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Efficiency and its Determinant: Evidence from Malaysia Shariah Compliant Construction Firms

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ABSTRACT

This paper investigates the relation between productive efficiency and its determinant of Shariah-compliant construction firms in Malaysia from 2002 through 2011. In order to achieve these objectives, we firstly apply the Stochastic Frontier Approach (SFA) to determine the firm's efficiency using one output (i.e. profit) and four inputs (comprising labour costs, physical capital, financial capital and current assets). The results show that the average technical efficiency achieved is about 56% indicating an input waste of about 44%. Secondly, using this efficiency score, we examine the factors that contribute to this efficiency. The results show that size, interest coverage, market to book value and profitability are negatively significant in explaining efficiency. The findings are relevant to the ongoing debate on the issue of inefficiency of Shariah-compliant firms in realizing optimal output. The results also suggest that in emerging economy, such as Malaysia requires near full efficiency to generate and spur industrial growth which in turn will contribute to the nation's economic growth.

KEYWORDS: Efficiency, Shariah-Compliant, Construction Firms, Stochastic Frontier Approach, Agency Cost.

I. INTRODUCTION

In today's highly dynamic, competitive and vibrant business environment where stakeholders have vested interests in the progress of a company, the performance level of a company is arguably as important as ever in terms of its measuring and monitoring by the company's stakeholders. Conflicting interests between owners and manager are quite common in today's business environment and as a result it gives negative impact on the firm's value [1] leading to financial difficulties.

Today, the expansion of a nation's economic fortunes, in most cases, is usually fuelled by the construction sector which draws on a significant capital base. Being an economy's significant employer, the construction sector is regarded as an important contributor to a nation's gross domestic product (GDP). As one of the most competitive sectors in the country, its most challenging task is meeting the production potential and minimizing waste. The construction sector in both emerging and mature economies, for example, is a classic case in point. In 2012, all sectors in Malaysia have recorded a tremendous growth including the construction sector which recorded a growth of 18.5% compared to 4.6% in 2011 and 6.0% in 2010. This is mostly due to the implementation of projects such as improvement in roads and rail accessibility, enhancement of electricity generation capacity, and increasing the production of oil and gas. The high percentage of growth is due to the higher construction-related financing, manufacturing sales and production activities.

In light of the above discussion, the paper's objective is to examine the relationship between productive efficiency and its determinant of Shariah-compliant construction firms. The present study provides additional insights into the task of production and the manager's decisions in deciding the factors that contribute to the firms' efficiency. This study follows the Leibenstein's theoretical work on stochastic frontiers in relation to the firm's efficiency. Specifically, in the first stage, the study employs Stochastic Frontier Analysis (SFA) approaches in estimating industry performance in terms of its technical efficiency. In the second stage, we employ the efficiency score from the first estimation and link it to the determinants of efficiency.

Instead of employing financial performance metrics to measure the firm's efficiency, the study employs an alternative method called productive efficiency, to measure the agency costs [2]. Technical inefficiency occurs when there are differences between the actual output and the potential output of the firm. In [3] has mentioned the disappointment of getting potential output as X-inefficiency. Therefore, it is beneficial to come up with an appropriate representation structure in generic optimization tool that is able to integrate and simplify the problem, easy to understand, user friendly and at the same time promote hybrid integration system.

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The remainder of the paper is organised as follows. Section II discusses the data and methodology used in the study. Section III reports the empirical results. Section IV presents the summary and conclusion.

LITERATURE REVIEW

Normally, the shareholders of a company have different needs and interests from the managers of a company, resulting in agency cost problem. The theory deals with the idea that the managers and the shareholders have different perceptions, interests and objectives towards the firm. In [4] highlighted that the importance of the agency costs arise from the separation of ownership and control of firms whereby the managers act in order to fulfil their own interest rather than the value of the firm. These conflicts will happen in the situations if the managers implement the risk shifting investment strategies in investing the firm's funds.

This incident leads to Jensen's ''free cash flow theory" where as stated by [1] ''The problem is how to motivate managers to expel the cash rather than investing it below the cost of capital or wasting it on organizational inefficiencies." Thus, high leverage is one of the ways to decrease waste of cash flow management through the threat of liquidation [5] or through the burden of cash flows generation to service the debts. In these situations, leverage will positively affect the value of the firm.

