The Ar-Rahnu Efficiency and its Determinants

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Abstract

The objective of this paper is to measure the efficiency of ar-rahnu and determin its efficiency. We use Data Envelopment Analysis (DEA) method to estimate ar-rahnu efficiency and Tobit model to determin the ar-rahnu efficinecy. We use three different types of DEA model which are technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE) Model. The efficiency of ar-rahnu is measured from the secondary data for 2006 across several ar-rahnu operators including Bank Rakyat, Permodalan Kelantan Berhad (PKB), Muasasah Gadaian Islam Terengganu (MGIT) and Co-operatives under Yayasan Pembangunan Ekonomi Islam Malaysia (YaPEIM). Based on the efficiency score, we find that PTE result is the highest than the other two models. Furthermore, most of the ar-rahnu branches operate in increasing return to scale which imply that most of them can improve their performance by increasing their inputs. While, variables that affect ar-rahnu efficiency found from this empirical study are loan-share, subsidized program, regulation, group, financial self-sufficiency and productivity.

JEL classification:
Keywords: microfinance institutions, efficiency score, data envelopment analysis (DEA), Tobit Model, subsidized program
1. Introduction

As an informal financial institution, pawnshops play an important role in providing funds especially for those who have difficulties in obtaining funds from the formal financial institutions. The establishment of the two types of pawnshop (i.e., conventional and Islamic pawnshop) in Malaysia contributes benefit to the society and potential for micro-enterprises development. In this paper we only concentrate on Islamic pawnshop (ar-rahnu) operated by Yayasan Pembangunan Ekonomi Islam Malaysia (YaPEIM) co-operative, Mu’assasah Gadaian Islam Terengganu (MGIT), Permodalan Kelantan Berhad (PKB) and Bank Rakyat. It constitutes alternative providers of financing which also reduces the debt burden of society. Nevertheless, the competition from ar-rahnu in providing and distributing funds to the society cannot be avoided. Thus, it is an important issue for ar-rahnu to operate efficiently in order to serve the society.

Efficiency issue in ar-rahnu is very important to be highlighted because of three reasons. First, until now no similar studies on relative efficiency of ar-rahnu have been done. Ar-rahnu was established less than 15 years ago as compared to conventional pawnshops that have existed more than 100 years. In 2003, after 10 years of operation, there were 147 ar-rahnu branches to serve the 1.22 million cumulative customers, whereas there were 242 conventional pawnshop branches in the same year (Mohd Arshad, 2004). The drastic increase in the number of ar-rahnu branches has raised an interesting question on whether the increase was due to the sustainability issue or subsidized program issue. Since ar-rahnu is an alternative to conventional pawnshop and its operation follows the shari’ah principles, a research should be done to see how efficient the ar-rahnu is. Ar-rahnu has to be efficient to ensure that it can be sustained.

Second, in managing the ar-rahnu, subsidies were given by the federal and state governments for them to start up their businesses. Several earlier researches expected that subsidized businesses are not efficient. So, this gives us a reason to find out and evaluate the efficiency of ar-rahnu and to determine whether ar-rahnu is more efficient with subsidy or without subsidy.

Third, we intend to look at the factors that affect the efficiency of ar-rahnu. It is very important to look at the factors because it will give us an idea and also to prove why some ar-rahnu branches are more efficient than others. In this research we want to see whether subsidies are important in running the ar-rahnu. We consider several factors as explanatory variables such as market power that reflect the institutions’ image, regulation, financial self-sufficiency and productivity. Hence, the level of ar-rahnu efficiency and the analysis of its determinants will be an interest to the stakeholders such as customers-members, ar-rahnu branch managers, local communities and ar-rahnu regulators (i.e.: Cooperative Development Department and YaPEIM).
Therefore, the aim of this study is to measure efficiency of ar-rahnu branches and this study will extend the existing research in finding out the determinants of ar-rahnu efficiency. Having measured the relative efficiencies, it is also of considerable interest to us to explain the DEA efficiency scores by investigating the determinants of the efficiency and hope that the result will guide the policy makers aimed at improving their performance.

The remaining discussion of this paper will be divided into three sections. The following section will discuss on the empirical methods. Then, section three will produce the results. Section 4 provides the conclusions.

2. The Empirical Method

To construct the efficiency model for ar-rahnu and it involves two steps. The first step is to estimate the efficiency. The second step is to find the factors that affect the efficiency. In recent years, many DEA applications employ a two-step procedure involving both DEA and Tobit. For example, in health and public studies, Luoma et. al (1996) and Chilingerian (1995) conducted both the DEA and Tobit analyses in health sector application; Viitala and Hanninen (1998) for the public forestry organizations in Finland; Kirjavainen and Loikkanen (1998) for Finnish senior secondary schools. There are also studies in banking using both steps in early 2000, for example, by Jackson (2000) evaluated the technical efficiency of Turkish commercial banks; Souza et. al (2003) measured technical efficiency to assess the significance of technical effects for Brazilian banks; Stavarek (2003) estimated commercial banks’ efficiency in Visegrad; Chang and Chiu (2006) investigated the bank efficiency index and efficiency effects incorporated into account credit and market risk for Taiwan’s banking industry. The main objectives of this study are to measure efficiency and find out the determinants of ar-rahnu efficiency. We will use both, the DEA and Tobit model to achieve the objectives.

