IMPACTS OF RISK BASED CAPITAL REGULATION IN MALAYSIAN ISLAMIC INSURERS (TAKAFUL)

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ABSTRACT

Risk Based Capital framework for Takaful operators (RBCT) is enforced by the Central Bank of Malaysia with the aim to ensure that Takaful operators have adequate capital to provide sound financial service. The objectives of this article is to examine the impacts of RBCT on efficiency, productivity and competitiveness level of Family Takaful Operators (FTO) and the relationship between efficiency and competitiveness in FTO in Malaysia. This study employs three methods namely Data Envelopment Analysis (DEA), Malmquist Productivity Index (MPI) and Panzar Rosse (PR) to investigate the impacts of RBC on the efficiency, productivity and competitiveness of FTO in Malaysia. The efficiency results indicate that after RBCT comes into effect, the cost efficiency has achieved higher efficient level. Although the productivity efficiency are improving, the technological systems of FTO are yet to achieve a reasonable level. From competitiveness results, the FTO are less competitive prior the implementation of RBCT, but has become more competitive after the regulation of RBCT framework. Furthermore, the more efficient of a Takaful market, the more competitive the market is. The implication of this study is that regulators need to impose prudent risk based capital regulation because it will improve the efficiency and competitiveness of Islamic insurers.

Keywords: Malmquist, Panzar-Rosse, risk based capital, Islamic insurance, Takaful

INTRODUCTION

Prudent capital risk management practices among banks and non-banks financial institutions are important to ensure a strong and healthy growth in the financial service sector (Huang & Paradi, 2011; Zakaria, 2017). Islamic insurance (Takaful) is a type of non-banks financial institutions that plays important roles to allocate efficient financial resources, produce liquidity, diversify financial losses and facilitate investment in an economy (Alhassan & Biekpe, 2016; Fah & Sin, 2014; Lee, Low, Chong, & Sia, 2018; Shan, Teng, Kai, & Chuan, 2016). The strong ethics of fairness in the Takaful (Islamic insurance) that leads to social integrity and environmentally friendly focus for developing economic activity have its appeal to a wide range of stakeholders (Salleh, 2016). Recently, the new paradigm of Islamic financial institutions has amazingly attracted the interest of both contemporary and Islamic economist (Sufian, 2009). However, the issues of regulation on Islamic insurance are still limited in the literature. Therefore, there is a rising concern on "Does risk based capital regulation improves the efficiency, productivity and competitiveness of Islamic insurers?"

Takaful is a product of Islamic insurance that prohibits generating money from money that forbids interest (Salleh, 2016). It matches deposits and investments to the real underlying assets which has preserved more reliable returns even during the economic downturn. Nevertheless, Takaful industry is not completely invulnerable to economic fallouts and still encounters enormous challenges to achieve growth and build mass coverage globally. Recently, the pressure for greater regulation in Takaful industry is increasing, in order to protect consumers and ensure prudent Takaful market conducts around the world (Malaysian Takaful Association Annual Report, 2016; Salleh; 2016). The challenging practices and regulatory concerns that present in Takaful insurance have motivated the relevant regulators to enhance their regulations towards global standards. This is because Takaful industry is of a great importance to consumers, firms and governments to enhance the financial system of an economy. Hence, Takaful industry is undergoing regulatory reforms in order to improve its performances. The regulatory environments are the key areas of the development for Takaful sector. Regulatory reformations in recent years also aim to improve the sector's global competitiveness as the market is being liberalised. However, these evolving regulations may put some pressure on operators' capitalisation in the short term. Thus, the studies of the impacts of risk based capital regulation on the efficiency, productivity and competitiveness in the Takaful industry are pertinent to highlight issues of concern that require attentions by both managerial actions and regulators.

Policymakers and economists believe that improving efficiency of firms will boost their competitiveness that will ultimately benefit consumers and firms (Alhassan & Biekpe, 2016; Apergis & Polemis, 2016; Bikker, 2016). Takaful industry provides particularly interesting features for studying the relationship between efficiency and competitiveness as the challenges that are facing Takaful industry is high. For instance, inadequate technology capabilities, notably low penetration rate, ineffective governance practices, shortage of human capital and lack of innovation in business model for new market niches Deloitte (2015). In the theory of "efficient structure hypothesis", Demsetz (1973) postulates that efficient firms will lead to a more competitive market structure as they are able to charge lower prices without sacrificing profitability. Assessing the relationship between efficiency and competitiveness will confirm whether the efficient structure hypothesis holds in the Takaful industry. Since Takaful industry is poised to become one of the major emerging international markets for insurance over the next decade, it is important to find out whether efficient structure hypothesis works well in the Takaful industry that will be beneficial for public welfare. Furthermore, Kader, Adams, Hardwick and Kwon (2014) suggest that although Takaful insurance has many similarities with Western insurance, the limited market liquidity for Islamic securities and lack of reinsurance capacity in many Islamic insurance markets cause the performance and financial regulation in many Islamic jurisdictions regularly lags behind developed economics. Therefore, by investigating the efficiency, productivity and competitiveness in Takaful industry could assist this industry to achieve effective long term plan.

The main reason that this study focuses on Malaysia is because there has been a higher acknowledgement of Islamic finance at the global level (Sufian, 2009; Abdul-Majid, Saal, & Battisti, 2011). Malaysia is one of the major Islamic financial hubs in the world. Moreover, Malaysian financial system was debatably unaffected by the global financial crisis in the late 2000s (Chen, Liu, & Kweh, 2014). The moderately small influence of the global financial crisis could be due to Malaysia has introduced considerably more effective financial regulatory policies since the Asian financial crisis of the later 1990s. To reinforce the roles of the financial services sector in supporting the economic transformation process in Malaysia and adding to the depth and diversity of the Islamic financial markets in Malaysia, the Central Bank of Malaysia or Bank Negara Malaysia (BNM) has implemented Risk-Based Capital Framework for Takaful Operators (RBCT) and comes into effective in 2014 to ensure that Takaful operators have ample liquidity, adequate capital buffers and a sound risk management. Implementation of RBCT is a part of the initiatives by BNM to set global standards for the effective regulation and supervision of Islamic finance in order to preserve financial stability in the Islamic financial system. In the Financial Stability and Payment

Systems Report (2017) by BNM, BNM has embarked on a review of RBCT to ensure that the standards continue to remain fit for Takaful operators. From the review, there is a need for cost efficiency enhance in order to meet the protection and saving needs of the participants. In addition, the quality of the professionals conducts and capital investment returns require improvements to achieve higher professional standards in the Takaful industry. Furthermore, the overall productivity of Takaful operators is low because the manpower contributing to less than 50% of the new contribution from the Takaful products. The current competition in Takaful industry is unsound because less than 40% of the Takaful operators offer affordable Takaful products to the public in B40 (median income of RM3000 monthly) segment. Takaful operators are being encouraged to remain competitive in order to provide a reasonable and affordable Takaful products to the public. All these transformation in the Malaysian's Takaful industry has made Malaysia leads the Takaful industry in terms of Takaful regulations as it is the first country in the world to implement a risk based capital framework and take the initiative to review the framework. Furthermore, the Malaysian Takaful industry is one of the fast growing markets in the world. Global Takaful Report (2017) identifies that Malaysia is the largest Takaful market in South East Asia region, with a 62% market share and followed by Indonesia at 33% in 2015. In view of these rising growth of Islamic insurance markets and development of regulatory regimes, optimising efficiency, productivity and competitiveness are likely to be a predominantly important business objective for Takaful insurers.

