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Why Do Firms Hedge? A Revisit for An Emerging Market Perspective

(Mengapa Firma Melindung Nilai? Penelitian Semula dari Perspektif Pasaran Muncul)

Adilah A. Wahab
Rozaimah Zainudin
(Faculty of Business and Economics, Universiti Malaya)

ABSTRACT

This study explores the determinants of hedging practices, focusing on foreign exchange exposure within 250 listed Malaysian firms. Aligned with the theory of underinvestment costs, a positive correlation between foreign exchange exposure and hedging is established. Firms with higher exposure display an increased propensity for hedging contracts, and the COVID-19 pandemic significantly impacts these practices. Quantile regression analysis reveals that heightened foreign exchange exposure induces Malaysian firms to intensify hedging, particularly in lower and middle distribution percentiles. Additionally, the study highlights the impact of growth opportunities on the intricate relationship between foreign exchange exposure and hedging practices. Implications include strategic consideration of foreign cash flow-based exposure in hedging decisions, recognizing hedging as pivotal during crises, and acknowledging the motivating role of growth opportunities in fostering increased hedging within a corporate framework.

Keywords: COVID-19; foreign exchange exposure; growth opportunities; hedging; quantile regression.

ABSTRAK

Kajian ini mengkaji faktor amalan lindung nilai, dengan memberi tumpuan kepada pendedahan matawang asing untuk 250 firma tersenarai Malaysia. Sejajar dengan teori kos terkurang pelaburan, terbukti korelasi positif antara pendedahan matawang asing dan lindung nilai. Firma yang mempunyai pendedahan yang lebih tinggi memaparkan kecenderungan yang meningkat untuk mengamalkan kontrak lindung nilai, dan pandemik COVID-19 memberi kesan ketara kepada amalan ini. Analisis regresi kuantil mendedahkan bahawa pendedahan matawang asing yang meningkat mendorong firma Malaysia untuk meningkatkan amalan lindung nilai, terutamanya dalam persentil pendedahan rendah dan pertengahan. Di samping itu, kajian ini membuktikan kesan peluang pertumbuhan terhadap hubungan antara pendedahan matawang asing dan amalan lindung nilai. Implikasi termasuk pertimbangan strategik pendedahan berasaskan aliran tunai asing dalam keputusan lindung nilai, mengiktiraf lindung nilai sebagai penting semasa krisis, dan mengiktiraf peranan moderator peluang pertumbuhan dalam memupuk peningkatan lindung nilai dalam rangka kerja korporat.

Kata kunci: COVID-19; pendedahan matawang asing; peluang pertumbuhan; amalan lindung nilai; regresi kuantil.

INTRODUCTION

Malaysia is one of the most open economies in the world. Its trade-to- GDP ratio rose to unprecedented heights in the year 2020, reaching 220%. Since 2010, it has been maintaining its trade-to- GDP ratio on an average of 130% (World Bank 2020). These statistics emphasize the massive international trade activities existing among Malaysian companies. The international finance theory observes that global market integration makes borderless activities cheaper due to systematic risk reduction. However, it also creates a new form of risk, such as foreign exchange risk (FOREX risk[1]), and political risk exposure. The literature indcates that emerging economies are more vulnerable than developed economies (Griffith-Jones & Ocampo 2009). Their vulnerability to FOREX risk was more pronounced during a crises (Qureshi et al. 2023). The largest FOREX turbulence ever experienced by Asian countries occurred during the Asian crisis of 1998. Bloomberg (2022) reported that the MYR had dropped to its lowest of MYR4.88 per dollar in year 1998, and by the end of 2022, it had reached MYR4.74 per dollar. The unstable FOREX movement of Malaysia pressures companies to deal with their unpredictable profits, project cash flows, and future costs (Lily et al. 2017). With worsening uncertainty in such highly atile financial markets, the importance of risk management is becoming recognized by the firms (Arnold et al. 2014). To mitigate FOREX risks and financial market turbulence, firms use risk management tools such as hedging through derivatives instruments (Hagelin & Pramborg 2004; Das & Kumar 2023).

The common causes for firms to engage in hedging strategies include concerns for underinvestment issues, foreign exchange exposure, financial distress, managerial ownership, and firm size. The literature recorded that

firms with high international activities weremore likely to be exposed to FOREX risk exposure, thereby causing uncertain firm cash flow (Alomran & Alsubaiei 2022; Froot et al. 1993). This uncertainty could lead to unpredictable financial commitment delivery in the future (Chay & Suh 2009), which may further dampen firm value (Jeon et al. 2017; Luo & Wang 2018; Tufano 1998). This leads to underinvestment issues as firms struggle to plan for future project financing commitments. To avoid financial problems, firms may forgo potentially positive NPV projects, limiting their growth. Hedging strategies can mitigate these challenges. Empirical evidence indicates that firms employing derivatives for hedging tend to create more value, thanks to reduced tax and financial distress costs (Modigliani & Miller 1958). It is apparent that firms facing higher financial distress, with larger ownership structures and sizes, are more inclined to hedge as a risk management strategy (Vural-Yavas 2016; Ameer 2010; Allayannis & Ofek 2001). Given Malaysia's high trade-to-GDP ratio, it's crucial to assess firms' vulnerability to foreign cash flow and their hedging decisions regarding FOREX exposure proxies, especially during crises.

Two perspectives exist regarding how future growth influences firms' hedging practices. One argues that firms use hedging to address underinvestment issues stemming from disrupted cash flows due to FOREX exposure. Previous studies indicate that higher future growth correlates with increased engagement in hedging strategies (Altuntas et al. 2017; Lee 2019). Conversely, an alternative view suggests that firm growth opportunities diminish hedging practices (Mian 1996). In emerging markets, the effect of future firm growth on hedging practices yields mixed results. Ameer (2010) found a positive association in Malaysia, while Sudarma and Sari (2020) found no significant link in Indonesia's listed property and real estate sectors. However, Yudha et al. (2022) identified a significant impact of growth opportunities on hedging decisions among state-owned firms in Indonesia, indicating hedging adoption to safeguard future cash flow for financing growth beyond the local level. These inconclusive findings prompt the current study to investigate the impact of firms' future growth on their hedging decisions, including the interaction with FOREX exposure, among Malaysian public listed companies (PLCs).

