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CONSTRUCTION FIRM'S EFFICIENCY IN MALAYSIA

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ABSTRACT

Construction firms in Malaysia have seen a strong growth. It has indicated being a potential as contributor to the nation's GDP. Records have also indicated that Shariah compliant organization have sustained resilience in various economic challenges. Therefore, this paper examines the technical efficiency of Shariah-compliant construction firms in Malaysia for the year between 2002 through 2011. Using Stochastic Frontier Approach (SFA) with one output (profit) and four inputs (labour costs, physical capital, financial capital and current asset) the results indicated that average technical efficiency is 55.59%, an indication of input waste of 44.41%, in terms of labour, financial capital, physical capital and current assets in producing an output. The mean efficiency achieved implies that the Shariah-construction industry is far from realizing 100% of its potential output. The findings are relevant to the ongoing debate on the issue of inefficiency of Shariah-compliant firm in realizing optimal output. The results suggest that in emerging economies like Malaysia, full efficiency will generate industrial growth which in turn will contribute to the nation economic growth.

Keywords: Efficiency; Shariah-compliant; construction firms; Stochastic Frontier Approach; Malaysia

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Introduction

Construction sector in Malaysia have continued to enjoy promising growth over the years and are predicted to grow in the future which have gained an important place in a nation's gross domestic product (GDP). The construction sector contributes a growth of 18.5% in 2012 as compared to 4.6% in the previous year. This is due to the recent development of rail and road facilities, oil and gas production capacity and high electricity capacity.

Presently, firms in any industries aim to survive for a long term and to be successful. In doing so, many firms have adopted a merging strategies in order to survive. However, some of them had been closed due to insolvency and financial distress especially during the Asian Economic Crisis in year 1997-1998 (Mat Nor, Mohd Said & Hisham, 2006). During this period large number of firms' in this sector have failed, thus making the firms in this sector more complex as compared to others sector even after the financial details in the annual report of such sector have been disclosed by the banks (Ng & Rusticus, 2012).

In the world of today, firms in different countries, regions and industries, will be facing different production opportunities. An understanding of the differences production opportunities phenomenon is essential to develop *technology sets* which consist of different set of available input and output combinations. Many *technology sets* related phenomena have been well addressed in the literature. Since, technology sets is very complex involving differences in available characteristics of the physical, social and economic environments in which production takes place. It is therefore, the main focuses of this paper is to further investigate the combine effect of the separate production frontier among different group of firms.

Due to above reason, this paper provides further analysis of how group frontiers can be estimated using stochastic frontier analysis (SFA) techniques. Specifically, we employ SFA approaches to estimating group frontiers as well as to segregate the performance differences into technology gap effects and technical efficiency. This paper also aims to make inter-firms comparison of their efficiency by using firm-level data drawn from the Shariah-compliant construction firms in Malaysia. In addition, the paper will use estimation methods can be extended to deal with issues such as time-varying inefficiency effects.

Literature Review

Anderson, Fish, Xia & Mixhello (1999) and Morey and Dittman (1995) wrote of the application of benchmark criteria of frontier model in a construction's operations and management can detect the inefficiency of the firms through the estimation of inefficient scores. On the other hand, Anderson, Fok & Scott (2000) believe in the importance of internal efficiencies to firm in all industry given the difference location and quality of product. As a result, it creates and imperfectly competitive conditions to others firms. This phenomenon therefore should be reduced in order to utilize their resources in the most efficient manner. According to Anderson et al, 2000, firms were inefficient in term of allocative inefficiency and technical inefficiency.

Previous studies by using SFA techniques namely performance and efficiency of Portuguese secondary schools (Pereira & Moreira 2007); efficiency of European rail sector (Smith, 2012); productivity in the US telecommunications industry (Seo & Shin,

2011) and technical efficiency of container ports (Cullinane, Wang, Song & Ji, 2006), automobile industry (Noor Aini & Basri, 2008); food manufacturing industry (Masud, Azizul & Anton, 2010); general insurance (Mohamad Arif, Wan & Nor Azlida, 2012); tea industry (Azizul & Mohammad Anamul, 2010) have observed that most of the efficiency performances show in a mixed industry. However recent studies conducted turns up and begin to focus on rail industry (Smith, 2012); efficiency of Indian manufacturing firms (Bhaumik, Das, & Kumbhakar, 2012); efficiency of container terminal operator (Yip, Sun & Liu, 2011); efficiency of dairy production in Canada (Yelou, Larue & Tran, 2010); New York airport performance (Diana, 2010); performance of European and American airlines (Lee, 2010).

