

Non-linear relationship between foreign currency derivatives and firm value: evidence on Shari'ah compliant firms

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Abstract

Purpose – This study examines the impact of hedging on firm value of Shari'ah compliant firms (SCFs) in a non-linear framework.

Design/methodology/approach – This study employs the system-GMM for dynamic panel data to examine the influence of derivatives usage on firm value (Tobin's Q , ROA and ROE). The sample comprised of 59 non-financial SCFs engaged in derivatives from 2000 to 2017 (18 years). The Saabuchi-Lind-Mehlum (SLM) test for U -shaped is performed to confirm the existence of the non-linear relationship.

Findings – This study concludes that hedging significantly contributes to firm value of SCFs based on the non-linear framework. This study suggests that, first, the non-linear relationship occurs due to the different degree of derivatives usage and risk. Second, firms practice selective hedging to maintain the upside potential of firm value.

Research limitations/implications – This study has important implications. First, the importance of risk management via derivatives to increase firm value, second, the evidence of selective hedging from the non-linear relationship between derivatives and firm value and third, the need for quality reporting on derivatives engagement by firms in line with the required accounting standard on derivatives.

Originality/value – This study fills the gap in the literature in relation to the risk management strategies of SCFs in three aspects. First, re-examines the relationship using recent data. Second, examines the relationship in the non-linear framework as the limited studies found in the literature on Malaysian firms are only based on linear relationship. Third, determines whether hedging undertaken by firms is optimal as this can only be addressed using the non-linear framework. This study is robust to the various definitions of firm value (Tobin's Q , ROA and ROE) and non-linear methodologies.

Keywords Hedging, Derivatives, Firm value, Shari'ah compliant firms, Non-linear

Paper type Research paper



1. Introduction

Risk management practices undertaken by firms are meant to reduce risk. Understanding the most critical risks facing the firms enables stakeholders especially managers to carry out the necessary measures to mitigate the adverse consequence of risk on firm value. Recently, a massive growth in derivatives usage is reported among firms around the world (Bartram, 2019; Siddika and Haron, 2020). Thus, risk management is essential to firms' operation and its failures will affect the value of the firms. Good risk management practice is the priority of shareholders. Bouwman (2014) stated that firms use derivatives as an effective tool for managing risk. In line with this argument, firms used derivatives for risk protection (Antônio *et al.*, 2019) and to minimize the impact of earnings volatility and interest rate risk (Barton, 2001; Siddika and Haron, 2020). Dewally and Shao (2013) stated derivatives are used to reduce risk exposure of the firm. Derivatives become an effective risk management instrument for hedging during the period of uncertainty and ultimately to increase the value of the firm (Baber, 2018; Bartram, 2019).

The global financial crisis of 2007/2008 had shaped the scope of derivatives instruments in most countries across the world. The collapse of some established and prominent US banks and financial institutions such as the Lehman Brothers, Merrill Lynch and National City Bank raised many questions about the effectiveness of risk management using derivatives. Furthermore, the failure of risk management using derivatives has led to the collapse of non-financial firms as well during the 2007/2008 crisis for firms in Brazil (Zeidan and Rodrigues, 2013). Dodd (2009) mentioned that 12 countries incurred losses in derivatives due to poor risk management pertaining to exotic derivatives losses in the emerging markets. Bartram (2019) reported that the huge losses related with derivatives have demanded proper reporting relating to derivatives activities by firms. Despite that, derivatives continue to be an effective hedging instrument among the firms for risk management (Ayturk *et al.*, 2016; Seng and Thaker, 2018; Bartram, 2019; Siddika and Haron, 2020).

The current study focuses on the impact of hedging using foreign currency derivatives (FCDs) and firm value which has limited discussion and empirical evidence in the context of Islamic finance. Mohamad *et al.* (2014) stated that empirical studies on Islamic hedging are still limited due to the lack of awareness on Islamic hedging and poor documentation of Islamic hedging in annual reports of firms. Abdul-Rahim *et al.* (2019) in their studies using linear regression found that none of the samples of the Shari'ah compliant firms (SCFs) in Malaysia report any use of Islamic hedging instrument, either in the form of *wa'd* or *tawarruq*. They further recorded that SCFs are twice as likely as their conventional counterparts in adopting foreign exchange hedging. Chong *et al.* (2014) reported that the volume of financial derivatives traded in Malaysia is relatively low compared to the neighboring countries. They stated further that this is partly due to the lack of understanding on derivatives among the managers of the firms. On the same notion, Ameer *et al.* (2011) reported that the awareness of derivatives among firms in Malaysia is still low and managers do not really understand the function and the importance of derivatives as a hedging instrument especially during the period of economic uncertainty. They also added that the practice of derivatives among Malaysian firms is not as extensive as those in the developed countries due to the lack of exposures on derivatives, which are generally considered to be costly and complex products. This is proven by Lau (2016) who reported merely 26.8% of Malaysian firms have derivatives contracts in their operation while the rest of them did not use any derivatives. Besides, Abdullah and Ismail (2017) also found that only 29.6% (48 firms) of the Malaysian listed firms chose to provide information on their derivatives positions while the rest of the firms failed to do so. This phenomenon is also reported by Ameer (2009) who found 298 firms in Malaysia do not participate in any form of hedging instruments during the period of his study.