This study contributes to the existing literature on risk management in several ways. Firstly, it utilizes the latest data from 2010-2020 to examine how foreign cash flows, as FOREX exposure proxies, affect hedging decisions among Malaysian Public Listed Companies (PLCs). The high-market openness policy currently adopted by Malaysia, exposes the PLCs to unstable FOREX fluctuations. These companies are increasingly using foreign currency derivatives (FCD) to mitigate the adverse movement of FOREX (Omar et al. 2022). Based on prior events and past studies it is evident that hedging practices, especially through the use of FCDs, represent a commendable strategy for effectively managing foreign exchange (FX) exposure (Mishkin & Eakins 2017; Moffett et al. 2017). The usage of FCDs is becoming more relevant to Malaysia when compared to other alternative derivative instruments. Secondly, the study establishes that there is a general agreement of a direct relationship that exists between FOREX exposure/risk and firm hedging practices. In adopting the approach in Lin and Lee (2017), this study applied the quantile estimation technique to decompose the multiquantile effect of FOREX risk on the use of hedging in Malaysian PLCs.

This study suggests that firms with different levels of hedging practices (categorized as three quantiles from highest to lowest) were expected to experience different impacts due to their varying FOREX exposures. Thirdly, the COVID-19 pandemic significantly increased FOREX exposure for both emerging and developed markets (Sirkarwar 2022). Vural Yavas (2016) noted that firms with higher FOREX risks are prone to adopt higher hedging activities in times of financial distress. In contrast however, Dodd (2009) and Zeidan and Rodrigues (2013) found that hedging did not effectively mitigate atility exposure during crises, but it instead worsens the firms' financial position. To confirm these contradictory findings, a COVID-19 dummy was added to our panel regression model so as to ascertain whether the pandemic has affected differently the PLCs hedging practices. Our findings would be relevant to understanding the nuances of current market dynamics, especially with the introduction of the COVID-19 impact into the analysis. Lastly, early empirical literature provided different outcomes of the impact of firms' future growth on their hedging strategies, particularly in emerging markets (Ameerm 2010; Sudarma & Sari 2020; Yudha et al. 2022). Due to the contradictory findings, this study reexamines the relationship between future growth prospects and hedging decisions among Malaysian PLCs. The theory of underinvestment posits that the opportunity for firm growth influences the relationship between FOREX risks and hedging practices among Malaysian firms. In this study, we verified the relationship between firms' future growth with the FOREX risk-to-hedging decision among Malaysian PLCs.

The remainder of this paper is structured as follows: Section 2 reviews the literature and develops the hypotheses. Section 3 describes the data and techniques used to achieve the study objectives. Section 4 discusses the findings and Section 5 concludes.

LITERATURE AND HYPOTHESES DEVELOPMENT

FACTORS INFLUENCING FIRMS TO PRACTICE HEDGING

Companies' decisions to engage in hedging practices are often influenced by numerous factors, including financial distress, managerial ownership, firm size, underinvestment costs, and FOREX exposure. Vural-Yavas (2016) observed that financially challenged companies in Turkey experiencing difficulties in meeting debt obligations faced higher bankruptcy probabilities, prompting them to resort to hedging as corrective action strategy (Abdulkadirov et al. 2020; Seok et al. 2020). Studies showed that firms with concentrated managerial ownership tend to increasingly depend on hedging to mitigate risks (Abdulkadirov et al. 2020). The reason is the presence of stronger management ownership who tend to be more loyal to the firm and hence more risk-averse and are prone to adopt hedging to preserve the value of their companies. Firm size is also a significant determinant of hedging practices. Research findings were however inconsistent. Smaller firms are prone to use more hedging, both in terms of contract value and size because they are more sensitive to information asymmetry (Mi & Xu 2020; Wei et al. 2017). In contrast, larger firms with significant understanding of derivatives usually employed more sophisticated hedging strategies to manage their FOREX risk (Geyer-Klingeberg et al. 2019). This advantage of sophistication is however not shared by smaller firms with negligible access to derivative expertise (Bartram 2019).

When focussing on future growths, firms typically look for investment opportunities through external financing. Studies by Paranita & Aditya (2020) and Yang et al. (2022) showed that leverage firms tend to forgo investment opportunities in prospective projects when faced with underinvestment issues. They will instead opt for engagement in hedging to secure their cash flows. The underinvestment cost theory explains the relationship between FOREX exposure and hedging. Froot et al. (1993) showed that external factors, such as FOREX exposure, may influence firms to adopt hedging as a strategy. Firms that don't comply to hedging are more likely to experience internal cash flow fluctuations, such as changes in external funds and capital investment. Bae et al. (2017), who examined the correlation between hedging and FOREX exposure in Korean firms, discovered that companies with high FOREX exposure engaged in hedging activities under certain conditions; namely, when cash flow was highly uncertain, when product portfolio was diverse, and when tax liabilities were high. Similarly, a positive correlation between FOREX exposure and hedging was detected among family-owned firms, although to a lesser extent. (Sikarwar & Gupta 2019). This trend was also observed among Shariah-compliant firms in Malaysia (Abdul-Rahim et al. 2022). Based on this, the following hypothesis was proposed:

H_1 FOREX exposure significantly increases hedging practices.