To date, there is no study on the impacts of RBCT on how Takaful operators in Malaysia have changed in their performance. Although Ismail, Alhabshi and Bacha (2011) and Saad (2012) have done the analysis solely on the efficiency of Takaful in Malaysia, their studies do not consider the effects of risk based capital regulation because RBCT has yet to be implemented prior to 2014. Against this backdrop, it is of interest to examine a more in–depth analysis on the performance of Takaful in Malaysia. The objectives of this paper are threefold. First, it identifies the performance of Family Takaful Operators (FTO) by constructing efficiency, productivity and competitiveness measures. Second, once the performance proxies are completed, the paper aims to examine the impacts of RBCT implemented on FTO, whether it has improved the efficiency, productivity and competitiveness of FTO in Malaysia. Third, it will examine the relationship between efficiency and competitiveness in FTO. This is to align with the BNM's objective in keeping close tabs globally on the development of international capital standards of the Takaful industry. The third objective of this paper provide a novel feature in providing a framework for the joint estimation of cost efficiency and competition on the individual FTO level by employing a non-parametric approach. To the best of our knowledge, this is the first study

to examine the relationship between efficiency and competitiveness in Takaful sector despite that Casu and Girardone (2006), Mlambo and Ncube (2011), Sufian (2011) and Apergis and Polemis (2016) have investigated this issue in the banking sector.

To support better understanding of the economics of Takaful insurance, we believe that by contributing the examinations on efficiency, productivity and competition of Takaful insurers in our study could provide comprehensive insights to the Takaful stakeholders. The significance of this study could be of interest to the Takaful insurers, policyholders, shareholders and industry regulators that allow them to make better solvency management, investment, risk and solvency decisions.

BACKGROUND

Currently there are 11 licensed Takaful operators in Malaysia of which three are purely Family Takaful operators and remaining are composite (General and Family) operators. The pure Family Takaful are AIA Public, Ammetlife and Great Eastern Takaful. On the other hand, the composite operators are Etiqa Takaful, Hong Leong MSIG Takaful, HSBC Amanah Takaful, MAA Takaful, PRU BSN Takaful, Sun Life Malaysia, Syarikat Takaful Malaysia Berhad and Takaful Ikhlas. In order to promote the interests of Takaful operators and to supervise self-regulation within the Takaful industry, Malaysian Takaful Association (MTA) is structured in November 2002 under the Malaysian Societies Act of 1966. The Takaful business shows a gradual increment over the past five years where the gross contribution of General and Family Takaful records at RM3.1billion in 2011 increases to RM5.7 billion in 2015 as shown in Table 1. The growth prospects for the Takaful sector are likely to remain stable that are supported by the greater size of Islamic population in Malaysia, mounting consumer awareness and recognition in Takaful model, as well as continuous government efforts to promote Islamic insurance (Insurance Services Malaysia, 2016). This shows that the future outlook of the Takaful business in Malaysia will be a promising outlook but might be nothing of some challenges.

In terms of the total assets of Family Takaful and General Takaful funds, the statistics also illustrates an increasing trend. The assets of these funds will play the role to facilitate investment in the economy. According to Figure 1, Takaful fund assets have grown from RM17 billion in 2011 to RM26.8 billion in 2016. In terms of market share of a combined assets of Takaful and insurance industry, Takaful operators are still considered smaller as compared to conventional insurers, the total assets of the Takaful is only 12.1% in 2016.

Despite the low market share of Takaful in Malaysian's insurance industry, the trend is demonstrating a rising trend from 8.6% in 2011 rises to 12.1% in 2016.

Table 1
Gross contribution of general and family Takaful (2011–2015)

Year	General (RM'billion)	Family (RM'billion)	Total (RM'billion)
2011	1.6	2.1	3.7
2012	1.7	2.4	4.1
2013	1.9	2.7	4.6
2014	2.2	3.0	5.2
2015	2.3	3.4	5.7
2016	2.4	3.9	6.3

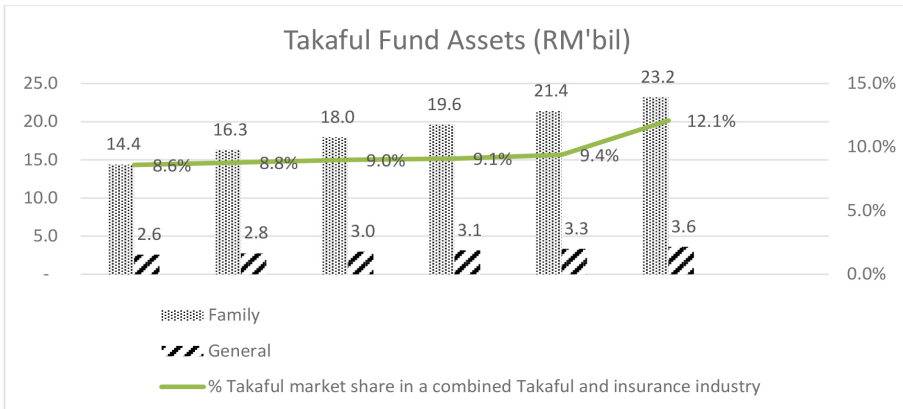*Source*: Malaysian Takaful Association Annual Report (2016)

Figure 1. Total assets of Family Takaful and General Takaful funds from 2011 until 2016 [Source: Malaysian Takaful Association Annual Report (2016)]

In view of a greater gross contribution and total assets from Family Takaful compared to General Takaful, this study will focus on the Family Takaful Operators (FTO). Furthermore, combining both Family Takaful and General Takaful might not provide a meaningful implication due to their nature of business is differentiated from life and non-life.

Globally, there is a development toward more risk-oriented regulation and governance, such as Europe's Solvency II on Europe's insurance companies which is introduced in 2007 and comes into effective in 2016. It rules out the amount of capital that Europe's insurance companies must maintain to minimise the risk of insolvency (Doff, 2016). In this vein, Malaysia is not an exception

in implementing risk-oriented regulation on insurance companies such as Risk-Based Capital Framework for Insurers which is applicable to conventional insurers in Malaysia and Risk-Based Capital Framework for Takaful Operators (RBCT) which is applicable to Takaful Operators in Malaysia. The introduction of RBCT in 2012 has been implemented in 2014 and applicable to all Takaful operators, issued under the Takaful Act 1984 for businesses generated from within and outside Malaysia. RBCT is to ensure Takaful operators maintain a capital adequacy level to commensurate with the risk profile and operate as financial buffer for the Takaful exposure. The objectives of RBCT are to ensure Takaful operators meet all obligations under Takaful contracts, offer flexibility to operate as long as the level of capital is appropriate and promotes overall financial system. The main purpose of the RBCT development is to ensure that the operations of Takaful are in line with the objective of Shariah, namely the "fiduciary duties" of the Takaful operator towards the participants. Hence, the operational management and capital management are mostly affected by the implementation of RBCT. According to an article by Kuala Lumpur Islamic Finance Forum (2016) and a report by BNM in Financial Stability and Payment Systems Report (2017), the challenges faced by Takaful operators are how to maintain the required risk capital to ensure a predetermined level of certainty that contingent benefit will be paid by the Takaful operators. This is because, building up surplus would result in existing participants being deprived of surplus distribution that might contradict with the Shariah compliance. Therefore, the efficiency, productivity and competition of Takaful operators will be affected because their input variables that are related to operational management and capital management are the proxies for the estimation of efficiency, productivity and competition. With the fact of Takaful executes important role to facilitate transactions in the economy with the efficient allocation of scarce resources, the issues link with underperformance (efficiency, productivity and competition) in Takaful sector are particularly essential to be addressed in Malaysia which is a developing country that strives to achieve as a high income country.