Islamic banking and finance have grown rapidly all around the world. The Islamic financial asset was worth USD \$2.431 trillion (end 2017) and grew to around USD

\$2.591 trillion (end 2018) (IFCI, 2019). Following this, the use of derivatives instruments among the SCFs as component of Islamic capital market is highly important for risk management and value protection. Mitchell (2010) and Bartram (2019) stated one of the factors that contribute to the global financial crisis is the failure of risk management while (Nafis and Shadique, 2016; Baber, 2018; Nomran and Haron, 2020) commented that during the financial crisis, Islamic finance is better equipped to cope with the economic downturn compared to the conventional finance. Consequently, the financial crisis has brought attention on the weakness of the conventional financial system and the proponents of Islamic finance suggested Islamic finance as an alternative to conventional finance (Bouslama and Lahrichi, 2017; Godil *et al.*, 2020). Nevertheless, SCFs as part of the Islamic capital market are also experiencing the same risks as its conventional counterparts such as the currency risk, interest rates risk, commodity risk and operational risk (Baber, 2018). Thus, the future of Islamic finance very much depends on its effectiveness in dealing with the rapidly changing financial system landscape, and this includes the risk management aspect. In this regard, SCFs need to be well positioned to overcome the challenges posed by the financial system landscape in terms of the latest risk management capabilities and operational system. The ability of the firms to effectively manage the risk affecting its businesses is therefore crucial for its sustainability (Bouslama and Lahrichi, 2017).

With regard to risk management using derivatives, past research have documented that the relationship between derivatives usage and firm value is a linear one. However, some researchers (e.g. Adam and Fernando, 2006; Adam, 2009; Nguyen and Faff, 2010b; Mnasri *et al.*, 2017; Huan and Parbonetti, 2019) argued that a non-linear relationship is more realistic than a linear one since economic conditions seldom remain constant and may change unexpectedly thus may affect firm value. If the relationship between derivatives and firm value is believed to be linear, while the relationship actually has a cause regime switching (non-linear), then the linear model may not be reliable. Through non-linear properties, a threshold point could be ascertained in the relationship between derivatives and firm value, which is necessary for managers to monitor the amount of derivatives usage. This is, however, not possible under the linear properties. Appropriate measurement therefore is required to ensure the validity and reliability of the estimation in the non-linearity relationship between derivatives and firm value. A clear understanding of the relationship would enable managers to clarify specific issues and take appropriate control and monitoring decision on derivatives activities. Therefore, based on the empirical evidence, there exists non-linear relationship between hedging and firm value.

Centered on the above arguments, this study is motivated based on first; there is a lack of empirical evidence on the non-linear relationship between the derivatives and firm value especially on Islamic hedging practices. Second, almost all past studies conducted in Malaysia recorded lack of awareness, poor in reporting hedging instruments and most of the firms do not practice extensive hedging as those in the developed countries (Seng and Thaker, 2018). Third, this study analyses the non-linear relationship between the SCFs that engaged in derivatives and its firm value, where Islamic hedging is still limited because of the lack of awareness on Islamic hedging and poor documentation of Islamic hedging in annual reports of firms (Mohamad *et al.*, 2014).

Considering these motivations, this study therefore aims to fill the gap in the literature in relation to the risk management strategies of SCFs in three aspects, first, to re-examine the relationship using quite most recent data on SCFs, second, to examine the relationship in a non-linear framework since the limited studies found on Malaysian firms in the literature are only based on linear relationship and third, to determine whether hedging undertaken by SCFs in Malaysia is optimal as this can only be addressed using the non-linear framework.

2. Literature review

2.1 Hedging from Islamic perspective

From the Islamic perspective, hedging is a method of precaution or minimizing loss from risk that persistently exists in the financial market. Many Qur'anic verses offer guidelines and suggest men to have risk management in their life. At the same time there is a section in the Qur'an that discusses the financial context of risk management implying that risk management is significantly important, as mentioned in Surah Yusuf (12:47–48):

Yusuf conveyed, "You will plant for seven years consecutively; and what you harvest leave in its spikes, except a little from which you will eat. Then after that seven difficult (years), which will consume what, you save for them, except a little from which you will store. Then will come after that a year in which the people will be given rain and in which they will press (olive and grapes)".

Prophet Yusuf translated the dream of the King based on the verse. Subsequent to the seven years of prosperity in Egypt, the Kingdom will experience seven years of dry season and to overcome the upcoming disaster, the Prophet recommended the King to strategize the economy of the country. Specifically, the people have to prepare the planting of crops and to store for preparation for the long seven years drought. As a result, the people were able to survive when the dry season hit for the next seven years (Kathir, 1988). Therefore it is evidence that managing risk is vital for risk if not well managed, can bring destruction.

SCFs must practice effective risk management and this could be achieved by engaging in hedging position. Effective risk management among the SCFs is important because these firms are also experiencing the same risks as their conventional counterparts, such as currency risk, interest rates risk, commodity price risk and operational risk (Ariffin, 2012). The SCFs are bound by Islamic principles. Nevertheless, their performance is to be comparable with the conventional firms. In this regard however, Mohamad *et al.* (2014) stated the risk management in Islamic finance is still at infancy stage and the use of hedging instruments is found to be rather limited. SCFs nevertheless need to be well positioned to overcome the challenges posed by the current financial landscape in terms of the latest risk management capabilities and operational system.

Islamic hedging is used to minimize the risk resulting from actual transactions, such as a sales, lease or investments. Khan (2000) stated that hedging is a device, which reduces the uncertainty of future price movements. Such a control of risk is critically important, particularly, for firms that maintain assets in excess of equity. Khan also stated that the permissibility of hedging in Islamic finance is restricted to genuine hedging, not a speculative one. There are two key differences between Islamic and conventional derivative instruments. First, with the intention of benefiting from market performance, Islamic derivative instruments are driven by actual risks and not speculative ventures (Sakti *et al.*, 2016). Second, unlike options, swaps, forwards and futures, Islamic derivative instruments are not tradable. Although Shari'ah scholars believe that Islamic hedging tools are acceptable as part of risk management, the instruments are to be used purely for hedging purposes (Khan, 2000). They are still essentially asset-based transactions that are supposed to be free from speculation. Meanwhile, the concept of conventional hedging contradicts the basic Shari'ah rules as the principles of conventional hedging are based on *ribā* (interest), *gharar* (uncertainty) and *maysir* (gambling/speculation) (Sakti *et al.*, 2016).