HEDGING PRACTICES DURING CRISIS PERIOD

Firms often review their hedging practices to minimize excessive risk exposure during turbulent periods, which may severely impact their financial situations and value creation. Hedging strategies, considered crucial for risk mitigation among Malaysian PLCs during the 2007/2008 global financial crisis (Zamzamir et al. 2021), however demonstrate varying effectiveness. While hedging was considered vital for Indian PLCs following the 2008/2009 crisis (Alam & Gupta 2018), its bottom-up effects are evident in influencing the firms' financial dynamics (Dodd 2009; Zeidan & Rodrigues 2013).

In the bottom-up effect, hedging can lead either to high-profits or huge losses for firms. For instance, during the oil crisis of 2008, the airline industry was adversely affected by extreme atility in fuel prices. Southwest Airlines, a major global low-cost carrier, actively used hedging practices to mitigate fuel price fluctuations, resulting in high profitability during the crisis period. During the crisis, with market prices ranging from US$93 to US$135 per barrel, Southwest Airlines purchased fuel at only US$51 per barrel through its hedging contract. The company remained the sole profitable airline in 2008, as reported by the Los Angeles Times (30 May 2008). Conversely however, firms commonly incur derivative losses during such financial crises (Dodd 2009; Zeidan & Rodrigues 2013) inving 50,000 companies across 12 economies (Dodd 2009). These derivative losses can spread over several local banks as a means of compensating their hedging obligations. The huge losses were due to the use of exotic derivatives which led to a weakening of the currency (Fritz 2012). Alacruz Celulosa for example, as related by Zeidan and Rodrigues (2013), suffered a loss of $1.95 billion in September 2008 due to hedging. The fundamental cause was attributed to the underestimation of systemic risks, which also affected the manager's decision to practise hedging. Another company, the Brazilian Real, depreciated by 23% in a single month in 2008, thus posing an impossible challenge for the management to provide a sound hedging plan instantaneously. In consequence, the outcome of hedging strategies may vary depending on the prevailing stable or unstable periods (Dodd 2009; Zeidan & Rodrigues 2013).

The COVID-19 crisis of 2020 produced an extreme detrimental effect on value of firms worldwide. Akhtaruzzaman et al. (2021) recorded the growth of hedging practices in the early phase of the COVID-19 crisis

(from December 31, 2019, to March 16, 2020). Firms however reduced their hedging usage during the second half of the pandemic period (17 March to 24 April 2020). Hedging becomes less attractive when there is government intervention in monetary and fiscal policies since it leads to an increase in hedging costs. Corbet, Hou et al. (2022) explained that China's stock index futures, in particular the CSI 300 index, were increasingly less effective in mitigating the price risk since they were constrained by the COVID-19 pandemic. They discovered that the effectiveness of stock index futures decreased by 20% to 40%. The literature review also indicated that crises changed the effectiveness of hedging in mitigating risks (Dodd 2009; Zeidan & Rodrigues 2013; Sensoy 2021). Thus, it was accordingly posited that the COVID-19 crisis altered hedging practices among Malaysian PLCs. Based on this, the hypothesis was developed as:

H_2 COVID-19 pandemic crisis significantly increases hedging practices.

QUANTILE ESTIMATION OF HEDGING DISTRIBUTION

Although past studies (Bae et al. 2017; Clark & Mefteh 2010) stressed on the strong association between hedging practises and FOREX exposure, current studies have analysed the relationship between hedging distributions and FOREX exposure (Bae et al., 2017; Clark & Mefteh, 2010). Bae et al. (2017) discovered that Korean industrial firms become increasingly inved in more derivative contracts when faced with high FOREX exposure. They also found a few contradictory characteristics between firms with high and low FOREX exposures. Firms with higher profitability, systematic risk, sales growth, and product diversity tended to have substantial FOREX exposure, and vice versa. These four characteristics were the driving force behind Korean firms' decision to increase hedging practices.

Clark and Mefteh (2010) found that French firms increased hedging usage with higher FOREX exposure, showing practices 1.5 times greater. Hedging distribution was found correlated with FOREX exposure. They also distinguished high and low FOREX exposure through using the median exposure whereas Bae et al. (2017), in a subsequent study, adopted the exports-to-imports ratio, using foreign assets and foreign sales as indications of internalisation, Aabo and Ploeen (2014) found that the distribution of hedging describer an inverse U-shape pattern. However, both the indicators of internationalization and FOREX exposure were not convincing since they contradicted the results of previous studies, the majority of which found a linear relationship between hedging and FOREX exposure. On this basis, the current study employs quantile regression to analyse data by dividing the level of hedging distributions into three percentiles (35th, 55th and 75th percentiles). In doing so, this study attempts to reveal the percentile of hedging distribution which may be associated with significant FOREX exposure. Hence, following Aabo and Ploeen (2014) and Bae et al. (2017), it was hypothesised that firm's relationship between the hedging distribution and FOREX exposure was non-linear:

H_3 The relationship between the three percentiles hedging distributions and FOREX exposure follows a non-linear relationship.

HEDGING AND GROWTH OPPORTUNITIES

Seok et al. (2020) and Vural-Yavas (2016) observed that firms facing financial challenges, but with robust growth opportunities, tended to engage in hedging practices. Growth opportunities enable firms to expand both domestically and internationally, inving currency exchange activities and exposure to FOREX risks. Seok et al. (2020) who studied 337 Korean firms, discovered negative significance for market-to-book ratio and a positive significance for capital expenditures related to hedging practices. Conversely, in an Indonesian study, Sudarma and Sari (2020) observed that growth opportunities had no influence on the hedging practices of 55 property and real estate listed companies, since they primarily relied on domestic funds. In a subsequent study however, Yudha et al. (2022) explored state-owned companies on the Indonesia Stock Exchange,and revealed that growth opportunities significantly impacted firms' decisions to hedge due to their constant aspirations for global expansion, thus subjecting them to FOREX exposure.