Methodology

The final data sets of 19 companies under the construction sector for this study are gathered from Osiris database covering from 2002 until 2011. The total 190 observations are included in this study because they have complete data of three inputs (labour costs, physical capital and financial capital) and one output (revenue) are employed.

To date various methods have been developed and introduced to measure the efficiency performance namely Data Envelopment Analysis and Malmquist Index. The stochastic frontier analysis (SFA) was chosen due to this analysis provides better estimate of efficiency scores according to the data's stochastic nature. Syrjänen, Bogetoft & Agrell (2006) identify several advantages of the study, this techniques separate noise from the overall efficiency analysis and provides a strong theory of significance testing by its gamma value.

Stochastic Frontier Analysis

Following Syrjänen, Bogetoft & Agrell (2006), a strong theory of significance testing by its gamma value and a noise separation make this technical efficiency score more useful. Cost management efficiency requires achieving the optimal profit for the firm for a given level of cost. In determining the efficiency level of construction sector, this study implies a Stochastic Frontier Analysis technique. This analysis was first introduced by Aigner, Lovell and Schmidt (1977), and Meussen and Van den Broeck (1977), describe the efficiency function for a firm to be generally formulated as in Equation

$$y_i = f(a_i, p_i, \varepsilon_i) \qquad i = 1, \ldots, n \quad \text{(Equation 1)}$$

Where y_i is the observed cost and profit of the firm, a_i represents a vector of the quantity of output variables, p_i represents a vector for the quantity of input variables, and ε_i being the a factor of composite error. Hence, this function gives a specification to minimizing cost in order to produce the output vectors, given cost-consuming factors, such as market price, management inefficiency, some economic exogenous factors, or perhaps just plain luck. The expression of ε_i, on the other hand, could be further split into two parts as below

$$\varepsilon_i = v_i + u_i \quad \text{(Equation 2)}$$

With v_i referring to endogenous factors and u_i referring to exogenous factors that give effect to a firm's operational costs. An endogenous factor refers to a continuous internal factor, while an exogenous factor refers to a continuous external factor. By that, v_i would

show the increase in cost and profit that is caused by inefficiency factors that might have been caused by management mistake, such as the quantity of employment that is less than optimum, or various inputs that are based on pricing factors. Likewise, u_i represents the temporary increment or decrement to cost and profit that is caused by random factors that might surface from measurement errors or unpredicted factors that could not be controlled by firm's management, such as weather, luck, or war. Both the variables v_i and u_i represents the standard normal distribution, $N|(0,\sigma^2)|$.

Model Specification

A stochastic frontier analysis can be expressed as Equation 3, where the technical efficiency of firm i is ui and non-negative variable, whereas the error term component vi is random variable can be either positive or negative.

$$y_i = \alpha + x_i\beta + (v_i + u_i) \qquad i = 1, \ldots n \qquad \text{(Equation 3)}$$

Where y_i is output technical efficiency , α is a constant variable, β are a vector for input and output parameters namely $\beta_1$is represents a labour, β_2 is represents debt capital, β_3 is represents physical capital , β_4 is represents current account, β_5 is represents profit, v_i is represents a random stochastic variable that is assumed to have normal distribution and u_i is represents a random variable that refers to technical inefficiency that could affect to company's sales, usually assumed to have normal distribution.

A through discussion of input and output variables which is being described as follows:

Table 1: Input and Output Variables

	Variable	Measurement/Proxy	Explanation
Input	Labour	Cost of Employee	Anisabanum etr al., (2013), Pulina,Detotto and Paba (2010) and Fenn et al., (2008)
	Debt Capital	Long Term Debts	Fenn et al., (2008) and Berger, Ofek and Yermark (1997)
	Physical Capital	Fixed Asset	Ariff and Can (2008), Barros (2004) and Anderson et al., (2000)
	Current Asset	Cash, Account Receivable and Short Term Investment	Anisabanum et al., (2013)
Output	Profit	Operating Revenue	Pulina, Detotto and Paba (2010) and Haugland, Myrtveit, and Nygaard (2007)

This current study employs one output variables and four input variables as a parametric measure of efficiency level. In this study all variables are converted to natural logarithmic form due to the sample firms are independent entity according to Srairi (2010). This is particularly true in the case of the banks. Although the approach discussed focussed on banking industry, but at the same time, it can be apply to non-banking industry.