Sakti *et al.* (2016) argued that derivatives instruments in the Islamic financial industry are essential due to the need for hedging and risk mitigation. Besides, they have argued that conventional derivatives should not be used in Islamic finance for hedging due to the conventional finance practicing derivatives for speculation. Beside, Wahab *et al.* (2020) employed logistic regression and found that FCDs are significant in predicting hedging among the SCFs in Malaysia.

Abdul-Rahim *et al.* (2019) documented that SCFs are found twice as likely as conventional firms to adopt hedging instruments and the Shari'ah compliant status does not hinder the respecting firms from using the contractual hedging instrument to mitigate risk exposure. Meanwhile Mohamad *et al.* (2014) found that financial firms used hedging instruments to reduce risk exposure such as Islamic forex, cross-currency swap and commodity hedging instrument. In addition, Arif *et al.* (2019) reported that the attitude of managers in relying on the current structure of conventional instruments is one of the key concerns that could threaten Islamic risk management tools in the financial market.

2.2 Empirical studies on hedging

The studies on hedging are voluminous. Some researchers (e.g. Belghitar *et al.*, 2013; Bouwman, 2014; Ant3nio *et al.*, 2019) recommend that hedging using derivatives is a value increasing strategy for the firm. Hedging theory is first discussed by Stulz (1984). He stated that if external financing is more costly than internal financing, hedging is a value-enhancing activity. This is if it closely matches fund inflows with outflows and decreases the probability that a firm needs to access the capital market. Hedging ensures that a firm has sufficient internal funds to avoid unnecessary fluctuations of risk thus, increases firm value. Stulz (1996) specified that tax incentives, underinvestment cost, financial distress and managerial compensation could increase firm value through hedging. Allayannis and Ofek (2001) reported that the inaccessibility of data on hedging activities causes the lack of empirical investigation on hedging. Furthermore, in the early 1990s, information on derivatives in firms was confidential as it was considered a strategic competitiveness component. In contrast, firms nowadays are required to disclose all information (risk management and financial derivatives) in the off-balance sheet of their annual reports. The availability of information then allowed researchers to examine the value relevance and the usage of derivatives for hedging.

Recent empirical studies linked firm value to hedging with the evidence available for both ends of the debate. Bhagawan and Lukose (2017) reported that to hedge currency exposure, firms are more likely to use derivatives. This is in line with Chong *et al.* (2014) who found that the use of derivatives is to minimize risk, hence increasing firm value. Besides, Allayannis and Weston (2001) claimed that FCD and firm value are positively significant. They also recorded that firm is exposed to currency risk and the use of derivatives for hedging is to create higher firm value. In contrast, firms that do not hedge will be affected and firm value will drop. Tanha and Dempsey (2017) also found that financial risk (such as interest rates, foreign exchange, equity) and commodity risk have influence on firms to hedge. Besides, Bartram *et al.* (2011) also found a positive relationship between the use of derivatives and firm value. They examined the effect of hedging on risk and value among non-financial firms from 47 countries and found evidence on the value relevance issue. Conversely, Bae *et al.* (2017) in their study on firms in the manufacturing and services industries in Korea found that FCDs fail to increase firm value. In another study by Bae and Kim (2016), it was reported that the heavy usage of FCD by Korean firms leads to lower firm risk. However it failed to increase firm value due to inefficient hedging practices of the firms. Magee (2013) found that no relationship between FCD and firm value. Belghitar *et al.* (2013) also found that there is no significant influence of FCD on firm value in the sample of French non-financial firms.

Conversely, Huan and Parbonetti (2019) found a non-linear relationship between derivatives and firm value. When the use of derivatives is moderate, hedging reduces risk, but aggressive use of derivatives by firms caused risk to increase. Mnasri *et al.* (2017) categorized the relationship between hedging and firm value to be linear in the case of swap, forward and futures but non-linear for options. According to their study, they argued that the relationship is not necessarily linear but also depends on the types of derivatives contracts engaged by the firms. Meanwhile, Adam (2009) stated that large investment program by

firms is better explained by a non-linear model as it can explain the upside potential to ensure sufficient internal financing for future investment expenditure. Further, he suggested that the non-linear model is able to explain whether the hedging is optimal or otherwise. Moreover, [Nguyen and Faff \(2010a\)](#) revealed that the lack of significant relationship between hedging and firm value found in linear model is likely due to the non-linear nature of the relationship. [Adam and Fernando \(2006\)](#) also argued that there was a possibility that any relationship between hedging and firm value could be non-linear. Notwithstanding such varied empirical evidence between hedging and firm value, this study therefore forms the following hypothesis:

- H1.* The relationship between foreign currency derivatives and firm value of Shari'ah compliant firms is non-linear.

3. Data and research methodology

3.1 Sample selection

The sample data of this study involves non-financial SCFs engaged in derivatives from 2000 to 2017 (18 years). Firms' engagement in derivatives is identified by referring to their annual reports in the off-balance sheet section in accordance with the standard reporting of financial instruments and disclosure of the MFRS 7 (Financial Instrument Disclosure). As for the selection of SCFs, following [Ramli and Haron \(2017\)](#) the firms need to fulfill the following criteria, i.e. the firm must consistently be Shari'ah compliant every year starting from 2000 until 2017 (18 years) and in accordance with the Securities Commission Malaysia (SC) Shari'ah compliant yearly listing. This is in contrast to the selection of Shari'ah compliant according to only specific cut-off year; say for an example, only based on November 2017 as per SC Shari'ah compliant listing. [Ramli and Haron \(2017\)](#) argued that the consistency in Shari'ah compliant listing reflects the real Shari'ah compliant status of the firms. Accordingly, there are 177 firms that are consistently being Shari'ah compliant from 2000 to 2017 (18 years). Out of these, only firms that engaged in derivatives are chosen, and the engagement in derivatives is irrespective of any years during the study period. Therefore after the filtering process, only 59 firms are engaged in derivatives positions out of the 177 SCFs.