Many studies have used data envelopment analysis (DEA) to evaluate the efficiency of financial institutions due to several reasons. Among the reasons are: Park and De (2004) revealed that DEA is the most important approach to measure efficiency. Furthermore, according to Krivonoshko et al. (2002), DEA is a powerful approach to efficiency investigation of production units. Ar-rahnu is the financial institution that is defined as a producer of services for account holder that is to perform transactions on deposits accounts and process document such as loan. Ar-rahnu is a production unit by producing small loan to the customer. Jemric and Vujcic (2002) revealed that the main advantage of DEA is that, unlike the regression analysis, it does not require a prior assumption about the analytical form of the production function. Instead, it constructs the best practice production function solely on the basis of observed data and therefore it is not possible to make mistake in specifying the production technology.

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1 For example; Luo (2003), Soteriou and Zenios (1999), Ataullah et al., (2004), Jemric and Vujcic (2002). Periera (2002) used DEA to evaluate the efficiency (financial and operational) of microfinance institutions and he concluded that DEA can be powerful instrument to operate in microfinance industry, whether in operation, deregulatory bodies or the financial institutions.
2.1 Data Envelopment Analysis

In the following discussion, we will discuss the standard estimation of efficiency. The standard estimation of efficiency can be divided into two; Charnes-Cooper-Rhodes Model (CCR model) and the Banker-Charnes-Cooper Model (BCC model). Both models allow the technical efficiency (TE) to be decomposed into two collectively exhaustive components: pure technical efficiency (PTE) and scale efficiency (SE) (see, Coelli (1996)).

The main difference between the two models is the treatment of return-to-scale. BCC allows for variable-return-to-scale (VRS); CCR assumes that each DMU operates with constant-return-to-scale (CRS). PTE refers to managers’ capability to utilize firms’ given resources, while SE refers to exploiting scale economies by operating at a point where the production frontier exhibits constant returns to scale (Ataullah et al., 2004). According to Luo (2003), SE can be used to determine how close a decision making unit (DMU) or operator is to the most productive scale size.

(a) Charnes-Cooper–Rhodes Model (Technical Efficiency)

Charnes, Cooper and Rhodes introduced a measure of efficiency for each DMU, which is to obtain a maximum ratio of weighted output to weighted input. The weight for the ratio is determined by a restriction that similar ratio for every DMU has to be less than or equal to unity, thus reducing multiple inputs and outputs to a single virtual input and single virtual output without requiring pre-assigned weights. The efficiency measure is then a function of weights of the virtual input-output combination. Formally the efficiency measure for DMU can be calculated by solving the following mathematical programming problem:

$$\max_{u,v} h(u,v) = \sum_{r=1}^{s} u_{r} y_{r} \cdot \sum_{i=1}^{m} v_{i} x_{i}$$

Subject to:

$$\left( \sum_{r=1}^{s} u_{r} y_{rj} - \sum_{i=1}^{m} v_{i} x_{ij} \right) \leq 1, \quad j = 1, 2, 3, \ldots, n$$

$$u_{r} \geq 0, r = 1, 2, \ldots, s \quad \text{and} \quad v_{i} \geq 0, i = 1, 2, \ldots, m$$

(1)

where $x_{ij}$ is the observed amount of inputs of $i^{th}$ type of the $j^{th}$ DMU ($x_{ij} \geq 0, i = 1, 2, \ldots, m, j = 1, 2, \ldots, n$) and $y_{rj}$ is observed amount of output of the $r^{th}$ type for the $j^{th}$ DMU ($y_{rj} \geq 0, r = 1, 2, \ldots, s, j = 1, 2, \ldots, n$).
The variable $u_r$ and $v_i$ are the weights to be determined by the above programming problem. However, this problem has an infinite number of solutions. If $(u^*, v^*)$ is optimal, the for each scalar $a$, $(au^*, av^*)$ is also optimal. Following the Charnes-Cooper transformation, one can select a representative solution $(u, v)$ for which

$$
\sum_{i=1}^{m} v_i x_{io} = 1 \tag{2}
$$

to obtain a linear programming problem that is equivalent to the linear fractional programming problem (1) – (2). The denominator in the above efficiency measure, $h_o$, is set to equal one and transformed linear problem for DMU$_o$ and can be written as:

$$
\max_{u} Z_0 = \sum_{r=1}^{s} u_r y_{ro}
$$

Subject to:

$$
\left( \sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \right) \leq 0, j = 1, 2, 3, ..., n
$$

$$
\sum_{i=1}^{m} v_i x_{io} = 1
$$

$$
u_r \geq 0, r = 1, 2, ..., s \quad \text{and} \quad v_i \geq 0, i = 1, 2, ..., m \tag{3}
$$

For the above linear programming problem, the dual for DMU$_o$ can be written as:

$$
\min_{\theta} Z_0 = \theta_0
$$

Subject to:

$$
\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{ro}, r = 1, 2, 3, ..., s
$$

$$
\left( \theta_o x_{io} - \sum_{j=1}^{n} \lambda_j x_{ij} \right) \geq 0, i = 1, 2, ..., m
$$

$$
\lambda_j \geq 0, j = 1, 2, ..., n \tag{4}
$$
Both linear problems yield the optimal solution $\theta^*$, which is the efficiency score (so-called technical efficiency) for the particular DMU. The value of $\theta$ is always less than or equal to unity, since when tested, each particular DMU is constrained by its own virtual input-output combination too. DMUs for which $\theta < 1$ are relatively inefficient and those for which $\theta^* = 1$ are relatively efficient, having their virtual input-output combination points lying on the frontier. The frontier itself consist of linear facets spanned by efficient units of data, and the resulting frontier production function, obtain with implicit constant returns-to-scale assumption, has no unknown parameters.