Furthermore, RBCT outlines the methodology to compute capital adequacy position of the Takaful operators, expectations in meeting Supervisory Target Capital Level (STCL) and measure Individual Target Capital Level (ITCL) that reflects their own risk profile and risk management practices, actions that can be taken by the Bank in cases of breach of capital level and lastly the prudential limits for investment. BNM imposes that all the Takaful Operators should maintain a minimum of 130% STCL or Capital Adequacy Ratio (CAR). A breach of STCL at a level below 130%, will cause stricter supervisory actions of increasing intensity which embrace business restrictions and/or restructuring measures, and potentially actions to resolve the financial position of the Takaful

Operator. In view of the implementation of RBCT to Takaful operators might tighten capital requirements, which will result in Takaful operators with limited operating scale or weak financial flexibility. Hence, they have to seek for strategic investors to enhance their capitalisation, as a consequence, it could further spur the activity in Takaful sector in the medium term. Thus, it is vital to study its impacts towards the efficiency, productivity and competitiveness of FTO in Malaysia.

LITERATURE REVIEW

The studies on the performance of insurance are originated from the study on performance of banking which is a part of financial institution and later the ideas are being borrowed and adopted to extent the research in insurance sector.

There are three main streams of financial institution performance: (i) frontier efficiency introduced by Charnes, Cooper and Rhodes (1978), also known as Data Envelopment Analysis (DEA), (ii) productivity changes introduced by Caves, Christensen and Diewert (1982), which is known as Malmquist Productivity Index (MPI) and (iii) competitiveness modelling, which is introduced by Panzar and Rosse (1987). Each of this model is able to provide a unique body of knowledge on how insurance industry is structured and performs.

Efficiency

The earlier studies on insurance efficiency that conducted by Cummins and Zi (1998) are mainly been interested in the United States' insurers. The outcomes recommend that the inefficiency is attributed to slow claims settlement practices and smaller size of firms, suggesting consolidation among smaller firms has the prospective to reduce costs in the industry. In an investigation into the impacts of regulations, the effects of regulation on United States' automobile insurance markets from 1992 to 1998 are conducted by Weiss and Choi (2008), the findings suggest that insurers benefit from cost efficiency by charging lower prices and gain smaller profits in non-stringently regulated states. Furthermore, insurers in regulated states are less efficient than in competitive states. In the same vein, the deregulation in life insurance industry in India from publicly owned to privatization policy has resulted in increasing allocative inefficiency at the initial stage but followed by higher competition and finally improvement in the cost efficiency (Tone & Sahoo, 2005). Eling and Schaper (2017) provide a more recent and in-depth analysis on the impacts of the major environmental challenges such as regulations, capital market developments, and competition on productivity and efficiency of European life insurance companies in 2002–2013. They conclude that capital adequacy regulation is negatively associated with efficiency, capital

market is the important driver of efficiency and competition reveals a negative and significant effect on efficiency. Conversely, Gaganis, Liu and Pasiouras (2015) argue that inverted U-shaped relationship between profitability performance and capital regulation exist in European insurers from 2005 to 2009 and suggest that capital regulation to insurance industry might not be straightforward, hence the regulators must mull over the trade-offs that exist between the sustainability of insurers and risk mitigation. As for the financial institutions in Asian developing countries, Malaysian financial system was debatably unaffected by the global financial crisis in the late 2000s due to the considerably more effective financial regulatory policies since the Asian financial crisis of the later 1990s. The Malaysian government also believes that strengthening the regulation in insurance industry could enhance the ability of the companies to recover faster after a financial crisis. Although the ample fallout of the global financial crisis in the late 2000s, insurance companies in Malaysia experience only a rather small spillover effect as the insurers in Malaysia have been managing efficiency performance well after the stringent capital regulation, indicating that performance assessment is essential in their sustainability (Wu, Kweh, Lu, & Azizan, 2016). Hence, it is beneficial to study the impacts of RBCT regulation imposed by BNM on the efficiency, productivity and competitiveness on Takaful insurers.

Productivity

Productivity has been studied by many researchers using Malmquist Productivity Index. The earlier studies on productivity analysis have mainly focused on the efficiency change over the period. To illustrate, Barros, Barroso and Borges (2005) investigate the total productivity change in the Portuguese insurance market from 1995 to 2001 and conclude that the market experiences technical efficiency improvements but deterioration in technological changes due to the firms are not utilizing inputs accordance with market prices. Similarly, the research in the Greek insurance market is found that the mixed insurance companies record the lowest productivity index, followed by non-life insurance companies and the life insurance companies exhibit the highest productivity index (Nektarios & Barros, 2010). Furthermore, Alhassan and Biekpe (2015) describe the improvement in total factor productivity in the nonlife insurers in South African from 2007 to 2012 is mainly contributed by technical change compared with efficiency change which indicates that the insurers adopt the best technology through innovations that leads to "frontier shift". Recent developments in productivity have heightened the need for "issues" to be discussed in the productivity analysis. The issue that relates to the single market effects on productivity in the German insurers is examined by Mahlberg and Url (2010) and they conclude that the single market effects have fostered the productivity of insurers and raised the importance to

innovate and introduce new technologies to improve productivity and remain competitive. The impacts of the World Trade Organization on the productivity in the Chinese insurance industry are another stream of issues being raised up and the findings prove that the insurers experience momentous growth in total productivity that strengthen the support for further deregulation (Leverty, Lin, & Zhou, 2009). Chen, Liu and Kweh (2014) evaluate the effects of intellectual capital on the changes in productivity of general insurers in Malaysia from 2008 to 2011. They confirm that the initiative executed by the Malaysian government in the 10th Malaysia Plan that emphasising on the knowledge-based economy has improved the managerial skills in the general insurance industry that lead to sustainable productivity growth. In this vein, it will be interesting to assess the extent to which risk based capital regulation is associated to the efficiency and productivity of the family Takaful in Malaysia to evaluate the effectiveness of Malaysian government in promoting sustainable long-term growth.

Competitiveness

The study on competition by using Panzar-Rosse model is limited in the insurance industry. In this model, the absence of concentration, it will lead to the presence of oligopolistic industry structure, whereby it is characterised as lacking of competition. Earlier research on the insurance market has revealed that the efficiency of insurers tends to be poor and competition between insurers is not strong (Cummins, RubioMisas, & Vencappa, 2017; Lee, Cheng, Nassir, & Razak, 2018). Thus, these studies propose that, the study on competition is needed to comprehend the analysis on efficiency and productivity. Recently, Jeng (2015) analyses the competition variation in the Chinese insurance industry, Alhassan and Biekpe (2016) examines the competition and efficiency in the nonlife insurance market in South Africa and Todorov (2016) accesses the competition in Bulgarian Insurance industry. Jeng (2015) concludes that although there is a declining trend in the insurance industry concentration, the behaviour of the insurance firms does not exclude the hypothesis of monopoly or collusive oligopoly behaviour. Hence, the authorities need to face the reality that the inability of local and foreign firms to compete equally will affect the local market and jeopardise customers' welfare in the long run. Todorov (2016) suggests that the insurance market in Bulgaria is still suffering from unsound competition that creates problems to the society and calls for further intervention by the regulators. Alhassan and Biekpe (2016) advocate that to reduce high-profit inefficiency and maximize the earning potential of non-life insurers, regulatory authorities should seek to improve the competitive conditions as a means of strengthening managerial efforts to reduce resource misuse and waste. Furthermore, market competition in the insurance study is examined by Coccorese (2012). The researcher assesses the degree of

competition in the Italian car insurance market in order to evaluate the considerable fine that is imposed on 39 companies by the Italian Antitrust Authority (IAA) in 2000. The results find out that the intervention of IAA in the Italian car insurance market that encourages the information sharing trend has led to a competitive and cooperative behavior. In this essence, the knowledge gained from studies of market competition in the insurance industry, which shows that the interference of regulators is required to guarantee both the customers' welfare and the good performance of insurers in the long run. It exhibits stronger justification to investigate the impact of efficiency on competitiveness within the family Takaful insurance industry in Malaysia with the goal of supplying meaningful information to the regulators of Takaful insurance industry.