The financial reports of the firms were downloaded from Bursa Malaysia's website in electronic format. The information on firms with derivatives positions are scanned by using the following keywords: risk management, derivatives, foreign exchange forward, forward foreign exchange, forward contract and forward exchange contract. The sample firms in this study include firms in the non-financial sectors covering consumer products, industrial products, plantation, construction, properties, technology, trading and services.

This study utilizes Malaysian data as Malaysia is the leading country in Islamic finance and having the most advanced Islamic capital market ([Ledhem and Mekidiche, 2020](#)). Nevertheless, hedging practices among its SCFs are still not well explored and very much lag behind against firms in the developed countries ([Wahab et al., 2020](#)). Furthermore, the awareness of derivatives among firms is still low and most managers do not understand the function and the importance of derivatives as a hedging instrument ([Ameer et al. \(2011\)](#)) and Islamic hedging is still limited due to the lack of awareness on Islamic hedging and poor documentation of Islamic hedging in annual reports of firms ([Mohamad et al., 2014](#)).

3.2 Dependent variable

Tobin's Q acts as a proxy for the dependent variable representing firm value. The measurement of firm value is defined as equity market capitalization (market value) plus total

liabilities (book value) over total assets (book value) (Allayannis *et al.*, 2011; Ayturk *et al.*, 2016; Haron *et al.*, 2020). For robustness check, this study also employed ROA and ROE as alternative measurements for firm value. Data on firms are collected from DataStream database.

3.3 Explanatory variables

Financial derivatives are represented by FCD, valued according to the notional value of the derivatives contracts divided by total assets (Allayannis and Weston 2001; Bartram *et al.*, 2011; Magee, 2013; Ayturk *et al.*, 2016; Bae *et al.*, 2018). Data on FCD are manually collected from the annual reports of the firms.

3.4 Control variables

Ten control variables are included to explain firm value:

(1) Managerial ownership

Adam and Fernando (2006) found managerial ownership influences risk management decision and firm value, further supported by Fahlenbrach and Stulz (2009) and Coles *et al.* (2012). Ameer (2010) recorded a significant relationship between managerial ownership and firm value of Malaysian firms. Seng and Thaker (2018) however found Malaysian managers take less hedging positions when they owned more shares. Managerial ownership is measured based on total shareholding (direct) owned by executive directors over the total common shares outstanding at the end of each year in the firm (Ameer, 2010; Haron *et al.*, 2020).

(2) Access to financial market

Allayannis and Weston (2001), Magee (2013) and Lau (2016) stated that firms paying dividends are less likely to face capital constraints, easy access to financial market and can reduce its dividend to increase investment. Following Allayannis and Weston (2001) and Lau (2016), the proxy for the access to the financial market is, firm that pays dividend in the present year equals “1” and “0” otherwise.

(3) Firm risk

Past studies reported that heavy use of FCD by Korean firms leads to lower firm risk and higher firm value (Choi *et al.*, 2013; Bae *et al.*, 2017). Following these studies, the measurement of firm risk is based on the average SD on daily stock returns of the year and then annualized to yearly return.

(4) Firm size

Past studies reported that firm size has a significant positive relationship with hedging decision, hence increases firm value (Allayannis *et al.*, 2011; Magee, 2013; Lau, 2016). However, Allayannis and Weston (2001) and Ayturk *et al.* (2016) found that firm size is negatively related to firm value. The proxy for the firm size is the natural logarithm of total assets (Lau, 2016; Haron, 2018).

(5) Industrial diversification

Highly diversified industries have a higher value compared to low diversified industries (Allayannis and Weston, 2001; Nguyen and Faff, 2010b; Bartram *et al.*, 2011; Ayturk *et al.*, 2016; Bae *et al.*, 2017; Haron, 2018). This study uses Herfindahl-Hirschman Index (HHI) to control for industrial diversification, measured by computing the total of the squared sales value for each segment as a fraction of total firm sales (Berger and Ofek, 1995; Haron, 2018).

(6) Industry effect

Decision to engage in derivatives by a firm is also influenced by the industry the firm belongs to (Allayannis and Ofek, 2001). If a firm that uses derivatives belongs to a high- Q industry, for example the technology-intensive industry, the firm is expected to generate more profit due to the industry itself (Lau, 2016). To control for industry effect, this study first constructs the industry adjusted Tobin's Q , then computes the log difference between the weight-adjusted industry Q and multi-segment for each firm (Allayannis and Weston, 2001; Ayturk *et al.*, 2016).

(7) Investment growth

Firms tend to have a large investment and depend on future investment opportunities to grow. The growth eventually influences firm value. Investment growth is measured based on the ratio of capital expenditure to sales (Allayannis and Weston, 2001).

(8) Leverage

The capital structure of firm affects firm value. This study uses long-term debt divided by total shareholder's equity to represent leverage (Allayannis and Weston, 2001; Allayannis *et al.*, 2011; Ayturk *et al.*, 2016).

(9) Time

The MFRS guideline states that it is compulsory for Malaysian listed firms to disclose their derivatives exposure in annual reports starting from year 2012 onwards. Following the MFRS, from year 2000–2011 equals "0" and 2012 to 2017 equals "1".

(10) Year crisis

This study also controls for year crisis (dummy) in which the crisis years (2007 and 2008) are categorized as "1" while the non-crisis year (other years) as "0" (Zeidan and Rodrigues, 2013; Abdul Bahri *et al.*, 2018).