(b) Banker–Charnes–Cooper Model (Pure Technical Efficiency)

Since there are no constrains for the weights $\lambda_j$, other than the positively conditions in the problem (1) – (4), it implies constant returns-to-scale. To allow for variable returns-to-scale, it is necessary to add convexity condition for $\lambda_j$, i.e. to include in the model (4) the constraint:

$$\sum j=1^n \lambda_j = 1$$

The resulting DEA model is called the BCC-model. Solving the model for each DMU, the BCC-efficiency scores are obtained, with a similar interpretation for its values as in the CCR-model. These scores are also called “pure technical efficiency score”, since they are obtained from a model that allows variable-returns-to-scale and hence eliminates the “scale part’ from the analysis.

(c) Scale Efficiency

According to Wang and Huang (2005), the scale efficiency score as defined by the ratio of CCR/BCC or (TE/PTE), exhibits large difference between the two groups. Then, a DMU found to be efficient with a CCR model will also be found to be efficient for the corresponding BCC model, and a constant return-to-scale means that DMU is the most productive scale size. When a DMU exhibits decreasing return-to-scale $\left(\sum j=1^n \lambda_j > 1\right)$, it is likely that the DMU can improve its performance by decreasing its size. On the other hand, when a DMU exhibits increasing return-to-scale $\left(\sum j=1^n \lambda_j < 1\right)$, it is likely that a DMU can improve its performance by increasing its size.

2.2 Tobit Model

As defined in equations (1) to (5), the DEA score falls between the interval 0 and 1 ($0 \leq h \leq 1$), making the dependent variable a limited dependent variable. A commonly held view in previous studies is that the use of Tobit model can handle the characteristics of the distribution of efficiency measures and thus provide results that can guide policies to improve performance. DEA efficiency measures obtained in the first step are the dependent variables in the second step in Tobit Model.
The Tobit model is suggested as an appropriate multivariate statistical model in the second step in order to consider the characteristics of the distribution of efficiency measure (Grosskopf, 1996).

Tobit Model is an extension of the probit model developed by James Tobin. In the Tobit Model, there is an asymmetry between observations with positive values of Y and those with negative values. The standard Tobit model can be defined as follows, for ar-rahnu observations:

\[
Y_t = \begin{cases} 
\alpha + \beta X_t + u_t & \text{if } Y_t > 0 \text{ or } u_t > -\alpha - \beta X_t \\
0 & \text{if } Y_t \leq 0 \text{ or } u_t \leq -\alpha - \beta X_t
\end{cases}
\]  \hspace{1cm} (6)

The basic assumption behind this model is that there exists an index function \( Y_t = \alpha + \beta X_t + u_t \) for each economic agent being studied. For \( Y_t \leq 0 \), the value of the dependent variable is set to zero. If \( Y_t > 0 \), the value of the dependent variable is set to \( I_t \).

Suppose \( u \) has the normal distribution with mean zero and variance \( \sigma^2 \). We note that \( Z = u / \sigma \) is a standard normal random variable. Denote by \( f(z) \) the probability density of the standard normal variable \( Z \), and by \( F(z) \) its cumulative density – that is \( P[Z \leq z] \). Then the joint probability density for those observations for which \( Y_t \) is positive is given by the following expression:

\[
P_1 = \prod_{i=1}^{m} \frac{1}{\sigma} f \left( \frac{Y_i - \alpha - \beta X_i}{\sigma} \right)
\]  \hspace{1cm} (7)

Where \( \prod \) denotes the product and \( m \) is the number of observations in the sub-sample for which \( Y \) is positive. For the second sub-sample (of size \( n \)) for which the observation \( Y \) is zero, the random variable \( u \leq -\alpha - \beta X \). The probability for this event is

\[
P_2 = \prod_{j=1}^{n} P \left[ u_j \leq -\alpha - \beta X_j \right]
\]  \hspace{1cm} (8)

The joint probability for the entire sample is therefore given by \( L = P_1P_2 \). Since this equation is nonlinear in \( \alpha \) and \( \beta \), the OLS procedure is inappropriate. The procedure for obtaining estimates of \( \alpha \) and \( \beta \) is to maximize \( L \) with respect to the parameters. This is the maximum likelihood procedure described.

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2 In a Tobit model, if assumption of \( u \) fail, then it is hard to know what the Tobit Maximum Likelihood Estimator (MLE) estimates.
Based on Wooldridge 2003, the likelihood ratio (LR) test is based on the concept as the F test in a linear model. The LR test is based on the difference in the log-likelihood functions for the unrestricted and restricted models.

The likelihood ratio statistic is twice the difference in the log-likelihoods:

\[ LR = 2(\ell_{ur} - \ell_r) \]  

where \( \ell_{ur} \) is the log-likelihood value for the unrestricted model and \( \ell_r \) is the log-likelihood value for the restricted model. Because \( \ell_{ur} > \ell_u \), LR is nonnegative and usually strictly positive. The multiplication by two in the (19) is needed so that LR has an approximate chi-square distribution under Ho. If we are testing \( q \) exclusion restrictions, \( LR \sim \chi^2_q \).