The efficiency and competition hypothesis suggests that increases in efficiency lead to increases in competition. This is because when the firms are efficient and able to reduce the cost of operations will lead to higher profit. This will increases the creation or entry of a more viable competitor to participate in this industry. Unlike the banking industry, the literature on the nexus between efficiency and competitiveness of the insurance market appears scant. Recently, Jeng analyses the variation in competition in the Chinese insurance industry and suggests that although the local insurance industry still needs protection, the authorities may need to comply with pressure from the global insurance community, as domestic and foreign firms do not face an equally competitive environment. Alhassan and Biekpe (2016) examine the competition and efficiency in the non-life insurance market in South Africa. They recommend that to reduce high-profit inefficiency and maximise the earning potential of non-life insurers, regulatory authorities should seek to improve the competitive conditions as a means of strengthening managerial efforts to reduce resource misuse and waste.

Literature on the Performance of Takaful Industry in Malaysia

Yakob and Isa (2016) use Data Envelopment Analysis (DEA) to obtain the efficiency score for the conventional and Takaful insurers in Malaysia. The findings suggest that Takaful operators postulate better risk management compared to conventional insurers, larger firms show better risk management efficiency but consumer preference is not significant. Furthermore, DEA model employed is suitable in delivering a comprehensive guide towards the best practices to the managers of the firms. Since this study is focusing on risk and investment management efficiency on Takaful operators in Malaysia but does not include the studies on productivity and competitiveness, and also does not consider the effect of risk based capital regulation, thus, we attempt to close the gaps by examining the impacts of risk based capital regulation on the efficiency, productivity and

competitiveness in Malaysian Takaful industry. Our research intends to provide a cohesive analysis to offer a helpful initiative that could cement the Malaysian Takaful industry as a Takaful hub.

As a summary from the literature review, it is understand that the study on the competition of Takaful insurance firms will comprehend the traditional studies on efficiency and productivity. Thus, the novelty in this paper is to identify the factors that influence the efficiency, productivity and competitiveness of FTO in Malaysia. Next, the implementation of RBCT with the development toward more risk-oriented regulation has motivated this paper to further analyse the impacts of RBCT on the efficiency, productivity and competitiveness of FTO in Malaysia. Lastly, examining the relationship between efficiency and competitiveness in FTO would will provide insights to the Takaful insurers and regulators to improve the performance of Takaful insurers.

DATA AND METHODOLOGY

This study will examine a total of 12 FTO in Malaysia spanning a period from 2011 to 2016. The firms level data are collected from the annual reports of the FTO, the macroeconomics data are extracted from the World Bank.

Efficiency

This research will execute the non-parametric frontier DEA approach to identify the input oriented cost efficiency of FTO which is explained through the Decision-Making Units (DMUs). In DMU, suppose there are N observations, in each observation, DMU ($j = 1,2,\ldots,n$), employs m inputs $x_{ij} = (1 = 1,2,\ldots,m)$ in order to generate s outputs $y_{rj} = (1=1,2,\ldots,s)$. Choose a DMU to be investigated for relative efficiency and for convenience of notation, identify this DMU as DMU_0. Charnes et al. (1978) suggest a simpler linear programming problem.

Maximising $z_0 = \sum_{r=1}^{s} u_r y_{r0}$ subject to the constraints; (1)

$\sum_{r=1}^{s} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{i0} \leq 0, j = 1,2,\ldots,n$ (2)

$\sum_{i=1}^{m} v_i x_{i0} = 1$ (3)

$u_r \geq 0, r = 1,2,\ldots,s$ (4)

$v_i \geq 0, i = 1,2,\ldots,m$ (5)

where x_{ij} is the observed amount of input i for the DMU_j, $x_{ij} > 0, i = 1,2,\ldots,$ $n; j = 1,2,\ldots,n$. y_{rj} is the produced amount of output r for DMU_j, $y_{rj} > 0, i = 1,2,\ldots,$ $n; j = 1,2,\ldots,n$. A set of "virtual multipliers" $\{v_i\}$ for inputs and "virtual multipliers" $\{u_r\}$ for outputs for DMU will be constructed from the optimal solution of the above mathematical programming problem. The "virtual input" refers to the weighted input $\left(\sum_{i=1}^{m} v_i x_{ij}\right)$ and the "virtual output" refers to $\left(\sum_{r=1}^{s} u_r y_{rj}\right)$. The best set of weights represented by values that maximise the efficiency score for each DMU_0 is generated by the mathematical programming, the weights are not programmed. The value of the objective function at the optimum is inferred as a measure of the relative efficiency of the DMU being estimated relative to all DMUs where each is represented as a ratio of virtue output to input. The final value of efficiency is always positive and less than or equal to 1. If the maximised score in its objective value is close to 1, then the DMU is interpreted as relative efficient, otherwise it is described as inefficient. Furthermore, cost efficiency (CE) is decomposed into technical efficiency (TE) and allocative efficiency (AE). TE is concerned with accomplishing maximum outputs with the least cost. AE refers to how various resource inputs are combined to produce a mix of different outputs.

According to Alhassan and Biekpe (2016) and Huang and Paradi (2011), labour, business services and financial capital are the common input variables for insurance company. Hence, this study categorises input variables into three categories which are labour (managing the firms to provide services offered by Takaful operators), debt capital and equity capital (these two capitals are important to maintain capital in order to satisfy regulatory requirements and ensure participants will receive compensation if there is any loss). They also explain that the output variables should involve risk-pooling and risk bearing services, financial intermediaries and services relating to insured losses. Therefore, this study uses three output variables to represent these activities. First, this study employs net contribution income to allow for risk-pooling and risk bearing services, because the Takaful operators receive contribution from the participants and participate in risk sharing through pooling. Second, net investment income plays the roles as financial intermediaries, by utilising the contributions from participants and allocate the contributions in financial assets. Third, claims losses is to provide compensations for the losses encountered by the participants. The input and output variables used in this study are explained in Table 2. The value added approach requires input price which is also described in Table 2.

Table 2
Input and output variables

Input Variables	Explanation/Proxy	Source	Price	Source
Labour	= Management expenses + Other Outgo	Annual report of the firms	= Average annual financial institution wage in Malaysia	International Labour Organization
Debt Capital	= Islamic Bonds	Annual report of the firms	= Annual return of Government Investment Issues (GII)	Bond Pricing Agency Malaysia
Equity Capital	= Islamic Securities and Equities	Annual report of the firms	= Average annual return Sukuk & Shariah Emas Index	Bursa Malaysia

Output Variables	Proxy/ Explanation	Source
Net Contribution Income	= Net Contribution Income FTO receive funds from their customers as a result of operating.	Annual report of the firms
Net Investment Income	= Net Investment Income From the collected contribution, it is invested by FTO to generate income.	Annual report of the firms
Claims losses	= Claims payment Benefits pay to the risks occured	Annual report of the firms

Productivity

In measuring the productivity change in FTO, the Malmquist Productivity Index (MPI) is employed in this research. The output based MPI between period *s* (the base period) and period *t* is illustrated as:

$$m_0\left(y_s, x_s, y_t, x_t\right) = \frac{d_0^t\left(y_t, x_t\right)}{d_0^s\left(y_s, x_s\right)} \left[\frac{d_0^s\left(y_t, x_t\right)}{d_0^t\left(y_t, x_t\right)} \times \frac{d_0^s\left(y_s, x_s\right)}{d_0^t\left(y_s, x_s\right)} \right]^{1/2} \tag{6}$$

where m_0 is the productivity of the most recent production point $\left(x_{t+1}, y_{t+1}\right)$ relative to the earlier production point (x_t, y_t). The notation $d_0(x_t, y_t)$ symbolises the distance from the period *t* observation to the period *s* technology. A value of m_0 higher than 1 indicated that positive total factor productivity growth from period *s* to *t*, meanwhile, a value less than 1 symbolises a total factor productivity is decreasing. There are two components in Equation (6) where the outer component without geometric mean measures the change in the output oriented defined as the technical efficiency change (EFFCH), is equivalent to the ratio of technical