Growth opportunities have commonly served as an independent or control variable in hedging studies. This study, which is aligned with the underinvestment cost theory, uniquely employs growth opportunities as an interaction variable, to enhance the connection between FOREX exposure and hedging. Froot et al. (1993) emphasized that in the face of cash flow uncertainties and the necessity for new investments, hedging becomes a strategic tool. Aabo and Ploeen (2014) similarly highlighted that companies with greater growth opportunities tend to be more proactive in their hedging in order to manage their FOREX exposure, particularly when venturing into new investments. From these insights, this study posits that higher FOREX exposure and higher growth opportunities could create more hedging practices. Thus, our hypothesis is formulated as:

H_4 Growth opportunities significantly influence the relationship between FOREX exposure and hedging practices.

DATA AND METHODOLOGY

SOURCES OF DATA AND SAMPLE SPECIFICATION

The data used in this study are those extracted from: FOREX exposure, hedging, and firm specific variables. For FOREX exposure indicator variables (specifically total and net foreign cash flow), data were extracted from firms' annual report as noted in items 31, 36, or 37 of the Foreign Currency Risk section. This FOREX exposure data are mandatory for firms listed on Bursa Malaysia since 1st January 2010, in line with the implementation of FRS 7 (Financial Instrument: Disclosure), and FRS 139 (Financial Instruments: Recognition and Measurement) which require listed companies to disclose risk management information (Financial Risk Management Policies). Similar to Luo and Wang (2018), the "find" function was used to detect hedging practices. Keywords encompassing "hedging, forward, futures or options" were also applied. Each hit was then checked to ensure that it referred to FOREX hedging practices. The notional value of derivatives that had been used by the reports in items 31, 36, or 37 was used. Information about firms' specific variables (i.e., firm size, interest coverage ratio, market-to-book value ratio, systematic risk) were extracted from Thompson Reuters DataStream. Total samples comprised 250 nonfinancial companies that were listed on Bursa Malaysia's stock exchange. Their published mandatory FOREX-hedging data based on FRS 7 and 139 were then retrieved. Observation period was based on an 11-year period, from 2010 to 2020. This was consistent with the starting year, the FRS 7 and 139 as announced by the Securities Commission of Malaysia. Since all these were subjected to more rules, their financial statement accounts were noticeably different from other businesses in nonfinancial sectors thus financial firms were excluded. After eliminating observations with missing data, the final sample was a balanced panel dataset containing 2750 company-year observations.

EMPIRICAL MODEL

Data were analysed for three different FOREX risk indicators for H_1. First, the multivariate regression was engaged to establish the link between FOREX risk and hedging. The analysis was then performed using a panel multiple model. The regression equation is shown below:

$$NV/TA_{i,t} = \beta_o + \beta_1 FOREXexposure_{i,t} + \beta_2 Firm\ size_{i,t} + \beta_3 Growth\ opportunities_{i,t} + \beta_4 Financial\ distress_{i,t} + \beta_5 Systematic\ Risk_{i,t} + \varepsilon_\tau \quad (1)$$

where, $NVTA_{i,t}$ represents the notional amount of hedging contracts practised by the firm for a particular year. The independent variables are defined in Table 1. This study includes a dummy year so as to examine the COVID-19 crisis year (i.e., year 2019 and 2020). The non-crisis period was classified as "0" while the COVID-19 year was classified as "1". The use of the dummy year is consistent with two earlier studies (Abdul Bahri et al. 2018; Zamzamir et al. 2021). The regression model used to examine H_2 is:

$$NV/TA_{i,t} = \beta_o + \beta_1 FOREXexposure_{i,t} + \beta_2 Covid19_{i,t} + \beta_3 Firm\ size_{i,t} + \beta_4 Growth\ opportunities_{i,t} + \beta_5 Financial\ distress_{i,t} + \beta_6 Systematic\ Risk_{i,t} + \varepsilon_{it} \quad (2)$$

The terms used for the interaction between FOREX risk and growth opportunities (measured by MTBV) were included in this study to evaluate the applicability of the underinvestment cost theory. This helped to establish the validity of the underinvestment cost theory. The interaction term included in the multivariate regression equation used to examine H_4 is as follows:

$$NV/TA_{i,t} = \beta_o + \beta_1 FOREXexposure_{i,t} + \beta_2 (FOREXexposure\ x\ Growth\ opportunities)_{i,t} + \beta_3 Firm\ size_{i,t} + \beta_4 Growth\ opportunities_{i,t} + \beta_5 Financial\ distress_{i,t} + \beta_6 Systematic\ Risk_{i,t} + \varepsilon_{it} \quad (3)$$

where $FOREXexposure\ x\ Growth\ opportunities$ is the interaction between FOREX exposure and growth opportunities. Prior research had shown firms' use of derivatives and growth opportunities' interaction (Lau 2016; Wahyudi et al. 2019). It was claimed that hedging by high-growth companies can enhance firms' fiscal condition. Quantile regression was utilized in this study to examine the robustness of evaluating the feasibility of the underinvestment cost theory. This approach, as demonstrated by Naifar (2016), facilitates efficient estimates of

the functional relationship and serves to mitigate the potential bias resulting from missing variables, as discussed by Du et al. (2012).

In addition, the quantile regression was used to test H_3, i.e., to assess whether there was a nonlinear relationship between FOREX exposure and hedging practice. To answer hypothesis (3), quantile regression will analyse the relationship between FX risk and hedging practice.

The estimation of α_τ and β_τ are defined as follows:

$$\min_{\alpha x, \beta x} \sum_{i=1}^{T} \rho_\tau \left(H_\tau - \alpha_\tau - \beta_1 FOREXexposure_\tau\right) \quad (4)$$

This study also uses three FOREX exposure indicators (total foreign cash flow, net of foreign cash flow, and foreign sales) on a separate basis to determine the multicollinearity error that was evident in the correlation matrix (see Table 3).