This means that, to test Ho at the 5% level, we use as our critical value at the 95th percentile in the \( \chi^2_q \) distribution. However, in the following discussion we will identify what are the factors effecting ar-rahnu efficiency.

With the efficiency measurement discussed above, it will provide efficiency index for every ar-rahnu branch. By measuring every ar-rahnu branch efficiency level, we have to find out what are the factors that affect their efficiency to ensure that those factors can help the branches in getting the right solution to improve their efficiency.

There are many factors that can affect efficiency based on the several case studies on the banking system. The factors mentioned in past studies are bank size (Rivas, Casu and Molyneux, 1998; Jackson and Fethi, 2000; Souza et al, 2003; Stavarek, 2003; Chang and Chiu, 2006), bank controlled by public or private (Souza et al, 2003; Jackson and Fethi, 2000, Stavarek, 2003; Chang and Chiu, 2006), market power or competitive conditions (Rivas, Casu and Molyneux, 1998; Chang and Chiu, 2006), equity ratio adequacy (Casu and Molyneux, 1998; Rivas, Casu and Molyneux, 1998; Stavarek, 2003); bank origin (Souza et al, 2003; Stavarek, 2003); return on average equity and country origin (Casu and Molyneux, 1998; Stavarek, 2003). Other factors that affect efficiency such as non performing loan, capital adequacy ratio, bank type, experience and other factors are also listed in the table below. Business of ar-rahnu is similar to the banking business where they provide business service to the customer. In ar-rahnu business, there are many factors that affect ar-rahnu efficiency due to the special characteristic of ar-rahnu in Malaysia. As discussed earlier, there are five (5) categories of ar-rahnu in Malaysia; Co-operative under YaPEIM, Banking Institutions like Bank Rakyat (BR) and Agriculture Bank of Malaysia (BPM), others Co-operative, MGIT and PKB. The uniqueness of ar-rahnu influences the efficiency of ar-rahnu’s operation. Furthermore, ar-rahnu production also has the same production process as banks. They provide services such as transactions on deposits and preparing documentations for providing loans. Based on the literature review on the determinants of the banking system efficiency with modification to ar-rahnu in Malaysia, we provide the potential determinants of ar-rahnu efficiency. Due to the availability of the data, this study will look at seven (7) factors that might affect ar-rahnu efficiency as described below.
The function of ar-rahnu efficiency can be written as follows:

$$EF = f (LSHARE, AGE, SUB, REG, GROUP, FSS, PROD)$$  \hspace{1cm} (10)

Where $EF$ is the level of ar-rahnu branch efficiency results obtained from DEA, which are: i) technical efficiency (TE); ii) pure technical efficiency (PTE); iii) scale efficiency (SE). $LSHARE$ is ar-rahnu branches loan share of market loans; $AGE$ is the number of years that the ar-rahnu has been operated; $SUB$ is the ar-rahnu funded by government or with subsidized program. $REG$ is the ar-rahnu branch which has been regulated and supervised detail by Department of Co-operative Development (JPK); $GROUP$ means the business group where the ar-rahnu is on a nationwide based or state level based; $FSS$ means financial self-sufficiency of a branch measured by customers per operating cost; And $PROD$ is productivity of staffs at the branch measured by loan disbursed in each branch per staff.

Equation (10) can be written in estimation function as follows:

$$EF_i = \beta_1 LSHARE + \beta_2 AGE + \beta_3 SUB + \beta_4 REG + \beta_5 GROUP + \beta_6 FSS + \beta_7 PROD + u_i$$  \hspace{1cm} (11)

Where $\beta_i$ is coefficient where $i = 1, 2, ..., 7$ and $u_i$ is disturbance term.

The relationship of the dependent variable and various independent variables in equation (11) are detailed as follow. The coefficient of $LSHARE$ is predicted to be positive in the regression. $LSHARE$ proxies for the ar-rahnu branch market power and the relationship of market power with efficiency is positive if concentration leads to higher profits. But, the increasing of non performing loans (NPL) will give a negative effect to the efficiency. Therefore, in this study, Loan share is expected to have positive or negative impacts to the efficiency of ar-rahnu branch.

Meanwhile, $AGE$ refers to the number of years that the ar-rahnu has been operating. Normally, the more years the ar-rahnu branch operated, it will give positive impact to the efficiency due to the economies of scale and experience gained.

In this study, subsidies ($SUB$) are divided into two types which is interest subsidy (donor funded with lower interest rate) and premise subsidy (use available business premise to operate ar-rahnu). Variable $SUB$ is expected to have a positive or negative impact on the efficiency score. As discussed earlier, non-subsidized programs will make MFIs more efficient to compete in the market. While, subsidized programs are less efficient because they are less motivate to ask for repayment and due to the problem of moral hazard (Morduch, 1998).
Regulation and supervision, REG, is suspected to have positive coefficient. It means that if the regulator regulates and supervises ar-rahnu branch often, it will ensure the operators are running the businesses properly and efficiently.

Variable GROUP means the business group operating the ar-rahnu branch. There are two types of business group, nationwide and state level. In this study, this variable will focus on nationwide level where it is expected to have positive impact on the efficiency. Furthermore, the financial self-sufficiency (FSS) and productivity (PROD) of ar-rahnuu branches should have a positive impact on ar-rahnuu branches’ efficiency.

As discussed before, dependent variable in the Tobit model is the DEA efficiency score. A positive coefficient implies an increase in efficiency whereas a negative coefficient means a decrease in efficiency. The significant of the regression result will be estimated at 95% level or higher by using the maximum likelihood estimator (MLE).