change in period t to the technological change (TECH) in period s. The internal part of geometric mean is to measure technical change. To simplify, the evaluation at x_t and x_s is the geometric mean of the shift in the technology between the two periods. Therefore, the two terms are to be summarised as:

$$m_0 = EFFCH \times TECH \tag{7}$$

where m_0 is the product of a measure of technological change (TECH) as gauged by the movements in the frontier gauged at period $t + 1$ and period t and a change in efficiency (EFFCH) over the same period. Furthermore, the sub-categories of EFFCH are:

$$EFFCH^{t,t+1} = \Delta PEFFCH^{t,t+1} \times \Delta SECH^{t,t+1} \tag{8}$$

where

$$\Delta PECH^{t,t+1} = \frac{D_v^{t+1}\left(x_j^{t+1}, y_j^{t+1}\right)}{D_v^{t}\left(x_j^{t}, y_j^{t}\right)} \tag{9}$$

$$\Delta SECH^{t,t+1} = \frac{D_c^{t+1}\left(x_j^{t+1}, y_j^{t+1}\right) / D_v^{t+1}\left(x_j^{t+1}, y_j^{t+1}\right)}{D_c^{t}\left(x_j^{t}, y_j^{t}\right) / D_v^{t}\left(x_j^{t}, y_j^{t}\right)} \tag{10}$$

in which variable return to scale (VRS) is denoted by "v" and constant return to scale (CRS) is denoted by "c". When $\Delta PECH^{t,t+1} > 1$ refers to an increase in PTE, when $\Delta PECH^{t,t+1} < 1$ refers to an decrease in PTE and when there is no change $\Delta PECH^{t,t+1} = 1$. Conversely, $\Delta SECH^{t,t+1} > 1$ indicates that the most efficient scale is rising over time implying the efficiency is improving, when $\Delta SECH^{t,t+1} < 1$, it indicates efficiency is decreasing. Lastly, when $\Delta SECH^{t,t+1} = 1$, there is no change in efficiency scale.
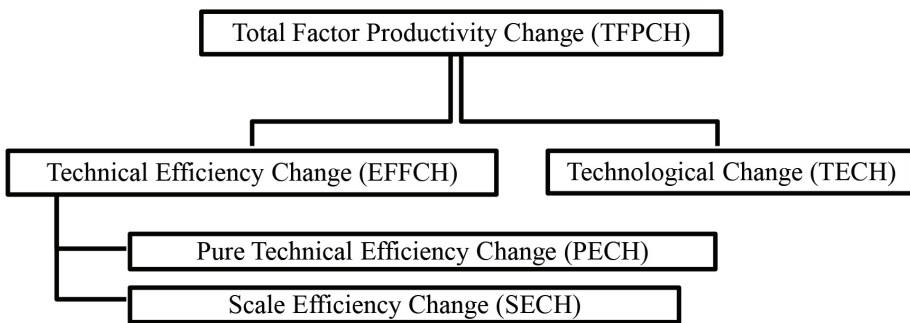

Figure 2. Relationship of the estimators in MPI.

In summary, there are five estimators for FTO in Malaysia over the time could be measured and their relationships are illustrated in Figure 2. The input and output variables are similar to DEA which is illustrated in Table 2.

Competitiveness

To measure the competitiveness of FTO in Malaysia, Panzar-Rosse (PR) method will be employed which is initially suggested by Panzar and Rosse (1987), then the method is applied by Murat, Tonkin and Jüttner (2002) and recently by Coccorese (2012) in measuring the competitiveness in the insurance industry. The revenue of the ith firm of the FTO at time t is estimated by Equation 11 and is explained in Table 3.

$$R_{it} = f(w_{it}, Z_{it}, Y_t, \varepsilon_t) \; equivalent \; to \; \ln rev_{it} = \alpha_0 + \alpha_1 \ln lp_{it} +$$
$$\alpha_2 \ln dcp_{it} + \alpha_3 \ln ecp_{it} + \beta_1 \ln size_{it} + \beta_2 \ln proclaim_{it} + \qquad (11)$$
$$\beta_3 own_{it} + \theta_1 gdpg_t + \theta_2 inf_t + \varepsilon_{it}$$

where w_{it} represents the vector of factor prices, Z_{it} = the firms variables affecting the cost function, Y_t = the macroeconomics variables shifting the demand function, and ε_t = the error term.

The PR H-statistics can be written as follow if firm i utilise m inputs,

$$H = \sum_{k=1}^{m} \frac{\partial R_{it}/Rit}{\partial w_{itk}/w_{itk}} = \sum_{k=1}^{m} \frac{\partial \ln R_{it}}{\partial \ln w_{itk}} \qquad (12)$$

Hence, the sum of the elasticities of the reduced form revenue is corresponded by H with respect to all the factor prices. H describes the percentage change of the equilibrium revenue as a result from a percent change in the price of all inputs employed by the firms. For a monopoly, a perfectly colluding oligopoly and a homogeneous conjectural variations oligopoly, the value is H < 0. Conversely, in a symmetric perfectly competitive market in long-run equilibrium, H = 1. Finally, in case of a symmetric monopolistic competition market, 0 < H < 1.

Basically, there are three assumptions need to be made in applying this technique. Firstly, higher input prices must not be associated with better quality services, this is because to avoid an increased revenue that would merely reflect the higher value of the product. Under this assumption, H-statistic should not be biased as the Takaful service can be regarded as rather homogeneous. Secondly, FTO must be considered as single product firms; this condition to apply in FTO is satisfied because these firms can be regarded as producing FTO services using

labour, debt capital and equity capital as inputs. Thirdly, observed perfect and monopolistic competition require that firms are observed in long-run equilibrium. To test this hypothesis, it is usually supposed that competitive markets equalise the rates of return across firms, so that they should not be significantly correlated with input prices. As a result, one can calculate PR H-statistic using the return on assets (ROA) as the dependent variable: a value of H = 0 would prove equilibrium. Claessens and Laeven (2004) and Coccorese (2012) suggests to consider (1 + ROA) as the dependent variable to avoid taking the natural logarithm of a negative value.

Table 3
Variables for Panzar-Rosse competitiveness study

Variables (Name)		Proxy/Explanation
R	ln (revenue), ln rev	= Net contribution income + net investment income Since FTO earns revenue through the contribution received and return from investment
W1	ln (labour price), ln lp	= (Management expenses + Other Outgo) / Total assets Proxy for the unit price of labour
W2	ln (debt capital price), ln dcp	= Net Contribution Income / Government Islamic Paper Proxy for the price for debt capital
W3	ln (equity capital price), ln ecp	= Net Investment Income / Islamic Securities and Equities Proxy for the price for the equity capital
Z1	ln (size), ln size	= Net Contribution Income / Total Assets
Z2	ln (provision outstanding claim), ln proclaim	= Provision outstanding claim Uncertainty of outstanding claims and unexpired risks (with respect to unexpired premiums), resulting from the risks of adverse claims experience.
Z3	Ownership, own	Dummy variable = 0 if it is local firm Dummy variable = 1 if it is a joint venture with foreign firm
Y1	GDP growth, gdpg	= Real Gross Domestic Product growth Fluctuations in the demand side of markets will influence competitiveness of the FTO
Y2	Inflation, inf	= Inflation rate General price level of the goods will influence the competitiveness of the FTO

Efficiency and Competitiveness

To investigate the nexus between the efficiency and competition, DEA efficiency score is included as among the independent variables by re-estimating the PR model. Casu and Girardone (2006), and Lee et al. (2018) have explained the

insertion of the DEA efficiency score on the basis that it can be treated as a proxy for managerial efficiency ability. Thus, extending the Equation (11), become:

$$
\begin{aligned}
ln\,rev_{it} &= f(w_{it}, Z_{it}, Y_t, DEA_{it}, \varepsilon_t) \\
&= \alpha_0 + \alpha_1 \ln lp_{it} + \alpha_2 \ln dcp_{it} + \alpha_3 \ln ecp_{it} + \beta_1 \ln size_{it} + \\
&= \beta_2 \ln proclaim_{it} + \beta_3 own_{it} + \theta_1 gdpg_t + \theta_2 \inf t + \gamma DEA_{it} + \varepsilon_{it}
\end{aligned}
\tag{13}
$$