VARIABLE SPECIFICATIONS

The dependent variable was measured by the notional value of hedging contracts used annually. The real value of the hedging contracts used is measured by dividing it with total assets (Abdul Rahim et al. 2022). The first independent variable is represented by the *FOREX exposure* indicators: (1) FS and (2) Foreign-denominated cash flow. Following Sun and Morley (2021), FS is calculated as a percentage of foreign sales to total sales. Information on FS is presented in the yearly report by geographic segments. Four indicators of foreign-denominated cash flow were also used: (1) TFCF, (2) TFCF/TA, (3) NFCF, and (4) NFCF/TA. Since 2010, information on TFCF and NFCF is provided in the financial risk management of the annual reports of Malaysian companies.

The second independent variable is represented by the dummy variable, *COVID-19 crisis*, which represents "1" if the firm experienced the COVID-19 crisis between 2019 to 2020 and "0" for otherwise. Firm-specific variables that were commonly found to have a significant impact on hedging practices[2] were controlled. *Growth opportunities* (GOP*)* is the market-to-book value. Firms with high GOP have higher potentials in practising hedging because they are expanding their operation activities both locally and internationally. International activities include currency exchange and FOREX exposure. In this regard, the firms will try to reduce FOREX exposure and create a stable cash flow through hedging. Therefore, GOP is expected to be positively related to hedging (Herawati & Abidin 2020; Yudha et al. 2022).

Firm Size is the natural logarithm of total assets. Smaller firms were more likely to adopt hedging because external financing would be more expensive (Bartram et al. 2018). Hence, a negative relationship between firm size and hedging was expected. *Financial distress* is the interest coverage ratio (ICR). Firms that can satisfy their interest obligations would not be in financial distress, thus they were more inclined towards hedging (Buyukkara et al. 2018; Mo et al. 2021). It is also posited that high financial distress firms would practise higher hedging. *Systematic risk*, which is a non-diversifiable risk, can only be mitigated through the use of hedging techniques (Chong et al. 2014), hence in line with existing findings, a positive relationship between systematic risk and hedging is expected (Hsu & Lee 2018). The proxies employed by each variable are explained in detail in Table 1. Identified variables were collected from the Datastream database whereas NV/TA, TFCF, TFCF/TA, NFCF, and NFCF/TA were collected manually from firms' annual reports.

A multivariate panel data regression model was used for controlling year, industry, and fixed/random effects with standard error clustered at the firm level. The choice between fixed effects and random effects was validated using Hausman test.

TABLE 1. Variable selection

Name	Descriptions	Measurement
Dependent variables		
NV/TA	Notional value	Ratio of currency derivative notional value to total asset
Independent variables		
FS	Foreign sales	Ratio of foreign sales to total sales
LnTFCF	Total foreign cash flows	Natural logarithm of foreign cash flows
TFCF/TA	Total foreign cash flows to Total Assets	Ratio of total foreign cash flows to total asset
LnNFCF	Net foreign cash flows	Natural logarithm of net foreign cash flows
NFCF/TA	Net foreign cash flows to Total Assets	Ratio of net foreign cash flows to total asset
Covid-19 crisis	Covid-19 crisis pandemic year	Dummy "1" Covid19 (Year 2019 and 2020), "0" otherwise
Control variables		
LnTA	Firm size	Natural logarithm of total assets
MTVB	Growth opportunities	Ratio of market book value to total equity
ICR	Financial distress	Ratio of interest coverage
SR	Systematic risk	The annualized standard deviation of Kuala Lumpur Composite Index

DESCRIPTIVE STATISTICS

Table 2 summarises the descriptive statistics of the variables. On average, the notional amount of hedging contract practices to total assets in Malaysia is 0.02, with a minimum of 0.00 and a maximum of 12.43. The firms maintained foreign sales ratio at 21%, with a maximum of 100%. In terms of foreign denominated cash flow, the average is - LnTFCF 93.88, TFCF/TA 0.11, LnNFCF 6.72, and NFCF/TA 0.06. The firms have an average firm size of 13.24. The mean of growth opportunities (MTBV) is 1.44 while financial distress proxied by ICR is 9.56, and systematic risk is 1.05.

TABLE 2. Descriptive statistics

Variable	Mean	Minimum	Maximum	SD
NV/TA	0.02	0	12.43	0.28
FS/TS	0.21	0	1.00	0.28
LnTFCF	93.88	0	177868	7.13
TFCF/TA	0.11	0	5.44	0.26
LnNFCF	6.72	0	16.73	4.72
NFCF/TA	0.06	0	4.37	0.19
LnTA	13.24	6.96	18.38	1.58
MTBV	1.44	-9.69	48.67	2.97
ICR	9.56	-97.68	102.68	22.09
SR	1.05	-7.72	8.30	0.90

The correlation test was then conducted to detect potential multicollinearity issues within the tested variables. Results are presented in Table 3. On the basis of the correlation matrix results, a high correlation between LnTFCF and LnNFCF (TFCF/TA and NFCF/TA, respectively) was found. To avoid potential multicollinearity problem in the estimation model, these highly correlated FOREX exposure variables were estimated separately. The rest of the variables were free from any potential multicollinearity problem since the correlation scores were below 0.5.