2.3 Data Sources and Input-Output Specification

Data from the 111 ar-rahnu branches were used to determine the relative efficiency of ar-rahnu in Malaysia. All the data are the 2006 secondary data obtained from Islamic pawnshop (ar-rahnu) operated by co-operative under Yayasan Pembangunan Ekonomi Islam Malaysia (YaPEIM), Mu’assasah Gadaian Islam Terengganu (MGIT), Permodalan Kelantan Berhad (PKB) and Bank Rakyat. The data have been collected from their headquarters but this study has to follow the rule where some data can not be disclosed (private and confidential). However, based on the objective of the study, this may not affect the methodology used and also the analysis.

The input-output specification is developed based on the production approach. The inputs of ar-rahnu consist of total expenses for salary (RM) \( x_{1j} \), and operating expenses (RM) \( x_{2j} \) and the outputs is the loan distributed to customers (RM) \( y_{1j} \). The above inputs were adopted from the model which have been developed by Camanho and Dyson (1999) to analyze the efficiency of bank branches, while the outputs were developed based on the objective of the study that is to analyze the ability of ar-rahnu in providing and distributing funds to the society (marketability efficiency). Based on Sealey and Lindley (1977), there is a production approach in measuring input and output in the banking system. Under the production approach, financial institution is defined as a producer of services for account holder that is to perform transactions on deposit accounts and process documents such as loans. According to Fadzlan (2007), the number of accounts or its related transactions is the best measures for output, while the number of employees and physical capital is considered as inputs. Therefore, based on the objective of this study and experts’ opinions, this study chooses the expenses for salary and operating expenses as inputs and the outputs is the loan distributed to customers\(^3\).

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\(^3\) See also Colwell and Davis, 1992
3. The Results

The empirical results from the DEA efficiency score will be discussed in this section. The descriptive statistics of the inputs and outputs in each DEA stage are reported in Table 1. The figures show the results for 111 Ar-rahnu branches from four (4) categories, with Bank Rakyat (90 branches), PKB (10 branches), MGIT (6 branches) and the co-operative under YaPEIM (5 branches). The results show that the mean of the yearly operating expenses is about RM35,008. The mean expenses for salary is RM61,124, while the mean for the number of employees is four (4) persons. For output, the mean of the loan distributed to customers is RM10,127,000 per year for each branch.

Referring to column six in Table 1, the standard deviation is high, indicating that the variation of the amount of operating expenses, salary and the average loan distributed to customers (from the mean) per Ar-rahnu branch is high. This is reflected from the large difference between the minimum and maximum values of the number of the amount of operating expenses, salary and the average loan distributed to customer (columns 3 and 4).

| Table 1: Descriptive Statistics of Inputs and Outputs |
|---------------------------------|----------|----------|---------|---------|----------|
|                                  | Number of observations | Minimum | Maximum | Mean    | Std. Deviation |
| Inputs:                         |                      |         |         |         |              |
| Operating expenses (RM)         | 111                  | 1,052   | 1,368,840 | 35,008 | 135,830    |
| Salary (RM)                     | 111                  | 28,800  | 198,000  | 61,124  | 18,957     |
| Number of employees (Person)    | 111                  | 3       | 11       | 4       | 1.12       |
| Outputs:                        |                      |         |         |         |              |
| Average loan distributed to customers (RM’000) | 111 | 139.82 | 37,097 | 10,127 | 7,362     |

The summary results of the production approach for TE, PTE and SE are reported in Table 2. Under the constant returns to scale assumption (TE model), the Ar-rahnu branches are characterized by a large asymmetry in their efficiency scores. Only five out of 111 (4.5%) Ar-rahnu branches are efficient. The average efficiency of the Ar-rahnu is only 0.173. It means that if the Ar-rahnu produces its output on the efficiency frontier instead of at its current (virtual) location, it would require about 82.7% of the inputs. This indicates that in general the technical efficiency of the Ar-rahnu is relatively low.

If we allow for variable-returns-to-scale (PTE model), we find higher efficiency scores for every Ar-rahnu branches. Allowing for variable-returns-to-scale always results in higher average efficiency because DMUs that are efficient under the constant-returns-to-scale are accompanied by new efficient DMUs that might be operated under the increasing or decreasing returns-to-scale. The average efficiency of the Ar-rahnu branches is 0.428 with 27 (24%) ar-rahnu branches being efficient. Furthermore, the average efficiency score for scale efficiency (SE model) is 0.411.
This condition indicates that the Ar-rahnu in Malaysia is operating far below the optimal scale. Only five out of 111 (4.5%) Ar-rahnu branches are efficient. In conclusion, PTE model has the highest number of efficient branches for Ar-rahnu and also the highest for average efficiency score.