DATA ANALYSIS AND INTERPRETATION

Efficiency

The efficiency level of the FTO by comparing to each other is computed by DEA and the result is shown in Table 4. The cost efficiency (CE) of FTO is 88%, which is attributed to the technical efficiency (TE) at 97% and allocative efficiency (AE) at 91%. TE of 97% indicates that the overall inefficiency to achieve maximum outputs with the least cost is 3%, meanwhile AE of 91% shows that FTO are at a 9% level of inefficiency in choosing different combined resource inputs to produce a mix of optimal different. Thus, the overall inefficiency in FTO is more affected by the inefficiency in choosing the optimal input to produce output rather than the inefficiency attributed to the achievement of maximum output by least cost. Furthermore, after the implementation of RBCT comes into effective in 2014, the mean efficiency in 2013 at 75% has improved to 90% in 2014 and further improved to 95% in 2016. More interestingly, the efficiency attributed to attain maximum outputs with the least cost has achieved relative efficient level at 100% as a result of RBCT (TE is at 97% in 2013 but perks up to 100% in 2014 to 2016). The AE of FTO in 2014 is 90% and in 2016 is 95%, hence, the inefficiency of FTO still exist even after the introduction of RBCT which is caused by the reason of inefficiency to choose optimal input to produce output. The results do not support the findings by Weiss and Choi (2008) and Eling and Schaper (2017) because they conclude that regulation will decrease the efficiency of insurers in the United States and Europe. However, the results are consistent with Gaganis et al. (2015) and Wu et al. (2016). They propose that stringent regulations could improve the efficiency of insurers at a certain level to ensure their sustainability. In view of the efficiency scores in this study are increasing since the implementation of RBCT, it may suggest that RBCT has motivated FTO in Malaysia to improve their efficiency. These results also parallel with the findings from Yakob and Isa (2016) that explain Takaful operators postulate better risk management efficiency because Takaful operators are concerning more on operational risk management rather than investment management. Their findings also indicate that DEA model is suitable in providing an ample guide towards the best practices that other firms might implement and worst practices that other firms should escape.

Table 4
Summary of cost efficiency

FTO	2011			2012			2013			2014			2015			2016			2011–2016		
	CE	TE	AE	CE	TE	AE	CE	TE	AE	CE	TE	AE	CE	TE	AE	CE	TE	AE	CE	TE	AE
AIA AFG	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-	-	-	-	-	-	1.00	1.00	1.00
Sun Life	1.00	1.00	1.00	0.48	0.49	1.00	0.53	0.69	0.77	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	0.88	0.82	0.86	0.94
Etiqa	0.65	0.65	1.00	1.00	1.00	1.00	0.55	1.00	0.55	0.60	1.00	0.60	0.58	1.00	0.58	0.70	1.00	0.70	0.68	0.94	0.74
GE Takaful	1.00	1.00	1.00	0.88	0.88	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.98	1.00
HLMSIG Takaful	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
HSBC Amanah Takaful	0.62	0.62	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.94	0.94	1.00
AIA Public	0.73	0.73	1.00	1.00	1.00	1.00	0.59	0.95	0.62	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.89	0.95	0.94
MAA Takaful	1.00	1.00	1.00	0.61	1.00	0.61	0.66	0.99	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.00	0.88
PRU BSN Takaful	1.00	1.00	1.00	0.54	1.00	0.54	0.65	1.00	0.65	0.93	1.00	0.93	0.88	1.00	0.88	0.90	1.00	0.90	0.82	1.00	0.82
Syarikat Takaful	1.00	1.00	1.00	0.90	1.00	0.90	0.48	1.00	0.48	0.27	1.00	0.27	1.00	1.00	1.00	1.00	1.00	1.00	0.78	1.00	0.78
Takaful Ikhlas	1.00	1.00	1.00	0.72	1.00	0.72	0.52	1.00	0.52	1.00	1.00	1.00	0.86	1.00	0.86	0.89	1.00	0.89	0.83	1.00	0.83
AmMetlife	-	-	-	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Overall	0.91	0.91	1.00	0.84	0.95	0.90	0.75	0.97	0.77	0.90	1.00	0.90	0.94	1.00	0.94	0.95	1.00	0.95	0.88	0.97	0.91

Note: CE = Cost Efficiency, TE = Technical Efficiency, AE = Allocative Efficiency

Productivity

In examining the productivity change of FTO, MPI analysis is computed and illustrated in Table 5. It is observed that the FTO in Malaysia have an average total factor productivity progress at 9% which is contributed by 6% progress in technical efficiency change and 4% of progress in technological change. Looking at the trend, the TFP is increasing but there is a drop from 2014 to 2015 and records a reduction in productivity by 13%. This suggests that the productivity of FTO in Malaysia is reducing after the initial implementation of RBCT. The regress in TFPCH is influenced by the technological change with a drop at 29%. This may signal that FTO in Malaysia are unable to reduce the cost and simplify their offerings to the customers. Another reason could be due to the fact that FTO have to update their system in meeting the minimum capital requirement and submitting the CAR report periodically as imposed by BNM. Although TECH is regressing, the EFFCH exhibits a progress of 22% which is contributed by increase in pure efficiency change by 16% and increase in scale efficiency change by 5%. This shows that the FTO in Malaysia are efficient in controlling their operating cost and operating at optimal scale after RBCT. However, from 2015 to 2016, the total factor productivity has increased by 2% that is contributed by 20% increment in efficiency change but 15% reduction in technological change. The findings support the analysis by Barros et al. (2005) and Chen et al. (2014) but contradict with the results by Alhassan and Biekpe (2015). This could be due to the appointed actuary has good managerial skills in deciding the basis of selecting the stress (worst case scenarios) factors for each product and each fund. This is because, RBCT has made it compulsory that each Takaful operator must appoint a certified actuary to determine and declare these decisions in the accompanying actuarial report. Therefore, the RBCT framework that focuses on the importance of risk-based capital management has led to improvement in efficiency change but lack of policies relating to regulate the innovation and new technologies in Malaysian Takaful operators has caused the deterioration in technological change.

Table 5
Summary of Malmquist Productivity Index

Year	Efficiency	Score
2011–2012	EFFCH	0.74
	TECH	1.64
	PECH	0.85
	SECH	0.87
	TFPCH	1.21

Table 5 (*continued*)

Year	Efficiency	Score
2012–2013	EFFCH	1.22
	TECH	0.96
	PECH	1.09
	SECH	1.12
	TFPCH	1.17
2013–2014	EFFCH	0.99
	TECH	1.26
	PECH	0.99
	SECH	0.99
	TFPCH	1.24
2014–2015	EFFCH	1.22
	TECH	0.71
	PECH	1.16
	SECH	1.05
	TFPCH	0.87
2015–2016	EFFCH	1.20
	TECH	0.85
	PECH	1.20
	SECH	1.00
	TFPCH	1.02
Overall geometric mean	EFFCH	1.06
	TECH	1.04
	PECH	1.05
	SECH	1.00
	TFPCH	1.09

Note: EFFCH = Technical Efficiency Change, TECH = Technological Change, PECH = Pure Technical Efficiency Change, SECH = Scale Efficiency Change, TFPCH = Total Factor Productivity Change

Competitiveness

The PR method will be employed to assess the competitiveness of FTO in Malaysia. Table 6 exhibits the descriptive statistics for the variables. Among the three inputs, the debt capital price at RM7.696 per unit seems to be the highest compared to labour price (RM0.188 per unit) and equity capital price (RM0.118 per unit). The standard deviation for fixed capital price is also high due the larger

range in between the maximum at RM193.98 per unit and minimum at RM0. It shows that some FTO rely heavily in Islamic bond and some FTO do not issue Islamic bond.