4. Regression model

Based on the argument that a non-linear relationship is more realistic than a linear one to examine the impact of derivatives on firm value (e.g. Adam and Fernando, 2006; Adam, 2009; Nguyen and Faff, 2010b; Mnasri *et al.*, 2017; Huan and Parbonetti, 2019), this study employs a non-linear model to examine the non-linear relationship between FCD and firm value in a panel data form by employing a standard quadratic model as follows:

$$Q_{it} = \beta_0 + \gamma Q_{it-1} + \beta_1 \text{FCD}_{it} + \beta_2 \text{FCD}_{it}^2 + \beta_3 \text{MO}_{it} + \beta_4 \text{ACCES}_{it} + \beta_5 \text{RISK}_{it} + \beta_6 \text{SIZE}_{it} \\ + \beta_7 \text{DIV}_{it} + \beta_8 \text{INDUSTRY}_{it} + \beta_9 \text{GROWTH}_{it} + \beta_{10} \text{LEV}_{it} + \beta_{11} \text{TIME}_{it} \\ + \beta_{12} \text{CRISIS}_{it} + \eta_i + \varepsilon_{it}$$

where, Q_{it} is firm value, measured by Tobin's Q for firm i in period t . To capture the persistence in firm value, the lagged value of Tobin's Q is included as an independent variable whereas $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}$ are the slopes parameter to be estimated. The explanatory variable is FCD_{it} (foreign currency derivatives) while the control variables consist of MO_{it} (managerial ownership), ACCES_{it} (access to financial market), RISK_{it} (firm risk), SIZE_{it} (firm size), DIV_{it} (industrial diversification), INDUSTRY_{it} (industry effect), GROWTH_{it} (investment growth), LEV_{it} (leverage), TIME_{it} (dummy time) and CRISIS_{it} (dummy crisis), while η_i is an unobserved firm-specific term and ε_{it} is an error term.

The non-linear model specification is generally similar to the studies of [Arcand et al. \(2015\)](#), [Abdul Bahri et al. \(2018\)](#) and [Law et al. \(2018\)](#) and this is done by incorporating FCD² into the model. The use of the non-linear model is first, to capture the non-linear relationship between FCD and firm value of SCFs and second, to ascertain the nature of the non-linear relationship, either in the form of *U*-shaped or inverted *U*-shaped. When β_1 is negative while β_2 is positive and both are statistically significant, this indicates a *U*-shaped relationship between FCD and firm value. While, if β_1 is positive and β_2 is negative, respectively, and both are statistically significant, this signifies an inverted *U*-shaped relationship between derivatives and firm value ([Arcand et al., 2015](#); [Abdul Bahri et al., 2018](#); [Law et al., 2018](#)).

In addition, this study performs the Sasabuchi-Lind-Mehlum (SLM) test for *U*-shaped for robustness check to confirm the existence of the non-linear relationship (*U*-shaped or inverted *U*-shaped) in the regression model. The SLM test was first introduced by [Sasabuchi \(1980\)](#), which was later extended by [Lind and Mehlum \(2010\)](#). The SLM test for *U*-shaped is described below:

$$\begin{aligned} H_0 &= (\beta_1 + \beta_2 \text{FCD}_{\min} \geq 0) \cup \\ &(\beta_1 + \beta_2 \text{FCD}_{\max} \geq 0) \\ H_1 &= (\beta_1 + \beta_2 \text{FCD}_{\min} < 0) \cup \\ &(\beta_1 + \beta_2 \text{FCD}_{\max} < 0) \end{aligned}$$

where β_1 and β_2 are covariance, FCD_{\min} is the minimum value of derivatives and FCD_{\max} is the maximum value of derivatives. If the null is rejected, it confirms the presence of *U*-shaped profile in the non-linearity relationship between derivatives and firm value. The *U*-shaped hypothesis in this study relies on the estimate of the quadratic model based on the system-GMM.

This study employed the two-step system-GMM (generalized method of moments) for dynamic panel data ([Arellano and Bover, 1995](#); [Blundell and Bond, 1998](#)) to estimate the regression. GMM is effective when the moment conditions are exercised in the model framework and the data with a certain number of moment conditions are specified in the model. Therefore panel GMM provides a solution for the endogeneity issue by substituting the endogenous variables with instrumental variables. System-GMM offers better elasticity to the variance-covariance framework and has greater effectiveness, improves accuracy and addresses endogenous issue in the model ([Baltagi, 2005](#)). This study also performs several diagnostic tests that include the validity test of the instruments and serial correlation test ([Arellano and Bover, 1995](#); [Blundell and Bond, 1998](#)). The Hansen test is employed to check the validity of the instruments used, while AR (1) and AR (2) are for the serial correlation tests. Hansen test has the null of valid instruments while AR (1) and AR (2) have nulls of the absence of first-order and second-order serial correlation in the residuals, respectively. For AR (1) the null hypothesis should be rejected and the failure to reject the null hypothesis for AR (2) test indicates that the regression model is robust. Apart from Hansen test and serial correlation tests AR(1) and AR(2), the system-GMM also requires: (1) the significance of the lagged dependent variable and (2) the absence of instrument proliferation, where number of instruments must be less than the number of groups. This study conducts the variance inflation factor (VIF) to check for multicollinearity between the independent variables. VIF of each variable should be less than 10 to be free from multicollinearity issue ([Baltagi, 2005](#)) – reported in [Table 2](#).