Nevertheless, there are also studies that find a negative effect on the value of the firm. This finding supports the theory of agency cost by [4]. Other than conflicts of interests between the shareholders and the managers, the conflicts can also exist between the debt holders and the equity holders of the firms. The default risk may form problems such as underinvestment problems or debt overhang problems [6]. Thus, the value of the firm has an inverse relationship with the level of its debt.

In addition, if a firm keep on using debt to finance the company's operations, and the level of debt is relatively high, a further increase in debt will cause negative effect on the agency costs [7]. There are three reasons that could cause negative effect between debts and agency costs. The first reason is the increment of bankruptcy costs [8]. The second reason is where a manager who inefficiently used the excess money of the firm that leads to increased agency costs [1]. The last reason is reduced efforts by managers in controlling the risks which will result in an increase in the costs of bankruptcy or financial distress [9].

Several studies have examined the performance of the Islamic markets and funds [10]. From the perspective of management and operations of the construction sector, Stochastic Frontier Analysis (SFA) can be used to determine which firm is efficient or inefficient in that particular sector. The SFA estimation will provide the efficiency score of the individual firms in that sector and the manager can apply benchmarking criteria in order to reduce the inefficient costs [11].

Additionally, the output or product quality and the geographical area of the firm also play important role in a firm's business operations and can generate imperfectly competitive conditions in an industry. Thus, it is of utmost importance for the manager to monitor costs closely from the start of an operations stage through to the finished goods stage to make sure that all inputs are being used efficiently to produce an output. Henceforth, it will increase the value and performance of the firm or industry [12].

Consequently, firms that are unable to produce the desired output as required by the management, show that they are inefficient in using all the resources or inputs to produce the said desired output. Inefficiency of the firms could be caused by failure in allocating all the resources efficiently (allocative inefficiency) or failure in utilizing all the resources that have been allocated for that particular section or department (technical inefficiency) [12].

DATA AND METHODOLOGY

The sample data consist firms in the construction sectors extracted from Osiris database. After filtering out companies with missing information, the final data set consists of 19 companies during the period from 2002 to 2011, totalling 190 observations. There are two types of technical efficiency (TE); output-based TE and input-based TE. For the output-based TE, it shows that the firm is able to produce as much as output from the specified amount of inputs. Under the input-based TE, the firm is able to produce the output at a minimal amount of inputs. This study adopts an output-based TE. In the production function, if the firm is on the production frontier, it indicates that the firm is labelled as 'best practice' and they proved that they are operating at optimum efficiency and utilising all of the resources that they have. The efficiency score of 1.0 indicates that the firm is operated on full efficiency and the firm is located along the production frontier. In contrast, the value of less than 1.0 indicates that the firm operates below the frontier or the firm is inefficient in utilizing all the resources to produce the output. The difference between the efficiency score of 1.0 and the observed value is known as technical efficiency.

Stochastic Frontier Analysis

This study estimates the technical efficiency score using SFA. Technical efficiency analysis is a measure for controlling management efficiency where it measures the level of cost that is sufficient to generate optimal

profit for the firm. This enables an organization's manager to identify the suitable degree of input that is required for the production of an output at a reasonable level [13]. One of the methods that can be used to measure technical efficiency is SFA, a mathematical parametric method of measuring levels of efficiency [14]. The SFA method is now being used in the analyses of profit efficiency. As a parametric econometric approach, it can also estimate the efficiency level of a firm.

The main advantage of this SFA approach compared to Malmquist Index and the non-parametric Data Envelopment Analysis (DEA) is that, the SFA provides better estimate of efficiency scores according to the stochastic nature of the data. In this respect, SFA could be better adapted with the data's variables, hence providing more accurate scores. In addition, this parametric approach provides a strong theory of significance testing by its gamma value and it also separates the noise from the overall efficiency analysis [15]. For a given gamma value, each of the frontier parameters used in the analysis could be related to the economic theory by creating a parametric frontier that takes into account its stochastic error based on several assumptions. Meanwhile, noise separation identifies the existence of any inconsistent data if they are present in the analysis.