Table 6
Descriptive statistics data of the variables

Variable	Obs.	Mean	Std. Dev.	Min	Max
rev (RM'billion)	69	0.513	0.662	0.015	3.450
lp (RM per unit)	69	0.188	0.151	0.017	0.685
dcp (RM per unit)	69	7.696	26.653	0	193.98
ecp (RM per unit)	69	0.118	0.126	0.123	0.842
size (ratio)	69	0.588	0.788	0.134	6.039
proclaim (RM'billion)	69	0.004	0.047	0	0.144
gdpc (%)	69	3.718	0.459	3.117	4.464
inf (%)	69	2.437	0.629	1.655	3.200

Note: rev = revenue; lp = labour price; dcp = debt capital price; ecp = equity capital price; proclaim = provision outstanding claim; gdpc = gross domestic product per capita; inf = inflation

The correlations among the independent variables are below 0.6 as described in Table 7, suggest that there is no serious multicollinearility problem in the model (Gujarati, 2014). The variance inflation factor is below 5, supports that the multicollinearility issue in the model is not severe.

Table 7
Correlation between the variables

	rev	lp	dcp	ecp	size	provclaim	own	gdpg	inf
rev	1								
lp	-0.29	1							
dcp	0.10	-0.01	1						
ecp	-0.23	0.02	-0.09	1					
size	0.45	0.22	0.31	-0.14	1				
provclaim	0.63	-0.38	-0.12	-0.18	-0.24	1			
own	-0.31	0.54	-0.12	-0.14	0.26	-0.59	1		
gdpg	-0.03	-0.09	-0.08	-0.09	-0.05	-0.01	0.02	1	
inf	0.07	-0.06	0.00	0.04	0.13	-0.05	0.06	0.47	1

Note: rev = revenue; lp = labour price; dcp = debt capital price; ecp = equity capital price; provclaim = provision outstanding claim; own = ownership (0 = local; 1 = foreign); gdpg = gross domestic product growth; inf = inflation

Table 8 reports the estimations for PR based on four models, where Model 1 to 3 are based on the dependent variable as ln revenue to test the market structure of FTO, meanwhile Model 4 employs ln (1 + ROA) as dependent variable to validate the existence of long run equilibrium of FTO in Malaysia. Model 1 includes a study period of 2011–2016. Model 2 shows the competitiveness result before the RBCT implementation, from 2011 to 2013. Model 3 exhibits the competitiveness result after the implementation of RBCT, from 2014 to 2016. Model 4 is to examine the continuation of long run equilibrium of FTO in Malaysia. For Model 1, the H-statistic depicts a value of –0.975 (coefficient from labour price, fixed capital price and capital price) which is less than 0, statistically significant different from 0 and 1, suggest that the FTO in Malaysia is described as monopoly market. As can be seen, the price of labour contributes the most to the H-statistics, followed by debt capital price and equity capital price. This shows that the labour cost constitutes as the main element of FTO's production function as servicing industry is less reliant on other capitals. Prior to the implementation of RBCT, the market structure is less competitive with its H-statistic at –1.0721, and it is statistically different from 0 and 1 from the Wald test result, recommends a monopoly market structure. After the implementation of RBCT, the competitiveness in FTO has been increased, its H-statistic reports a value of 0.138, this result is statistically significant different from 0 and 1, thus it is in monopolistic competitive structure. The results are consistent with the findings by Jeng (2015) and Alhassan and Biekpe (2016) that conclude that the competition among the insurers are moving towards more competitive. The results further support the recommendation by Todorov (2016) that proposes that intervention by the regulators is needed to enhance the competition among insurers.

To validate the tests in Model 1 to Model 3, the FTO in Malaysia should be in the long run equilibrium. The factor input prices should not be correlated with the dependent variable if the market is in the equilibrium. Model 4 is to examine the equilibrium position of the FTO in Malaysia. From the result, the Wald test is unable to reject the null hypothesis of H = 0, thus it is concluded that the FTO in Malaysia is in the long-run equilibrium of study during the period covered in this study. Following Sufian and Habibullah (2013), the outcomes suggest that even though the process of FTO in complying RBCT is still continuing, it is possible that the response to the institution at various times is in the equilibrium.

Table 8
Estimation results for Panzar-Rosse

	Dependent Variable (DV): ln rev			DV: ln (1+ROA)
	(1)	(2)	(3)	(4)
Variables	2011–2016	2011–2013	2014–2016	2011–2016
ln lp	-0.912***	-0.813***	-0.385	-0.078*
	(0.214)	(0.260)	(0.568)	(0.040)
ln dcp	-0.087	-0.094	0.146	-0.049**
	(0.132)	(0.249)	(0.181)	(0.034)
ln ecp	0.024	-0.165	1.621**	0.0468
	(0.181)	(0.235)	(0.501)	(0.038)
ln size	0.975***	0.972**	-0.559	0.0987**
	(0.259)	(0.395)	(0.853)	(0.048)
ln provclaim	0.574***	0.476***	0.743***	-0.0135
	(0.056)	(0.081)	(0.090)	(0.041)
own	0.309	-0.163	1.203**	0.0586
	(0.289)	(0.387)	(0.439)	(0.059)
gdpg	-0.167*	-0.263*	-0.065*	-0.143***
	(0.225)	(0.404)	(0.286)	(0.0462)
inf	-0.046	-0.072	-0.062	-0.008
	(0.189)	(0.215)	(0.271)	(0.035)
Constant	10.170***	11.990***	9.333***	1.544***
	(1.246)	(2.183)	(2.212)	(0.249)
Observations	69	36	33	69
Adj R^2	0.764	0.781	0.796	0.353
F-statistics	21.270***	13.900***	11.884***	4.263***
H-statistics	-0.975	-1.072	0.138	
(F-stat) H = 1	53.850***	24.630***	4.04**	
(F-stat) H = 0	13.160***	4.600**	10.57**	2.56
Market Structure	Monopoly	Monopoly	Monopolistic competition	Equilibrium

Note: rev = revenue, lp = labour price, dcp = debt capital price, ecp = equity capital price, provclaim = provision outstanding claim, own = ownership (0 = local; 1 = foreign), gdpg = gross domestic product growth, inf = inflation

    Moreover, provision for outstanding claims seems to be the significant control variable that influences the revenue of the FTO as exhibited by Model 1 to 3 in Table 8. This variable is the total forecasted cost to the FTO that undertakes all claims occurring from experience which have occurred up to the end of the financial year regardless of whether the cases have been reported or not that excludes the amounts already paid in regards to the claims. Since there could be cases that not all the accidents are reported to the FTO immediately right after the events and not all the claims are paid immediately to the insured, this provision plays major role to the Takaful insurance firm. Sufficient provision for outstanding claims could ensure the effectiveness of Takaful insurers in handling and satisfying the customer, therefore it will increase the revenue of the FTO. It is also interesting to note that after the implementation of RBCT, the FTO with foreign ownership show statistically significant in improving their revenue, this is mainly due to the support from the parent companies of foreigned-owned FTO in meeting the Supervisory Target Capital Level imposed by BNM. Moreover, one of the macroeconomics factors, which is GDP growth, postulates negative significant relationship with the performance of FTO in Malaysia, hence a better economic growth in Malaysia does not necessarily show a better performance on FTO.