TABLE 3. Pearson correlation coefficient result

	FS	LnTFCF	TFCF/TA	LnNFCF	NFCF/TA	LnTA	MTBV	ICR	SR
LnTFCF	-0.01	1.00							
TFCF/TA	0.28	-0.01	1.00						
LnNFCF	0.50	-0.04	0.35	1.00					
NFCF/TA	0.15	-0.01	0.88	0.26	1.00				
LnTA	0.22	0.05	-0.02	0.34	-0.04	1.00			
MTBV	-0.06	0.01	-0.02	0.08	0.00	0.07	1.00		
ICR	0.03	-0.01	0.01	0.05	-0.01	0.10	0.21	1.00	
SR	0.01	-0.02	0.02	0.05	0.02	0.06	-0.06	-0.01	1.00

EMPIRICAL RESULTS

FOREIGN EXCHANGE EXPOSURE AND HEDGING

The results of equation (1) are summarised in Table 4. The indicators of FOREX exposure, FS, TFCF/TA, LnNFCF, NFCF/TA were found to be significantly related to NVTA. The findings derived from the current study are consistent with previous studies (Abdul-Rahim et al. 2023; Ayturk et al. 2016; Butt et al. 2018; Vural-Yavas 2016; Wahab et al. 2020) which indicated that FS and foreign cash flow (i.e., TFCF/TA, LnNFCF, NFCF/TA) had a positive and significant effect on company's decision to practise hedging. This outcome suggests that companies with higher FOREX exposure were more likely to practise hedging. Lily et al. (2019) noted that emerging countries have higher FOREX exposure than industrialised countries. This scenario is likely to occur in Malaysia because of the exchange rates with trading partners, the use of other currencies as vehicle currency, and the crises that affected adjacent countries. Table 4 presents the regression analysis.

TABLE 4. Regression analysis

	(1)	(2)	(3)	(4)	(5)
FS	0.0005*				
	(1.7800)				
LnTFCF		0.0003			
		(0.2100)			
TFCF/TA			0.3333***		
			(16.0100)		
LnNFCF				0.0049***	
				(3.2300)	
NFCF/TA					0.3538***
					(12.6700)
Ln (TA)	-0.2060**	-0.0189***	-0.0171***	-0.0234***	-0.0165***
	(-4.2800)	(-4.0000)	(-3.7600)	(-4.7700)	(-3.5900)

	(1)	(2)	(3)	(4)	(5)
MTBV	0.0026	0.0022	0.0030	0.0189	0.0026
	(1.0900)	(0.9700)	(1.3400)	(0.8100)	(1.1500)
ICR	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	(-0.2900)	(-0.2700)	(-0.2500)	(-0.3000)	(-0.2000)
SR	0.0052	0.0051	0.0036	0.0041	0.0041
	(0.7900)	(0.7800)	(0.5800)	(0.6300)	(0.6400)
_cons	0.2712***	0.2584***	0.2005***	0.2870***	0.2079***
	(4.3100)	(4.1300)	(3.3100)	(4.5500)	(3.4100)
Obs	2750	2750	2750	2750	2750
R^2	3.7200	3.7800	10.4400	3.2700	9.6800

Notes: The value "ŧ" represents the value of the coefficient and the value in brackets "()" represents the t value. ***, ** and * are significance levels at 1%, 5% and 10%, respectively.

The finding for *LnTA* was consistent with previous studies which had indicated that smaller firms had higher hedging practices (Nance et al. 1993; Wei et al. 2017; Mi & Xu 2020). Smaller firms were more vulnerable to information asymmetry, so they experienced more financial distress. These elements drive smaller firms to engage in hedging. Other control variables of the *MTBV, ICR* and *SR* were found to be insignificant.

THE EFFECT OF COVID-19 CRISIS ON HEDGING

Table 5 reports the regression analysis derived from the estimation of equation (2). The findings were consistent with Emm et al. (2022). The results for all the FIVE (5) models were unanimous, showing a highly positive significance for the COVID-19 dummy. The findings showed that Malaysian PLCs increased hedging practices during the COVID-19 crisis period. This outcome supported hypothesis H_2 which states that the COVID-19 crisis significantly increased hedging practices. In the context of developed countries, increased market risk also affected firms' financial market performance during the COVID-19 pandemic (Emm et al. 2022). A similar adverse effect was also observed for developing countries (Akhtaruzzaman et al. 2021; Majumder 2022). Nonetheless, the effect may be more pronounced when compared to well-developed countries (Emm et al. 2022; Corbet et al. 2022). The underinvestment cost theory explains how external factors like crises and exposures could lead to cash flow atility. This implies that turbulence period encourages firms to hedge so as to mitigate cash flow atility risk.

TABLE 5. Regression analysis

	(1)	(2)	(3)	(4)	(5)
FS	0.0004*				
	(1.7300)				
LnTFCF		0.0003			
		(0.0200)			
TFCF/TA			0.3287***		
			(15.8700)		
LnNFCF				0.0049***	
				(3.1800)	
NFCF/TA					0.3463***
					(12.3100)
Covid-19 crisis	0.0481***	0.0484***	0.0244*	0.0478***	0.0288**
	(3.6000)	(3.6200)	(1.9000)	(3.5800)	(2.2000)
_cons	0.2837***	0.2709***	0.2077***	0.2992***	0.2164***
	(4.5000)	(4.3200)	(3.4200)	(4.7300)	(3.5400)
Obs	2750	2750	2750	2750	2750
R^2	2.86	2.61	10.60	3.13	7.13

Notes: The value "ŧ" represents the value of the coefficient and the value in brackets "()" represents the t value. ***, ** and * are significance levels at 1%, 5% and 10%, respectively.

QUANTILE REGRESSION ON FOREX EXPOSURE AND HEDGING

Tables 6-8 illustrate the quantile regression analysis. Equation (4) was estimated at three quantiles - 35^{th}, 55^{th}, and 75^{th} quantile to capture the nonlinear effect between FOREX exposure and hedging. Quantile regression offers flexibility to recognise important differences between different points within the hedging distribution.