To date various study have been developed and introduced by using this stochastic frontier analysis to different sector including, manufacturing sector (Bhaumik, Das, & Kumbhakar, 2012); infrastructure sector (Smith, 2012); container terminal sector (Yip, Sun & Liu, 2011); Airline sector (Lee, 2010) and (Oum, Yan & Yu, 2008).

Analysis/Results

The technical efficiency of the panel data which consists of 190 observations were generated by using Frontier Version 4.1 software through maximum likelihood technique according to Coelli (1996). The model verification test result is as follow:

Model verification test

To ensure the appropriateness of utilising Maximum Likelihood Estimation (MLE) to fit the stochastic frontier model, the likelihood ratio test was implemented. The results of the stochastic frontier estimation are reported in Tables 2 and 3. Table 1 show that the log function specified above fits the data well. Table 2 shows the Gamma test of hypothesis of the stochastic frontier model. There is a technical inefficiency effects in the model 1 (Panel data) and model 2 (Pool data) with a γ_1 score of 0.77275532 and γ_2 score of 0.74431254, respectively. Hence, both model shows that the null hypothesis that there is no technical inefficiency exists in the modal could be rejected. The finding of this study is consistent with work of Basnayake and Gunaratne (2002).

Table 2: Gamma Test of Hypothesis of the Stochastic Frontier Model

Model	Null Hypothesis	γ -value	Decision
Model 1	$H_0 : \gamma = 0$	0.77275532	Reject H_0
Model 2	$H_0 : \gamma = 0$	0.74431254	Reject H_0

Descriptive Analysis

Table 3 shows the efficiency score computed by this model. The average efficiency scores of profit in Shariah construction firms are 55.59%. This score suggest that the construction firms mostly reduced their input costs by 44.41% without reducing their profit, a level that is viewed as not encouraging as such, confirm the findings of Hassan, Mohamed & Bader (2009). These efficiency scores is very low as compared to other industries due to lack of management skills. The firm's efficiency range from 34.44% to 93.58%. It is clear that there is a wide variation of efficiency scores of construction industry in Malaysia that will be resulted in wastage that could contributed to the lower return on invested capital.

Table 3: Descriptive Analysis for Firms' Technical Efficiency Estimates (2002-2011)

	Mean	Minimum	Maximum
Overall construction sector	0.5559	0.3444	0.9357

Results

Results shown in Table 4 indicate that the averages of technical efficiency score from 2002 to 2011 are slightly decreasing throughout the years. From the efficiency scores in Table 4, the firm's average efficiency decreases slightly from 2002 to 2011 from 56.85% to 55.11%. The scores for the firms on average ranged between 55.11% and 56.85%. The external factor namely regulations, competition and Gross Domestic product are probably driving these score (Hassan, Mohamad & Bader, 2009).

Table 4: Descriptive Analysis for Overall Firm's Technical Efficiency Estimates for Individual Years

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Mean									
0.5685	0.5666	0.5647	0.5628	0.5609	0.5589	0.5770	0.5550	0.5531	0.551

Based on the results, it can be concluded that the construction firms in Malaysia are less efficient, as they are shown to waste 44.41% of their inputs based on stochastic frontier analysis in 2002-2011.

In order to get an optimal efficiency that present the highest output for a given level of input, those firms in a less efficient should reduce the unnecessary inputs.

From our findings it shows that the firms with the superior mean is Gamuda Berhad with an annual mean of 93.58%. This result suggests that firms could only reduce their input costs which are costs of goods sold, staff, and its operations by 6.42% without decreasing their output. As a results, the quality management and the best business practices is probably driving these high efficiency results.

The second highest score goes to Bina Goodyear Berhad with technical efficiency estimate of 70.87% and followed by WCT Berhad with technical efficiency score of 65.73%. This shows that 29.13% of the resources were unutilised by Bina Goodyear Berhad and 34.27% of the resources were poorly managed by WCT Berhad. This shows that the firms lack efficiency in allocating resources to produce the maximum output. Hence, the revenue and profits could not be maximized.