5. Empirical analysis and discussions

[Table 1](#) presents the descriptive statistics of the variables used in the analysis (together with skewness and kurtosis). The sample comprises of 59 non-financial SCFs from the main

Variables	Obs	Mean	Std. Dev	Min	Max	Skewness	Kurtosis
Tobin's Q	1,043	1.0851	0.8989	0.0000	9.6898	0.0000***	0.0000***
FCD	477	35.4748	84.6637	0.0009	953.4154	0.0000***	0.0000***
MO	1,052	0.0811	0.1384	0.0000	0.8194	0.0000***	0.0000***
CAPITAL	1,062	0.8386	0.3770	0.0000	1.0000	0.0000***	0.0000***
RISK	1,054	0.3653	0.2257	0.0731	3.5968	0.0000***	0.0000***
SIZE	1,044	13.5857	1.7561	6.8690	18.7867	0.0000***	0.8013
DIV	1,042	0.1452	0.1036	0.0054	0.7336	0.0000***	0.0000***
INDUSTRY	1,045	3.1477	0.8378	-0.0700	14.4083	0.0000***	0.0000***
GROWTH	1,035	0.0947	0.1889	0.0005	3.6880	0.0000***	0.0000***
LEV	830	0.2783	0.3874	3.4200	4.6432	0.0000***	0.0000***
DUMMY TIME	1,062	0.3333	0.4716	0.0000	1.0000	0.0000***	0.0000***
DUMMY TIME	1,062	0.1111	0.3144	0.0000	1.0000	0.0000***	0.0000***

Note(s): *** represents the significant at level $p < 0.01$

Table 1. Summary of descriptive statistics

Variables	Tobin's Q		ROA		ROE	
	VIF	1/VIF	VIF	1/VIF	VIF	1/VIF
FCD	1.07	0.9309	1.07	0.9309	1.08	0.9293
MO	1.19	0.8401	1.19	0.8401	1.20	0.8365
CAPITAL	1.38	0.7261	1.38	0.7261	1.37	0.7292
RISK	1.64	0.6106	1.64	0.6106	1.63	0.6134
SIZE	2.20	0.4537	2.20	0.4537	2.25	0.4437
DIV	1.24	0.8084	1.24	0.8084	1.23	0.8111
INDUSTRY	1.53	0.6530	1.53	0.6530	1.55	0.6468
GROWTH	1.26	0.7942	1.26	0.7942	1.27	0.7876
LEV	1.50	0.6665	1.50	0.6665	1.53	0.6527
DUMMY TIME	1.40	0.7120	1.40	0.7120	1.40	0.7123
DUMMY CRISIS	1.17	0.8578	1.17	0.8578	1.16	0.8627
Mean VIF	1.42		1.42		1.42	

Table 2. Variance inflation factor (VIF) and tolerance

market of Bursa Malaysia. First, the mean for Tobin's Q is 1.0851 (SD 0.8989) implying that the firms are profitable, on average. The mean of FCD is 35.4748 with SD of 84.6637 and the mean for managerial ownership is 8.11% (SD 13.84%) indicating a lower ownership in the sample firms.

Table 2 contains the results of VIF on the independent variables with the mean VIF of 1.42. Higher VIF of more than 10 indicates the presence of multicollinearity (Baltagi, 2005). Based on the results of low VIF as presented in Table 2, thus, this finding suggests the non-existence of potential multicollinearity between the independent variables.

This study presents a non-linear approach estimated through the two-step system-GMM estimator. The results in Table 3 show the coefficients β_1 (FCD) and β_2 (FCD²) are negative ($p < 0.05$) and positive signs ($p < 0.01$), respectively and both are statistically significant. This indicates the relationship between FCD and firm value is non-linear U-shaped. In addition, several control variables are found to be significant (managerial ownership, industrial diversification, industry effect, investment growth, leverage, time and year crisis) in determining firm value.

Next, for the robustness check of the non-linear U-shaped, the SLM test for U-shaped is performed and reported in Table 4. The slope of (FCD_{min}) is negative and statistically significant ($p < 0.01$), whereas the slope of (FCD_{max}) is positive and also significant ($p < 0.01$). Therefore, based on the SLM test, this confirms the non-linear U-shaped relationship between

	Tobin's Q	ROA	ROE
Tobin's Q (-1)	0.913*** (31.91)		
ROA(-1)		0.636*** (19.38)	
ROE(-1)			0.490*** (13.66)
FCD	-0.0227** (-2.46)	-0.0041** (-2.18)	-0.0022* (-1.85)
FCD ²	0.0095*** (4.94)	0.0008** (2.16)	0.000964*** (3.61)
MO	-0.202*** (-10.85)	-0.0025 (-1.26)	-0.0082** (-3.06)
CAPITAL	0.0428 (0.31)	0.0415*** (5.67)	0.119*** (17.88)
RISK	-0.0033 (-0.02)	0.0000 (0.00)	0.0700*** (4.41)
SIZE	0.0737 (1.33)	-0.0146** (-2.74)	-0.0116** (-2.61)
DIV	-0.294* (-1.84)	-0.0702** (-3.00)	0.190*** (3.91)
INDUSTRY	-0.186*** (-4.72)	-0.0147** (-2.55)	-0.0427*** (-5.75)
GROWTH	-1.786*** (-4.20)	-0.275*** (-7.80)	0.0563 (0.83)
LEV	-0.315*** (-2.73)	0.0134 (0.68)	-0.00947 (-0.44)
DUMMY_TIME	-0.253*** (-6.60)	0.0052 (1.60)	-0.0321*** (-3.47)
DUMMY_CRISIS	-0.228*** (-7.93)	0.0087 (1.59)	0.0219*** (3.92)
Constant	-0.853 (-1.04)	0.249** (3.21)	0.165** (2.75)
No of observations	324	324	312
No of instruments	43	45	43
No of groups	47	47	47
AR (1)	0.080	0.005	0.051
AR (2)	0.504	0.901	0.250
Hansen Test	0.700	0.304	0.699
Threshold point	1.1861(3.27%)	2.4922(12.09%)	1.1611(3.19%)

Table 3. Regression results of non-linear models (two-step system-GMM)

	Tobin's Q	ROA	ROE
Extreme point (turning point)95% Fieller interval	1.1861 (-6.9813, 6.8600)	2.4922 (-6.9813, 6.8600)	1.1611 (-6.9813, 6.8600)
Slope at FCDmin	-0.1561*** (-5.2701)	-0.0156** (-2.3017)	-0.0157*** (-3.7604)
Slope at FCDmax	0.1085*** (4.0115)	0.0072** (1.7284)	0.0109*** (3.0675)
Hypothesis test	H0: Inverted U-shaped H1: U-shaped	H0: Inverted U-shaped H1: U-shaped	H0: Inverted U-shaped H1: U-shaped
SLM test for inverted U-shaped			
t-value	4.01**	1.73**	3.07***
p-value	0.0000	0.0424	0.0011

Table 4. Sasabuchi-Lind-Mehlum (SLM) test for U-shaped model

FCD and firm value as depicted in the regression model. Besides, the extreme point (turning point) for Tobin's Q is 1.1861 with 95% Fieller confidence interval (-6.9813, 6.8600).