### Table 2: Summary Results of DEA Scores

<table>
<thead>
<tr>
<th>Efficiency</th>
<th>Number of Ar-rahnu branches</th>
<th>Number of efficient branches (or in optimal scale)</th>
<th>Average efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE (CCR model) - CRS</td>
<td>111</td>
<td>5 (4.5%)</td>
<td>0.173</td>
</tr>
<tr>
<td>PTE (BCC model) - VRS</td>
<td>111</td>
<td>27 (24%)</td>
<td>0.428</td>
</tr>
<tr>
<td>SE - scale</td>
<td>111</td>
<td>5 (4.5%)</td>
<td>0.411</td>
</tr>
</tbody>
</table>

In addition, Table 3 shows that of 111 Ar-rahnu branches in this study, 95 (86%) show increasing returns-to-scale, 5(4%) show constant returns-to-scale, and 11(10%) show decreasing returns-to-scale. The previous information indicates that the percentage of Ar-rahnu branches under increasing returns-to-scale is greater than the others. It means that most of Ar-rahnu branches can improve their performances by increasing their inputs, and a small number can improve their performances by decreasing their inputs. It indicates that managers’ capability to utilize Ar-rahnu resources still needs to be enhanced to increase their efficiency in providing and distributing funds to society.

### Table 3: Summary Results of Returns to Scale

<table>
<thead>
<tr>
<th>Returns to scale</th>
<th>Number of branches</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase Returns to Scale (IRS)</td>
<td>95</td>
<td>86</td>
</tr>
<tr>
<td>Constant Returns to Scale (CRS)</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Decrease Returns to Scale (DRS)</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>111</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Note: IRS, CRS, DRS represent increasing returns-to-scale, constant returns-to-scale and decreasing returns-to-scale, respectively.

The Tobit result is given in Table 4. The results are used to identify the determinants of Ar-rahnu efficiency. As mentioned above, this study involves two steps; the first step is to estimate the efficiency while the second step is to find the factors that affect the efficiency. In this section, we will discuss the descriptive statistics including the minimum value, maximum value, mean, standard deviation, skewness and kurtosis for every variable used in the Tobit regression model. The objective of this analysis is to elaborate in detail the criteria of each variable used in this study. This study used ten (10) variables all together e.g.: Technical Efficiency resulted from DEA for constant returns to scale (TE), for variable returns to scale (PTE) and scale efficiency (SE), loan-share (LSHARE), age (AGE), financial self-sufficiency (FSS), and productivity (PROD). The other three variables are dummy variable (1 or 0) such as subsidy (SUB), regulation (REG) and group (GROUP).
Table 4 illustrates the descriptive analysis for each variable used in this study. For the efficiency score, PTE and SE have similar mean which is 0.4 but for TE, the mean is lower at 0.2. The skewness and kurtosis for PTE and SE are around zero (0) which mean the PTE and SE data are normally distributed. Meanwhile, skewness for TE is far from 0, which means that the data are not normally distributed. For variable LSHARE, the minimum value is 0.1 and the maximum value is 2.9. The mean value for LSHARE is 0.8 and the standard deviation is 0.6. Based on the skewness and kurtosis values, it seems that the LSHARE data follow the normal distribution. For variable AGE, the minimum value is 1 and the maximum value is 15 with the mean value at 9.6 and the standard deviation at 4.7. AGE data are also normally distributed based on the skewness and kurtosis values.

### Table 4: The Descriptive Statistic for Each Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE</td>
<td>.002</td>
<td>1.000</td>
<td>.172</td>
<td>.226</td>
<td>2.396</td>
<td>6.044</td>
</tr>
<tr>
<td>PTE</td>
<td>.004</td>
<td>1.000</td>
<td>.428</td>
<td>.359</td>
<td>.578</td>
<td>-1.065</td>
</tr>
<tr>
<td>SE</td>
<td>.027</td>
<td>1.000</td>
<td>.411</td>
<td>.271</td>
<td>.579</td>
<td>-.611</td>
</tr>
<tr>
<td>LSHARE</td>
<td>.011</td>
<td>2.951</td>
<td>.805</td>
<td>.585</td>
<td>.891</td>
<td>.673</td>
</tr>
<tr>
<td>AGE</td>
<td>1.000</td>
<td>15.000</td>
<td>9.621</td>
<td>4.707</td>
<td>-.431</td>
<td>-1.385</td>
</tr>
<tr>
<td>SUB</td>
<td>.000</td>
<td>1.000</td>
<td>.810</td>
<td>.393</td>
<td>-.1609</td>
<td>.599</td>
</tr>
<tr>
<td>REG</td>
<td>.000</td>
<td>1.000</td>
<td>.927</td>
<td>.259</td>
<td>-3.355</td>
<td>9.425</td>
</tr>
<tr>
<td>GROUP</td>
<td>.000</td>
<td>1.000</td>
<td>.846</td>
<td>.361</td>
<td>-.953</td>
<td>1.846</td>
</tr>
<tr>
<td>FSS</td>
<td>.432</td>
<td>102.208</td>
<td>27.053</td>
<td>23.296</td>
<td>1.027</td>
<td>.443</td>
</tr>
<tr>
<td>PROD</td>
<td>10.750</td>
<td>15.940</td>
<td>14.394</td>
<td>.989</td>
<td>-1.496</td>
<td>2.809</td>
</tr>
</tbody>
</table>

Meanwhile, SUB, REG and GROUP have interesting results. Although the mean and standard deviation values for these three variables are similar at 0.8 to 0.9 and 0.2 to 0.4 respectively, but the skewness and kurtosis are different. The data for SUB and GROUP are normally distributed but not for REG since the value for both skewness and kurtosis are far from 0 which are 3.3 and 9.4 respectively. Furthermore, descriptive statistics for FSS has high standard deviation (23) but the data are normally distributed because the skewness and kurtosis values are around 0. PROD has a standard deviation value of 1 but the skewness and kurtosis are higher which are -1.4 and 2.8 respectively. However, PROD data are still normal distributed.