Efficiency Model

The theory suggested by [16, 17] has been adapted to a stochastic frontier production function by [18] which is being used in this study. This function is formulated in (1)

$$Y_i = f(X_i, \beta)\varepsilon_i \quad (1)$$

where Yi represents the output vector for a firm i, Xi being the input vector, β being a parameter vector, and εi representing factor errors. This model explains the output that has been produced as a function of the firm's resources or set of inputs, with the application of effects from technical inefficiency. The model also explains that the inefficiency would be modelled by other estimator variable that could be observed while all parameters are estimated simultaneously. The stochastic element in this model makes it less vulnerable to the effects of other factors compared to the deterministic frontier models.

In the present study, the technical efficiency measures how firms could minimize costs in order to maximize profits. These are measured via the mathematical model in the SFA. Four variables, namely labour, financial capital, physical capital and current assets are used as input; while the output chosen is profit. The input variables represent sources of a firm's activity, while the output variable represents outcome from the firm's operational activities. These independent variables are used in the estimation of both cost and profit efficiency levels. Hence, these parameters are considered and reflected in the formula below, as an extension to (2)

$$y_i = \alpha + x_i\beta + (v_i + u_i) \qquad i = 1, \ldots n \quad (2)$$

where

y_i = technical efficiency estimates

α = constant variable

β = vector for input and output parameters

β_1 = labour

β_2 = debt capital

β_3 = physical capital

β_4 = current assets

β_5 = profit

v_i = a random stochastic variable that is assumed to have normal distribution

u_i = a random variable that refers to technical inefficiency that could affect company's sales, usually assumed to have normal distribution

These input variables (labour debt capital, physical capital and current assets) and output (profit) that the researcher chose are reliable and consistent with most of the previous research. The output variable used in this paper is profit. This output variable is measured by the operating revenue of the firms.

While, labour is used to measure this input variable, it follows the [19] where the proxy for measuring labour is based on cost of employees. Debt capital is the input variable which is measured by long term debts of the firms from other financial institutions as used by [20]. All variables for the production function are converted to natural logarithmic form. This approach is suitable if the sample is operated as independent entities [14].

On the other hand, physical capital is also one of the input variables which are measured by the amount of fixed assets as per [12]. Another input variable that have been used in this study is current assets. The proxies for the current assets are cash, short term investment and accounts receivable. These are the usual working capital elements which would affect companies' cash flow position. Therefore, injudicious or gross working capital

mismanagement may result in the winding up of companies. This input variable is based on the value of the current assets as per [21].

Agency Cost Model

The equation model for regression is shown below:

$$D_i = a_0 + a_1 L_i + a_2 L_i^2 + a_3 Z_{1i} + u_i \quad (3)$$

where D represents the firm's efficiency score obtained from the regression; while L is the debt ratio; Z_1 is a vector of control variables; and u is a zero mean error term. The agency cost hypothesis emphasise that leverage (L) will have a positive relationship with efficiency, $\alpha_1 > 0$, $\alpha_1 + 2\alpha_2 L > 0$. However, there is a possibility that at the point where the leverage level is adequately high, the effect of leverage on the efficiency might be negative. Therefore, it shows that the quadratic specification might not be consistent as they can switch from positive to negative at higher levels of leverage. Leverage will have a negative effect on efficiency for values of $L < -\alpha_1/2\alpha_2$. A sufficient condition for the inverse U-shaped relationship between leverage and efficiency to hold is that $\alpha_2 < 0$.

The variables included in Z_1 are the determinants of capital structure. On top of that, the researcher presume that tangibility, profitability, interest coverage ratio, Z-score, size, non-debt tax shield and market to book ratio will have relationship with the firm's capital structure. Thus, it will affect the firm's efficiency during the period of 2002 up to 2010. Debt ratio is measured by total debts to total assets and is expected to have relationship with leverage [22, 23].

Assets' tangibility will be calculated by tangible fixed assets to total assets [24]. Normally, if the firm would like to borrow funds from the lenders, they require assets to be as charged as collateral [6, 22]. This is also the requirement from the Al-Quran for the Shariah compliant firm. The firms which have more investment in tangible assets such as land, plant and equipment will be facing less cost of funding compared to firms which invested heavily in intangible assets. The study anticipates that tangibility is positively correlated with the debt. Therefore, firms with considerably large investment in tangible assets will likely to accept the technological changes faster than their counterparts. Hence, these firms would be better in the management and technology, and in this way, it will be more efficient and profitable.