This study confirms that the relationship between FCD and firm value is non-linear (U-shaped) indicating that derivatives can start enhancing firm value up to a certain point. As reported in Table 3 and supported by Figure 1, the threshold point is 1.1861 (3.27%), which means once the derivatives ratio reached beyond the threshold point, the impact of FCD on firm value is improving positively as confirmed by the U-shaped curve. In other words, derivatives activities/hedging position cause positive changes in firm value, when the threshold point of Tobin's Q is surpassed. This finding is consistent with the hedging theory

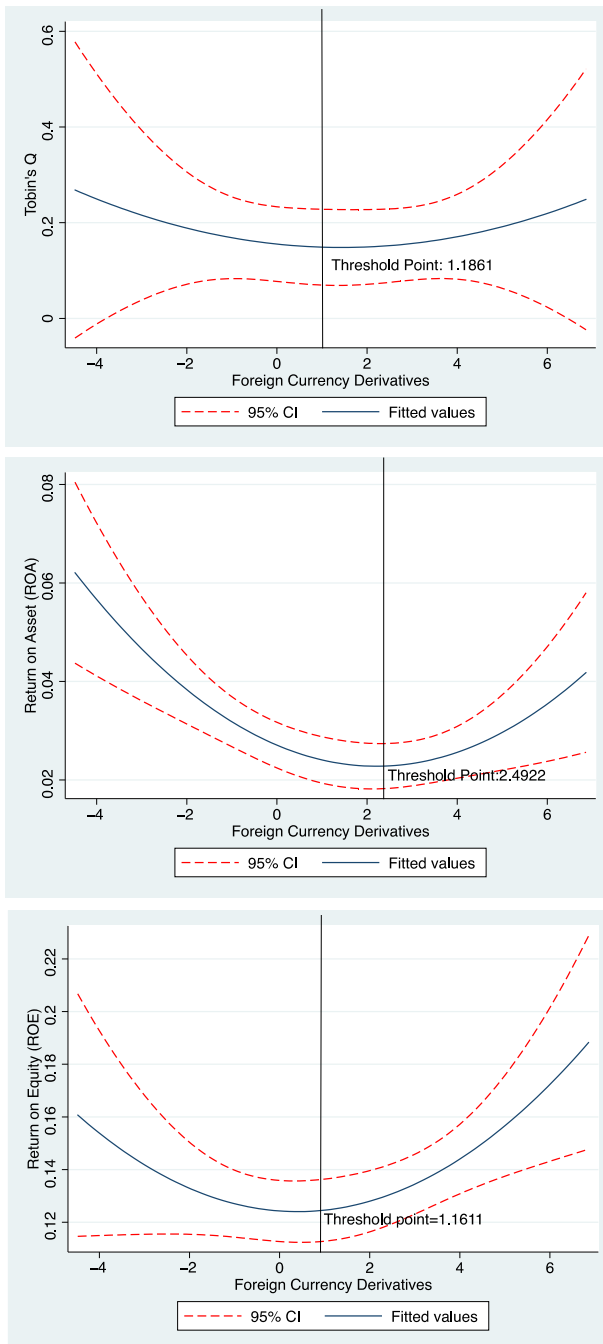


Figure 1. Non-linear relationship between derivatives and firm value (Tobin's Q, ROA and ROE)

that states hedging via derivatives is a value increasing strategy for the firm and mitigates the risk.

In relation to the non-linear *U*-shaped curve, Adam *et al.* (2017) in their study on hedging explains that, a *U*-shaped curve indicates a presence of selective hedging practiced among the managers of the sample US firms. Firms hedge by varying the size and the timing of their derivatives transactions based on managers' market views, a practice known as "selective hedging". In this type of hedge, managers will only be taking a hedging position subject to market timing where managers incorporate their market views into firms' hedging programs. This practice according to them is widely spread in the US and other countries. Stulz (1996) argued that selective hedging could enhance the value of firms that possess an information advantage relative to the market and have the financial strength to withstand the additional risk from market timing. Adam *et al.* (2017) also found that the selective hedging is most prevalent among firms that are most likely to have private information about future prices; as in the current study, the future movement of foreign currencies. Therefore, the managers of SCFs will only participate in selective hedging if they deemed appropriate to take such positions subject to market timing. This strategy is able to enhance firm value as suggested by Stulz (1996) and explained by the *U*-shaped curve. The strategies undertaken by the managers therefore will enhance firm value only after hedging position surpassing certain threshold point. The finding of the current study on selective hedging also supports the argument by Huan and Parbonetti (2019) in a non-linear framework where if the use of derivatives is moderate, hedging reduces risk, but aggressive use of derivatives by firms caused risk to increase, hence destructing firm value.

The non-linear relationship found in this study is in line with (Adam and Fernando, 2006; Adam, 2009; Mnasri *et al.*, 2017; Huan and Parbonetti, 2019) and is suggesting the following reasons; (1) when firm capital expenditure and cash flow are becoming more sensitive due to increasing business risk, firms are motivate to use hedging instruments to achieve value maximizing (2) the non-linear relationship occurred due to the different degree of derivatives usage and risk and (3) firms practice optimal hedge to maintain the upside potential of firm value and to ensure sufficient internal financing for future investment expenditure. This finding therefore, is consistent with the hedging theory, H1 hence is supported.