From the results of the descriptive analysis, we find that most variables are normally distributed, except TE and REG. We assume that those two variables are not normal distributed and thus will affect the results in Tobit regression. Our discussions will be separated into three sections. First, we will discuss the results from the Tobit regression with TE as dependent variable, followed by PTE and SE as dependent variables. TE, PTE and SE are obtained from DEA which measure efficiency score with the value between 0 and 1.

In discussing the determinants of ar-rahnu efficiency in TE category, we find that by looking at the results from Tobit regression in Table 5, the coefficients of LSHARE, ROUP, FSS and PROD are significant.
LSHARE is the loans disbursed to customers at each branch per the total loans in the ar-rahnu market. This variable is expected to have positive or negative impact to the efficiency score. Based on Tobit regression result, LSHARE is positively correlated with efficiency score at 1% significance level. This implies that, ar-rahnu branch with more loans disbursed to customers is associated with higher efficiency. This result is consistent with Chang and Chiu (2006) and Jaoquin and Juan (2007). Variable GROUP is defined as ar-rahnu operates in nationwide group (1) (which means that it can open branches) or state group (0). This variable is expected to have positive impact to the efficiency score. Based Tobit regression results, variable GROUP has positive impact on ar-rahnu efficiency score and is significant at 5% level. This means that an ar-rahnu institution that is capable to open branches will have higher efficiency score.

Financial self-sufficiency (FSS) is the ratio of customers to loans disbursed. This variable is expected to have a positive impact on the efficiency score. From the Tobit regression results, FSS has a positive impact on ar-rahnu efficiency level and is significant at 1% level. This means that an ar-rahnu branch with more customers is associated with a higher efficiency score. This implies that the more customers they have, the outreach will increase and this situation will give a positive impact for the growth of ar-rahnu and thus could cater more needy people especially from the lower income group. Productivity (PROD) has a negative impact on the ar-rahnu efficiency at 1% significance level. PROD is the ratio of loans and staffs. This implies that, an ar-rahnu branch with more loans disbursed will give negative impact to the efficiency score. In other words, if ar-rahnu branches employ more staffs, it will decrease the productivity and increase the efficiency score. This result supports the finding in DEA, where a lot of ar-rahnu branches operate in increasing returns to scale which means that they should increase input (such as labor and capital) to improve their performance. Indirectly, this implies that the ar-rahnu institution can create more jobs to the society.

Table 5: The Tobit Regression Results of Technical Efficiency Score (TE), Pure Technical Efficiency (PTE) and Scale Efficiency (SE)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>TE Coefficient</th>
<th>t-ratio</th>
<th>PTE Coefficient</th>
<th>z-ratio</th>
<th>SE Coefficient</th>
<th>z-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.364</td>
<td>5.052***</td>
<td>2.634</td>
<td>3.113***</td>
<td>1.814</td>
<td>3.559***</td>
</tr>
<tr>
<td>LSHARE</td>
<td>0.248</td>
<td>3.060***</td>
<td>-0.200</td>
<td>-1.351</td>
<td>0.564</td>
<td>5.967***</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.203</td>
<td>-0.037</td>
<td>-0.491</td>
<td>-0.490</td>
<td>-0.104</td>
<td>-0.180</td>
</tr>
<tr>
<td>SUB</td>
<td>0.175</td>
<td>0.025</td>
<td>0.178</td>
<td>1.429</td>
<td>-0.174</td>
<td>-2.367***</td>
</tr>
<tr>
<td>REG</td>
<td>0.139</td>
<td>0.102</td>
<td>-0.664</td>
<td>-2.699***</td>
<td>0.278</td>
<td>1.917**</td>
</tr>
<tr>
<td>GROUP</td>
<td>0.141</td>
<td>1.919**</td>
<td>0.469</td>
<td>4.545***</td>
<td>-0.147</td>
<td>-0.183</td>
</tr>
<tr>
<td>FSS</td>
<td>0.357</td>
<td>2.631***</td>
<td>0.113</td>
<td>4.352***</td>
<td>0.195</td>
<td>-1.276</td>
</tr>
<tr>
<td>PROD</td>
<td>-0.181</td>
<td>-4.896***</td>
<td>-0.151</td>
<td>-2.262**</td>
<td>-0.133</td>
<td>-3.274***</td>
</tr>
<tr>
<td>Sigma</td>
<td>0.195</td>
<td>14.286***</td>
<td>0.347</td>
<td>12.107***</td>
<td>0.208</td>
<td>14.361***</td>
</tr>
</tbody>
</table>

Notes:
*** Significant at 1%
** Significant at 5%
* Significant at 10%
Now, we discuss the determinants of ar-rahnu efficiency in PTE category. Results shown in Table 5 are the PTE as a dependent variable for Tobit regression model. From the Tobit regression, the coefficients of REG, GROUP, FSS and PROD are significant. The coefficient LSHARE is not significant in TE category. However, REG are significant (in TE, REG variables are found not to be significant).

In this study, variable GROUP has a positive impact on ar-rahnu efficiency and it is significant at 1% level (higher than in TE category). This means that the ar-rahnu institution with the capability of opening more branches will generate higher efficiency score. This result is similar to the hypothesis made in this study. The variable FSS also has a positive impact on ar-rahnu efficiency score and is significant at 1% level (similar with TE category). As mentioned earlier, FSS is a ratio of customers to loans disbursed. Meaning that, an ar-rahnu branch with more customers is associated with a higher efficiency score. This regression result is consistent with the hypothesis made in this study.