MTD ACPI Engineering Berhad displays the lowest average efficiency score of 34.44%. According to the results, 65.56% of MTD ACPI Engineering Berhad's resources were poorly managed during this period. This may be due to unnecessary inputs at a given level of output or vice-versa during a period of analysis. It is also shows that the inefficiency firms are reluctant to compete in the competitive construction sector.

Discussion

From the overall statistical results, it showed that the efficiency score was more or less the same from 2002 to 2011. It shows that time does not affect the technical efficiency score or it can be said that the all the firm's technical inefficiency is constant during the period of analysis. Our finding of time-varying model does not take into account in which some firms maybe relatively inefficient initially but become relatively more efficient in

subsequent periods. The basic model of the time-varying model is presented below.

To choose whether we should select Panel Data or Pool Model for our analysis, we need to perform another test that is called a Likelihood Ratio Test as conducted by Kodde and Palm (1986) and Coelli, Rao and Battesse (1998). From the estimates, it is found that the Likelihood-Ratio Test of Model 1 (Panel Data) is 50.022437 and Likelihood-Ratio Test of Model 2 (Pool Data) is 48.839313. Therefore, we put all the information in this formula to find the Likelihood Ratio for both model

LR = -2 (48.839313 - 50.022437)
= 2.366248

From Table 5 below, since the Likelihood Ratio is 2.366248, and the t-value that obtained from Kodde and Palm (1986), at 99% confidence level with a degree of freedom of 1 for the model, the value of likelihood ratio obtained from the analysis was significant fail to reject the null hypothesis. It indicates that we should use the Model 2 Pool Data instead of Model 1 Panel Data because it has time-invariant inefficiency effects. It gives almost the same technical efficiency score regardless the time and it allows for variations in technical inefficiency effects over time.

Table 5: Likelihood-Ratio Test of Hypothesis of the Stochastic Frontier Model

Model	Null Hypothesis	Likelihood- Ratio	t-value	Decsion
Model	H_0	2.366248	5.412*	Fail to Reject H_0

*significant at 1% level
The critical values are obtained from table of Kodde and Palm (1986).

The finding of this study shows the technical efficiency of Shariah construction firms is at average level of 55.59% for the period of study. It is viewed as not encouraging due to the firms only manages to achieve 50% of the optimum level efficiency. This score suggests that firms could reduce their input costs which are physical capital, financial capital, current assets and labour by 44.41% to produce an output. The results are very similar to those obtained by Hassan, Mohamed & Bader, (2009). Based on the results, it can be concluded that only 55.59% of the potential outputs are being optimized in this industry.

If we look at the 10-year analysis, it shows that the technical efficiency for all 190 firms being examined had decreased slightly from 2002 to 2011. Most of the firm's technical efficiency was above the 50% marks. Only four of them scored less than 50% namely MTD ACPI Engineering Berhad with 34.44%, Ho Hup Construction Company Berhad at 37.61%, TRIPLC Berhad with efficiency 48.01% and Malaysian Resources Corporation Berhad with the technical efficiency score of 48.33%. This study observed significant reasons on the inefficiency performance by the construction sector in Malaysia including firm's management cost control of the internal and external resources regardless of highly competitive market (Hassan, Mohamad & Bader, 2009).

However, these results were not very encouraging. It is most probably cause by many factor namely poor management skills, lack of awareness of achieving the optimal profitability and productivity. Generally, the likelihood to get the efficient level which is higher derived from the mixed uses of input and output at the optimum level.

Conclusions

This study has provided evidence on the Shariah-compliant construction firms' efficiency in Malaysia. It is important for these firms to reduce the cost on their daily operations in achieving optimal profit. Emphasis has been placed on construction firms since the sector is an important contributor to the GDP.

This paper offers empirical support that majority of Shariah-compliant construction firms in Malaysia are inefficient since their estimated optimum efficiency is about 50% and therefore should seriously consider improving their technical efficiency. The findings suggest that there are a lot of wastage of resources since they are not fully utilised indicating ineffectiveness in cost control and internal resources monitoring. Therefore, the firms should focus their technical efficiency through well managing of entire firm resources in realizing optimal output.

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