The *U*-shaped relationship profiles for the regression (Tobin's *Q*, ROA and ROE) are illustrated in Figure 1. The solid line is positioned within a confidence interval of 95% as shown by the dashed line, which supports the *U*-shaped relationship between FCD and firm value.

5.1 Robustness test

This study performs a robustness test to check the consistency of the result (Tobin's *Q*) with alternative measurements of firm value (ROA and ROE). The robustness tests are to reinforce the reported results that the use of derivatives among Malaysian SCFs may affect firm value and also there exists a non-linear relationship between the FCD and firm value. Table 3 reports the results for alternative measurements (ROA and ROE). The non-linear results show that the FCD and FCD² (ROA and ROE) are negatively and positively significant, indicating a *U*-shaped relationship, consistent with Tobin's *Q*. Table 4 reports the results of the SLM test for *U*-shaped of ROA and ROE and consistent with the results of Tobin's *Q*.

6. Conclusion, limitation and future research

This study examines the relationship between FCD and firm value based on a non-linear model, controlling for managerial ownership, access to financial market, firm size, leverage, firm risk, industrial diversification, industry effect, investment growth, time and crisis year.

The results of the study are robust based on first, the various measurements of firm value employed (Tobin's Q , ROA and ROE), second, the SLM test for U -shaped relationship and third, the use of system-GMM estimator to control for endogeneity. This study concludes that derivatives significantly contribute to firm value of SCFs and there exist a non-linear U -shaped relationship between FCD and firm value. The selective hedging strategy undertaken by the SCFs therefore is effective and value enhancing in contrast to aggressive hedging which caused value destruction.

Despite the study period of 18 years, the current study however is not exhaustive in the sense that its sample is limited to only 59 SCFs engaging in derivatives during the study period. Due to this constraint, it may cause limitation on the generalization of the results and the representation of the whole population. The result shows managerial ownership is statistically significant with firm value for firms that engaged in derivatives for risk management. Hence, for future research, researchers may investigate further the role of managerial ownership on hedging decision and its implication on firm value. Future research may also examine firms' sample into different categories and characteristics such as size, profit, etc. and whether such firm characteristics matter in firm hedging and firm value. Besides, this study only focuses on SCFs. This context of analysis can be extended to both categories of firms (SCFs and non-SCFs) in the Malaysian context. This study also suggests future research may be extended to other countries around the world that offer both Shari'ah and non-Shari'ah compliant investments.

Overall, this study has important research implications. First, the finding of this study confirms the hedging theory that hedging is value enhancing. Most importantly hedging efficiency also matters in ensuring that SCFs fully benefit from their risk management strategies. This study provides evidence that SCFs perform optimal hedging in managing their foreign currency (FC) risk indicating the ability of the managers of the firms to fully hedge the FC risk. This is done by entering into sufficient FCD contracts making the hedging position not to be under-hedged or over-hedged. Having optimal hedge also means that SCFs are fully protected from FC risk during the period of currency volatility until the FCD contract is expired. This somehow reflects the skill of the managers of SCFs in dealing with the FC risk using FCD. The results of this study therefore are in line with the hedging theory and the hedging theory from the Islamic perspective.

Second, this study found evidence of selective hedging practiced by the SCFs based on the significant U -shaped relationship between FCD and firm value. Selective hedging means the managers of SCFs will only participate in hedging if they deemed appropriate to take such hedging positions subject to market timing. In this regard, the hedging strategy is a moderate strategy instead of an aggressive one. Undertaking a moderate hedging strategy is crucial as past literature documents that aggressive use of derivatives by firms caused risk to increase, hence destructing firm value.

Having explained the research implications (optimal hedging and selective hedging), in terms of risk management processes on hedging for the SCFs, this study recommends that, first; the SCFs have to ensure that the hedging positions undertaken by the firms is optimal. This is because when hedging is optimal, the SCFs are fully isolated from FC risk, unlike being under-hedged or over-hedged hence, value maximization. An appropriate hedging mechanism therefore needs to be implemented by the SCFs to ensure the hedging exposure is optimal to fully protect its underlying (foreign currency). Second, the SCFs have to be selective in entering the FCD contracts to hedge subject to market timing as to avoid aggressive hedging. This demonstrates the importance of the managers to have the ability to correctly predict the volatility of FC against the local currency (Ringgit Malaysia-RM). This is imperative as the managers may not need to hedge if the foreign currency volatility against RM is not significant. Doing so will only lead to the additional hedging cost to the firm hence negatively affecting firm value.

Moving forward, despite the effective hedging implemented by the SCFs in managing its FC risk as evidenced in this study, an important issue that needs to be highlighted in relation to hedging within the context of Islamic finance is that, there is no disclosure in the annual reports whether the hedging instruments used by the SCFs are Shari'ah compliant or otherwise. This is due to no requirement or accounting standard imposed on firms in Malaysia to disclose whether the hedging instruments are Shari'ah compliant. [Abdul-Rahim et al. \(2019\)](#) acknowledged the fact that most of Malaysian firms still adopt conventional hedging instruments mainly because of more documentation needed in dealing with Islamic hedging instruments. They added further that documentation related to Islamic hedging instruments are also cumbersome and need to be prepared before and after the transactions are completed. The virtue of the SCFs should lie on how they conduct their business activities. It is widely known that the Shari'ah principles do not permit conventional hedging instruments. This is because of the presence of *ribā al-nasi'ah* resulting from the delay in the delivery as well as the differences existed in the actual foreign exchange value being exchanged. Therefore, the managements of the SCFs are responsible to the stakeholders to disclose the FCD instruments they are using. In relation to this, for policy recommendation, the regulator may consider imposing SCFs to report Islamic hedging instruments either in the form of *wa'd* or *tawarruq* in their annual reports to represent their hedging exposure in such instruments.

This study also highlights the importance of quality reporting on derivatives usage by firms and the information symmetry in line with the required accounting standard on derivatives. Without the quality reporting, research on derivatives hedging will never be possible.

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