    In Table 9, when controlling for DEA efficiency score in the models, the coefficients for DEA efficiency score are negative signs in Model 5, 6 and 8, suggest that a greater score in efficiency level will generate a lower total revenues for FTO in Malaysia, indicate that the FTO with the highest inefficiency and incurs the highest costs may be able to generate higher revenue than more cost-efficient FTO which is similar to the explanation by Casu and Girardone (2006). However, from Model 7 (Model 3 is without efficiency factor and Model 7 is with efficiency factor, after the implementation of RBCT, the coefficient for DEA score becomes positive. This may recommend that after the FTO in Malaysia comply to RBCT, the FTO with higher efficiency level could generate higher revenue with the minimal cost. The result may imply that the implementation of RBCT would encourage the FTO to be more efficient in achieving higher revenue. The findings are consistent with the recommendations by Alhassan and Biekpe (2016) that propose insurers to achieve higher efficiency in order to maximise revenue and remain competitive in the market. Moreover, the results also support the suggestions by Coccorese (2012) that the roles of regulation is important to produce a competitive and cooperative behaviour in the insurance market.

Table 9
Relationship between competitiveness and efficiency

Variables	Dependent Variable (DV): ln rev			DV: ln (1+ROA)
	(5)	(6)	(7)	(8)
	2011–2016	2011–2013	2014–2016	2011–2016
ln lp	-0.838***	-0.668**	-0.328	-0.0501
	(0.218)	(0.296)	(0.635)	(0.0410)
ln dcp	-0.0671	-0.0236	0.151	-0.0547**
	(0.129)	(0.258)	(0.208)	(0.0244)
ln ecp	-0.0126	-0.269	1.435**	0.0355
	(0.191)	(0.256)	(0.557)	(0.0361)
ln size	0.898***	0.716	-0.612	0.0761
	(0.261)	(0.467)	(1.034)	(0.0492)
ln provclaim	0.549***	0.438***	0.731***	-0.0198
	(0.0637)	(0.0892)	(0.135)	(0.0120)
own	0.324	-0.154	1.261**	0.0608
	(0.286)	(0.387)	(0.439)	(0.0539)
gdpg	-0.149	-0.0500	-0.044	-0.135***
	(0.236)	(0.454)	(0.331)	(0.0445)
inf	-0.0254	0.0249	-0.0416	-0.000944
	(0.181)	(0.235)	(0.314)	(0.0338)
dea	-0.571	-0.866	0.0961	-0.170
	(0.543)	(0.847)	(1.189)	(0.102)
Constant	11.76***	12.11***	9.132**	1.738***
	(1.434)	(2.184)	(3.438)	(0.265)
Observations	69	36	33	69
Adj R^2	0.774	0.781	0.776	0.365
F-statistics	19.07***	12.49***	9.6***	4.14***
H-statistics	-0.917	-0.9609	1.258	
(F-stat) H = 1	51.57***	20.66***	4.04**	
(F-stat) H = 0	12.76***	4.96**	4.18**	1.73
Market Structure	Monopoly	Monopoly	Monopolistic competition	Equilibrium

Note: rev = revenue, lp = labour price, dcp = debt capital price, ecp = equity capital price, provclaim = provision outstanding claim, own = ownership (0 = local; 1 = foreign), gdpg = gross domestic product growth, inf = inflation, dea = efficiency

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

There is a noteworthy prospective of Islamic finance particularly in Malaysia as it is one of the major Islamic financial hubs in the world. Therefore, BNM is trying to set global standards for the effective regulation and supervision of Islamic finance to preserve financial stability in the Islamic financial system. In improving the performance of Takaful sector in Malaysia, BNM has implemented RBCT in 2014. As such, there are three main objectives from this study to study the issues related to the FTO and RBCT in Malaysia.

First, it identifies the performance of FTO by constructing efficiency, productivity and competitiveness measures. Second, it is followed by the impacts of RBCT on the efficiency, productivity and competitiveness of FTO in Malaysia. From the DEA efficiency study, the overall efficiency of FTO in Malaysia is inefficient which is more affected by the allocative inefficiency rather than technical efficiency. After the implementation of RBCT, the inefficiency of FTO still exist that is caused by the reason of FTO are inefficient in choosing the optimal input to produce output rather than the inefficiency attributed to the achievement of maximum output by least cost. From the Malmquist Productivity study, the technological productivity change is reducing, FTO in Malaysia are probably unable to reduce the cost and simplify their offerings to the customers due to the weakness in having more technological system. This is in line with the speech by the Governor of BNM in Takaful Annual Dinner and Awards 2018 that highlights that Takaful operators are lag behind technology (Takaful Annual Dinner and Awards, 2018). This is because, technology is restructuring the landscape of finance and reducing the barriers to entry from adjacent industries. Hence, Takaful operators must shape up to have embraced technology, particularly fintech in order to come up with shariah-compliant digital financial products (The Edge Markets, 2017). Despite the improvement in efficiency change after RBCT, the study find out that the technological systems of FTO are yet to adapt the requirements imposed by RBCT. From the Panzar-Rosse competitiveness model, labour costs constitute as the main element of FTO's production function due to FTO is part of servicing industry that is less reliant on other capitals. Prior to the implementation of RBCT, the market structure is less competitive, but after the implementation of RBCT, FTO in Malaysia has become more competitive. This shows that RBCT is one of the major initiatives to establish a strong, stable, competitive and inclusive Takaful operators that supports efficient and effective intermediation of funds, the improvement of vibrant financial markets and contributes towards meeting the financing necessities of the economy (Malaysian Takaful Dynamic, 2015). Furthermore, provision for outstanding claims plays major role to the FTO. A sufficient provision for outstanding claims by FTO

could ensure them to be effective in handling and satisfying the customer that leads to increase in revenue. However, a better economic growth in Malaysia does not necessarily guarantee the prosperity of FTO in Malaysia as there would be more challenging business conditions.

Third, it examines the relationship between efficiency and competitiveness in FTO. The results suggest that FTO with the highest inefficiency and incurs the highest costs may be able to generate higher revenue than more cost-efficient FTO before the compliance to RBCT. Due to a more stringent capital requirement after the introduction of RBCT, FTO is facing with a more challenging operating environment to maintain the capital requirement and market share. The higher operating costs may arise in meeting the RBCT requirements. Thus, they are encouraged to be more efficient in enhancing internal controls to maintain the capital requirement and market share in the competitive Takaful market (Malaysian Takaful Dynamic, 2015). Thereby, the RBCT framework has pushed the Takaful operators in Malaysia to improve their efficiency and remain competitive in order to protect the interest of public.

The results from this study are valuable for both academics and policy makers in understanding the factors that drive the efficiency, productivity and competitiveness of the Takaful industry. The managers of the Takaful industry have to support the deeper revision of the regulatory policies in improving their efficiency and revenue. Consistent with the studies by Tone and Sahoo (2005) and Coccorese (2012), increase in the competition level of financial institution after the intervention of regulator provides a stronger justification that regulator could make a balance between competition and prudential regulatory activities. This is because the supervision authorities play major role in taking care of the public welfare by enhancing the market competition, at the same time to allow the financial institutions to safely manage their additional profit margins and increase their capital base. Furthermore, as proposed by Apergis and Polemis (2016) the managers of the financial institution could provide supportive actions which are self-discipline mechanism in strengthening the financial stability of an economy by adopting more appropriate own-implemented risk management policies in order to reduce moral hazard issues and increase their capitals buffer to accomplish shareholders wealth maximisation.

The limitation of this research is lack of period for post implementation of RBCT since 2014. Even though still at its early stage, the implementation of RBCT based on well-articulated formation, prudent measurement and compliance with Islamic law, which together might enable a new discourse of global convergence of regulatory measures. Moreover, to understand overall Islamic

insurance performance, more study is needed on international perspective. Thus, future study on efficiency or competitiveness in Islamic insurance area could be investigated in cross-country settings. Generally, the analysis presented in this study could stimulate future research on the effects of regulatory controls on the performance of Islamic insurance. This is to ensure that Takaful insurance industry is able to effectively and efficiently in delivering sound Islamic financial services to stakeholders and public.

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