The OLS results suggest that FS does not play a significant role in influencing the hedging practices of Malaysian PLCs. The quantile regression results revealed similar insignificant results for the lower and highest conditional distribution of hedging practices (at 35^{th} and 75^{th} quantile). However, FS is an important factor that increased PLCs' hedging practices at the 55^{th} and 75^{th} percentile. Similar findings were found for LnTFCF where there was a positive significant relationship between LnTFCF towards the mid- and higher conditional distribution of hedging practices. However, LnTFCF did not seem to be an important determinant which encouraged Malaysian PLCs to increase hedging. The results of the quantile regression suggest that when Malaysian PLCs

have a higher level of FS and LnTFCF, they were likely to get inved with hedging practices at the 55th and 75th quantile of the hedging distribution. This is not the case for the lower and highest distribution of hedging practices. The OLS results in Table 4 (Model III-V) are recalled illustrating the outcome for the other three FOREX exposure proxies (TFCF/TA, LnNFCF, and NFCF/TA). It is unanimously agreed that higher TFCFTA, LnNFCF, and NFCF/TA made PLCs practised more hedging. The quantile regression results showed a highly positive relationship for the lower and mid bounds of the conditional hedging distribution. These results suggest that higher TFCF/TA, LnNFCF, and NFCF/TA were likely to induce Malaysian PLCs to practise more hedging in the 35th and 55 quantiles. In contrast, the coefficients were found to be insignificant at the 75th percentile of the hedging distribution. These results imply that TFCF/TA, LnNFCF, and NFCF/TA do not influence Malaysian PLCs in their hedging practices at the top of the distribution. These three proxies were only able to increase firms' hedging usage in the lower and middle distribution.

TABLE 6. Quantile regression analysis -35th percentile

	(1)	(2)	(3)	(4)	(5)
FS	0.0001				
	(0.0001)				
LnTFCF		0.0003*			
		(0.0002)			
TFCF/TA			0.0067**		
			(0.0034)		
LnNFCF				0.0003***	
				(0.0001)	
NFCF/TA					0.0005**
					(0.0007)

Notes: Figures in parentheses are standard errors. ***, ** and * denote significance at 1%, 5% and 10% levels, respectively.

TABLE 7. Quantile regression analysis – 55th Percentile

	(1)	(2)	(3)	(4)	(5)
FS	0.0001**				
	(0.0001)				
LnTFCF		0.0011***			
		(0.0003)			
TFCF/TA			0.0183***		
			(0.0033)		
LnNFCF				0.0018***	
				(0.0005)	
NFCF/TA					0.0224***
					(0.0053)

Notes: Figures in parentheses are standard errors. ***, ** and * denote significance at 1%, 5% and 10% levels, respectively.

The results shown above are consistent with Huan and Parbonetti (2019) who found that hedging reduces risk when the usage of derivatives is at moderate level. However, when firms aggressively use the derivatives, risk increases. Huan and Parbonetti (2019) focussed on banks, and their outcome showed that bank risks started to rise as banks' derivatives usage exceeds 3%. The findings of the Malaysian PLCs in this study showed similar outcomes which corresponded to the maximum level of derivative usage for banks. In addition, considering quantile regression can mitigate missing variable bias (Du et al. 2012). The results of this study revealed a more detailed percentage, indicating the specific percentiles of FOREX exposure and corresponding indicators that could influence hedging practices. Tables 9 shows the quantile regression analysis for the 75th percentile.

TABLE 8. Quantile regression analysis – 75th Percentile

	(1)	(2)	(3)	(4)	(5)
FS	0.0004***				
	(0.0001)				
LnTFCF		0.0026***			
		(0.0003)			
TFCF/TA			0.0182		
			(0.0182)		
LNNFCF				-0.0005	
				(0.0006)	
NFCF/TA					0.0018
					(0.0104)

Notes: Figures in parentheses are standard errors. ***, ** and * denote significance at 1%, 5% and 10% levels, respectively.

THE MODERATING ROLE OF GROWTH OPPORTUNITIES ON THE RELATIONSHIP BETWEEN FOREIGN EXCHANGE EXPOSURE AND HEDGING

The moderating effect of growth opportunities (measured by MTBV), when applied to the FOREX exposure with hedging in Table 9 equation (3), produces a result that is both positive and significant in Models III and V. Both

models showed that as MTBV rises, TFCFTA and NFCFTA's influence on hedging also rises. The findings are consistent with the theory of underinvestment costs, suggesting that companies with a large FOREX exposure would be forced to implement hedging in order to take advantage of growth opportunities. In contrast to Models I, II, and IV, the interaction term yields a nonsignificant result. The non-significant result aligns with Aabo and Ploeen (2014) and Bhagawan and Lukose's (2016) findings, emphasizing hedging distribution, especially for larger firms. Including firm size aids in calculating FOREX exposure, clarifying the impact of growth opportunities on hedging and FOREX exposure. Differing growth opportunities across firm sizes lead to distinct risk management strategies. Vural and Yavas (2016) rationalize the lack of relationship between growth opportunities and hedging, citing potential fund allocation issues for new projects, limiting funds available for hedging and hindering support for firm-adopted hedging practices.This partially support H_4.

TABLE 9. Regression Analysis – Growth Opportunities

	(1)	(2)	(3)	(4)	(5)
FS	0.0003				
	(0.8400)				
FSMTBV	0.0001				
	(0.8100)				
LnTFCF		0.0003			
		(-0.1200)			
LnTFCFMTBV		0.0001			
		(0.1400)			
TFCF/TA			0.2065***		
			(6.8900)		
TFCF/TAMTBV			0.1186***		
			(5.8600)		
LnNFCF				0.0046***	
				(2.6200)	
LnNFCFMTBV				0.0003	
				(0.4500)	
NFCF/TA					0.2453***
					(6.3200)
NFCFTAMTBV					0.0983***
					(4.0200)
Obs	2750	2750	2750	2750	2750
R^2	3.40	3.78	11.67	3.28	7.55

Notes: The value "#" represents the value of the coefficient and the value in brackets "()" represents the t value. ***, ** and * are significance levels at 1%, 5% and 10%, respectively.