Profitability is measured using a computation of earnings before interest and tax to the total assets [24]. From the previous research, there are contradiction in the results of the findings between them pertaining to the relationship between profitability and leverage [22]. Some of them found a negative correlation due to the firms preferring to use internal funds to finance their new investment compared to leverage [25].

Interest coverage ratio is also considered as one of the capital structure determinants. Some researches indicate that there are significant negative correlation between interest expense and leverage as suggested in the trade-off theory. Interest expense is proxy by interest payment to total debts [26].

Z-score model is a linear model which consists of five different variables that has been modified and developed for different types of firms. It was said to be the first scoring model for credit. It was created by Edward Altman in 1968. It started when the originator tried to discover the difference in the variables within the sample of bankrupt and non-bankrupt firms. Unfortunately, this model has its own weakness whereby if the period is longer, there will be a fluctuation in the financial metrics [7]. In this study, the researcher would like to forecast the likelihood of the firm's default for ten-year duration. In [27] find evidence that the larger the Altman Z score (used as proxy for distance of the bankruptcy), the smaller the firm leverage. Hence, our hypothesis is that the longer the distance from bankruptcy, the lower the leverage [28]. Our proxy for distance from bankruptcy is the Altman Z score modified by [29].

Firm's size is proxy by natural logarithm of the total assets. There is a positive relationship between the size of the firm and efficiency. The larger the firm, the better technology that the firm used and consequently, the firm will be better managed and will be more diversified. However, the correlation might also be negative in certain circumstances where there is loss of control resulting from inefficient management of the firm.

Non-debt tax shield can be deduction of tax for the non-debt items such as investment tax credits and depreciation [30] and depletion allowances [31]. These non-debt tax shields compete with interest as a tax deduction. In consequence, the non-debt tax shield has negative relationship with debt. The firm is encouraged to take up the debt due to the tax shield benefit that they will get from interest deductibility [32]. On the other hand, the firm with great amount of non-debt tax shield will be less motivated to consume debt because they have got the non-debt tax shield incentive. And so, the non-debt tax shield is expected to have positive relationship with efficiency.

Market-to-book ratio is measured by relating total liabilities and shareholders' equity to total assets. Market-to-book ratio represents market perception. The market perception measures how investors perceive a firm. Customer's perception towards the value of the firm will lead to the customer's satisfaction, and repurchase decisions. This value is very much related to strong customer loyalty, repeat business or transactions, customer's attachment to the firm, positive word of mouth and the most important thing is it will contribute to the growth of

the firm's market share. According to [33], market-to-book ratio should have positive relationship with leverage indicating that the 'value' stocks outperform 'growth' stock. In [34] mentions that the higher market-to-book tends to be a sign of more attractive future growth options which a firm tends to protect by limiting its leverage. Similarly, in [35] shows that the high ratio of market-to-book value signify that the firms has better investment opportunities. Thus, it is expected to have a positive relationship with efficiency.

EMPIRICAL RESULTS AND DISCUSSION

A firm is considered as technically efficient if it is able to produce maximum outputs from a given inputs or minimize inputs used in producing given outputs. Table 1 shows the average technical efficiency of only 55.59% for all firms being examined during the years 2002 until 2011. This indicates that the Shariah-compliant construction firms operating in Malaysia had wasted their resources or inputs of 44.41%, in terms of labour, debt, physical capital and current assets, to produce an output. This could result from the managers and the owners of the firm having insufficient management skills. An inefficient firm will incur unnecessary cost and wastage resulting in low returns on invested capital. There is a wide variation in the technical efficiencies among the different firms in the construction industry.

Table 1: Descriptive analysis for firms' technical efficiency estimates

	Mean	Minimum	Maximum
Overall Construction Sector	0.5559	0.3444	0.93579426

Table 1 shows that the overall efficiency level for the construction firms is 55.59%, suggesting that the firms, on average, are less efficient. This means that 44.41% of the resources are wasted or poorly managed relative to a best-practice firm during the study period. Such firms should not waste the inputs to accomplish the maximum level of output or they should strive to maximise output at a given input level.