Meanwhile, variable REG is expected to have a positive impact on the efficiency score. REG is a dummy variable and is assigned the value ‘1’ if the branches are regulated by the Department of Co-operative Development and ‘0’ if otherwise. From the regression result, REG has a negative impact on the ar-rahnu efficiency at 1% significance level. This implies that, ar-rahnu branch with more regulations will affect the efficiency score negatively. The result differs from the expectation. Based on the regression result, productivity (PROD) has a negative impact on the ar-rahnu efficiency at 5% significance level. PROD is a ratio of loans and staffs. This implies that, if an ar-rahnu branch employs more staffs, then the productivity will decrease but the efficiency score will increase. Our next discussions are on the determinants of ar-rahnu efficiency in SE category. Table 5 also shown the result when SE as a dependent variable. From Tobit regression, there are four (4) variables significant in explain the variation in dependent variable, they are LSHARE, SUB, REG and PRO. However, in this result, GROUP and FSS are not significant as in the PTE category.

Based on the Tobit regression results, LSHARE is positively correlated to the efficiency score at 1% significance level (similar as when TE becomes the dependent variable). This implies that the ar-rahnu branch with more loans disbursed to customers is associated with a higher efficiency. This result is consistent with Chang and Chiu (2006) and Jaoquin and Juan (2007).

In this study, subsidies (SUB) are divided into two types which is interest subsidy (donor funded with lower interest rate) and premise subsidy (use available business premise to operate ar-rahnu). Variable SUB is expected to have a positive or negative impact on the efficiency score. Base on the Tobit regression results, SUB is negatively correlated to efficiency score at 5% significance level. This implies that the ar-rahnu branch with more subsidies from donors or headquarters is associated with a lower efficiency. This result parallel with Hollis and Sweetman, 1998; Morduch, 2000 and Aghion and Morduch argument.
Variable REG has a positive impact on ar-rahnu efficiency score and is significant at 5% level. This result differs from the result in PTE category which is negatively correlated. This means that an ar-rahnu branch with more regulations will give higher efficiency score. This result is consistent with the hypothesis made in this study. Meanwhile, variable productivity (PROD) also has a negative impact to on ar-rahnu efficiency at 1% significance level. This implies that the more productive an ar-rahnu branch is, the lower is its efficiency score. This regression result is similar to when both TE and PTE are chosen as dependent variables. As mentioned earlier, PROD is the ratio of loans and staffs.

Base on the Tobit regression results, in the TE category, they are four (4) independent variables that have significant impact on the ar-rahnu efficiency. Those variables are LSHARE, GROUP, FSS and PROD. Of the four (4) variables, only PROD has a negative correlation with the efficiency score while the other three (3) have positive correlations. Meanwhile, in the PTE category, they are four (4) variables that have significant impacts on ar-rahnu efficiency. Variables GROUP and FSS have positive impacts and variable REG and PROD have negative impacts. Furthermore, for SE category, four (4) variables including LSHARE and REG have positive impacts on ar-rahnu efficiency. Variables SUB and PROD are negatively correlated to the ar-rahnu efficiency score.

From our findings, we can summarize that LSHARE, GROUP and FSS have positive impacts on ar-rahnu efficiency. These regression results are expected as discuss in methodology section. However, PROD has a negative impact on ar-rahnu efficiency that is unexpected because in the methodology, we expect PROD to have a positive impact. Meanwhile, for REG, we expect that the variable REG to have a positive impact on ar-rahnu efficiency. The Tobit regression results are more interesting since it has positive and negative impacts. We expect SUB could have a positive or negative impact on the ar-rahnu efficiency. However, in this study, the tobit regression result shown SUB has negative impact on ar-rahnu efficiency score. Furthermore, variable AGE is not significant at all. All of these results have brought forth some interesting discussions.

4. Conclusions

Most of the ar-rahnu branches are facing increasing returns to scale in their operations. This means that most of the ar-rahnu branches can improve their performances by increasing their inputs, implying that ar-rahnu branches can still expand their businesses by increasing their inputs in terms of labor or capital. The implication is that the ar-rahnu business can create more jobs for the community indirectly and at the same time requires more funds from donors.

Subsidized program has negative impact to the efficiency score. Ar-rahnu industry is unique where some branches are subsidized and some not. Subsidized program in this study means interest subsidy (donor funded with lower interest rate) and premise subsidy (use available business premise to operate ar-rahnu). This implies that the ar-rahnu branch with more subsidies from donors or headquarters is associated with a lower efficiency.
Non-subsidized programs will make ar-rahnu more efficient to compete in the market. Meanwhile, ar-rahnu with subsidized programs are less efficient because they are less motivate to ask for repayment and due to the problem of moral hazard.

The development of MFIs always being ignored by the main players (government, donors and operators) in the industry because MFIs is a non-profit industry. As shown in the findings, ar-rahnu industry really needs funding to start their businesses and operates efficiently. To start the ar-rahnu business, around RM3 to RM5 million is needed. With this huge amount, supports are needed from donors especially the government and NGOs. MFIs are created to help the poor, lower income group and MSEs to ensure they can survive in the short term. Poverty could be greatly reduced through smart subsidy for ar-rahnu. Ar-rahnu is an alternative to the conventional pawnshop. Therefore, it is important to ensure that ar-rahnu institution operates efficiently and can be sustained in the market.

References


