have positive impact on efficiency. However, these factors could not explain the slowdown of efficiency at the second part of sample period. Nor, the expenditure of training for employees could explain the efficiency. A regression analysis with efficiency level is set as a dependent variable and NPF as an explanatory variable shows NPF has significantly impact on the efficiency level.
- Fortunately, the results based on BOPO (operating cost to operating income ratio) also shows impressive description of BPR-S efficiency. This confirms the finding of frontier production function analysis.
- The NPF (Non-performing funds) of the BPR-S also indicates a good sign of efficiency level. During the sample period of time, the NPF keeps decreasing although with a declining rate. NPF has significantly impact on the efficiency level.
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