Table 2: The determinants of firm efficiency

Variables	Coefficient Estimate	T-Ratio	P-Value	R-Squared
Intercept	0.7416	28.73	0.000	0.5062
Debt ratio	-0.0026	-0.55	0.586	
Tangibility	0.0057	3.27	0.001***	
Profitability	-0.0206	-2.49	0.013**	
Interest coverage ratio	-1.28e-07	-2.86	0.004***	
Z-Score	0.0022	1.61	0.108	
Size	-0.0269	-9.69	0.000***	
Non-debt tax shield	-0.0772	-1.61	0.107	
Market to book ratio	-0.7416	-5.31	0.000***	
F-test			0.000***	

*** Significant at 1% level
** Significant at 5% level

Table 2 reports the estimates of the efficiency equation. Since the test (F) is less than 0.01, the model fits the data quite well. The results show that the linear equation has a significant effect on efficiency. In general, the higher the R-squared, the better the model fits the data. The value of R-squared is 50% indicating that 50% of the total variance in efficiency is explained by the independent variables.

The study finds that tangibility is positively associated with efficiency at 1% level. The result shows that higher tangibility indicates that the firm should have more benefits or opportunities of investing in land, equipment and other tangible assets. Thus, the firm would have lower cost of funding compared to firms that depend primarily on intangible assets [2]. Furthermore, the higher the tangibility, the higher will be the efficiency of producing output from a given input. Therefore, tangibility is expected to be positively related to efficiency.

Additionally, the study also finds that firms which operate using more tangible assets give the impression of a more efficiently run firms. Firms that operate in the sector that has more tangible assets and substantial tangible investment opportunities are normally those that are adopting better technologies and are employing good, reliable and effective managers. In that way, the firm will achieve and can improve its efficiency compared to their peers in the same industry.

Nevertheless, the negative correlation of size on efficiency at 1% level may indicate the loss of control by the firm's manager resulting from inefficient hierarchical structures in the management of the company. As [9] points out, the negative effect of size on efficiency should be interpreted within the partial regression context. This effect is conditioned on leverage and other variables. Larger firms might be more efficient than the smaller firms because they might have more leverage. This, in turn, improves their efficiency. In [24] states that larger firms may be more diversified, thereby making them less prone to bankruptcy risk.

The effect of profitability on efficiency is negative and statistically significant at 5% level. These could be due to the firm having to service its debts and interest payments instead of investing in new technology items, machinery and new equipment which, subsequently, should make the firm more efficient.

The same goes to the effect of interest coverage ratio on efficiency. It has a significant negative correlation with efficiency. An increase in debt will increase the probability of default. This can be gleaned from the interest coverage ratio. Therefore, interest coverage ratio acts as a proxy of default probability which means that a lower interest coverage ratio indicates a higher debt ratio and vice versa. Thus the higher the probability of default, the lower will be the firm's efficiency.

Finally, the study finds that the market-to-book ratio is significantly negatively correlated with efficiency at 1% level. As a consequence of servicing too much debt and interest payments, investors would likely invest their money in other firms with less debts and having better investment opportunities. And for that reason, the efficiency level of such firm or industry will drop.

CONCLUSION

This paper investigates the relationship between efficiency and its determinant. Using a sample of 19 Shariah-compliant construction firms from 2002 through 2011, the study shows that the overall efficiency level for the construction firms is 55.59%, suggesting that the firms, on average, are less efficient. This means that 44.41% of the resources are wasted or poorly managed relative to a best-practice firm. The results also show that size, interest coverage, market to book value and profitability are negatively significant in explaining efficiency.

Generally, the reason why the construction industry is poorly managed could be due to the firm employing managers who lack the necessary management skills and strategies, awareness, refuse to adopt and adapt best business practises and quality management systems such as financial management and customer focused activities in order to enhance the firms' profitability and thus, improve the firm's productivity level.

An efficient firm will usually use their optimum levels of inputs and therefore, will reduce usage of excessive inputs to achieve the maximum level of output or they would produce maximum level of output by using limited input that they have. Hence, profits or revenue of the firm would be maximised. Efficient firms produce high degree of industrial efficiency which results in high economic growth to the nation. Conversely, inefficient firms incur unnecessary cost and wastage resulting in low return on invested capital. Inefficiency is a result of using excessive inputs for a given output level or poor output at a given input level. Inefficiency increases cost of production which adversely affects prices, sales and revenue.

This raises the concern that if this situation were to continue, it could lead to failure of the firms to compete effectively in the global market which would impact not only the entire construction sector's performance, but also the nation's economic growth as a whole. The policy implication of the present investigation is, therefore, focusing more on firms' technical efficiency through better management of the firm's entire resources in realizing its optimal output.

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