ROBUSTNESS CHECKS

The system generalisation method of moment analysis (GMM) was performed to test hypotheses (1), (2), and (4). The aim was to determine the robustness of previous empirical conclusions. Azman-Saini et al. (2010) had asserted that controlling the simultaneity bias which developed in models with an endogenous dependent variable was one of the primary purposes why GMM was utilised as an estimator. According to Magee (2009), the reverse effect (reverse causality) had caused endogeneity to exist in the model. Following Magee (2009) and Wahab et al. (2020), system GMM was employed to resolve the endogenous issues. Details of the GMM results are presented in Tables 10.

TABLE 10. System Generalise Method of Moment (GMM) analysis results

	Panel A: Without FX risk x MTBV interaction					*Panel B: With FX risk x MTBV interaction*				
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
NVTA (t-1)	0.6202***	0.6223***	0.4734***	0.5962***	0.5372***	0.6214***	0.6276***	0.5227***	0.5977***	0.5623***
	(1671.2900	(2384.8400)	(951.8100)	(488.2700)	(1926.3700)	(5866.2800)	(7823.8600)	(4614.5500)	(937.7500)	(6053.1500)
FS	0.0007**					0.0005***				
	(123.2500)					(559.9000)				
FSmtbv						0.0001***				
						(29.1500)				
LnTFCF		0.0005***					-0.0004***			
		(246.7200)					(-301.4100)			
LnTFCFmtbv							0.0002***			
							(309.7600)			
TFCF/TA			0.2671***					0.1198***		
			(471.3000)					(370.4200)		
TFCF/TAmtbv								0.1224***		
								(1093.8500)		
LnNFCF				0.0132***					0.0116***	
				(215.8700)					(490.8500)	
LnNFCFmtbv									0.0002***	
									(144.8600)	
NFCF/TA					0.2031***					0.0882***
					(487.0200)					(688.8100)
NFCF/TAmtbv										0.1012***
										(3128.4700)
No. of instruments	222	222	222	222	222	250	250	250	250	250
No. of groups	250	250	250	250	250	258	258	258	258	258
AR2 (p >chi2)	0.781	0.8390	0.7170	0.2740	0.4960	0.7810	0.7490	0.7020	0.2950	0.7770
Hansen (p >chi2)	0.226	0.1160	0.1530	0.3170	0.1380	0.5210	0.5500	0.5260	0.6250	0.5100

Notes: This table shows the system GMM – Panel A for the analysis of Equation (6) and Panel B for Equation (8). "[a]" denotes coefficient and z-statistic is in parenthesis "( )". ***, ** and * represent the significance level at 1%, 5% and 10%, respectively.

The results in Table 10 (Panel A) showed that all the indicators of FOREX exposure were positively significant to the hedging practices. The significance and signs were compatible with the baseline regression (see Table 4). This highlights the validity of the empirical findings of this study. LnTFCF showed a substantial and positive coefficient in Table 10. The significance and sign of the COVID-19 crisis coefficient is consistent (Table 5). In response to H_4, the results in Table 10 (Panel B) showed that the coefficient of MTBV interaction terms is significant and positive. Compared to the base regression result (refer to Table 5), it yielded a better outcome. This implies that the endogeneity problem can be resolved by system GMM. Since Arellano-Bond (2) and the Hansen test was insignificant, the results shown in Tables 10 and 11 are robust, and the models fit the data well. Table 11 shows that the COVID-19 crisis was significantly associated with the hedging practices.

TABLE 11. System Generalize Method of Moment (GMM) analysis results.

Variables	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*
NVTA (t-1)	0.6228***	0.6237***	0.5538***	0.6166***	0.5886***
	(3000.000)	(3000.000)	(3480.910)	(8391.480)	(6678.050)
FS	0.0006***				
	(144.100)				
LnTFCF		0.0003***			
		(226.180)			
TFCF/TA			0.2331***		
			(421.470)		
LnNFCF				0.0126***	
				(327.410)	
NFCF/TA					0.1791***
					(441.620)
Covid-19 crisis	0.0305***	0.0302***	0.0192***	0.0292***	0.0231***
	(414.750)	(510.230)	(212.040)	(243.460)	(288.070)
No. of instruments	232	232	232	232	232
No. of groups	250	250	250	250	250
AR2 (p >chi2)	0.864	0.927	0.814	0.302	0.571
Hansen (p >chi2)	0.117	0.118	0.140	0.199	0.126

Notes: This table shows the system GMM of Equation (7). "[a]" denotes coefficient and z-statistic is in parenthesis "( )". ***, ** and * represent the significance level at 1%, 5% and 10%, respectively.

CONCLUSIONS

This study had examined the impact of hedging and foreign currency exposure on 250 nonfinancial PLCs in Malaysia, for the period of 2010 to 2020. It further examined the impact of COVID-19 on firms' hedging practices. Quantile regression was used to revisit the FOREX exposure-hedging relationship by focussing on three stage percentiles (35^{th}, 55^{th} and 75^{th}). Growth opportunities was further interacted with FOREX exposure and hedging practices.

The baseline estimation results derived from this study suggest that FOREX exposure was positively related to hedging practices for all the firms, thereby supporting hypothesis H_1. Findings also showed that the COVID-19 period was a determinant that influenced these Malaysian nonfinancial PLCs to practise more hedging, thereby supporting hypothesis H_2. When the baseline model was re-estimated with the quantile approach, results showed that Malaysian firms with hedging distribution at 55^{th} and 75^{th} percentile were impacted by the higher level of their FS and LnTFCF. This was not the case for the lower (35^{th}) and highest (75^{th}) distribution of the hedging practices. The findings for TFCF/TA, LnNFCF, and NFCF/TA showed no significant relationship in the higher hedging distribution quantile (75^{th} percentile). The three FOREX exposure proxies did not affect Malaysian PLCs' hedging practices at the upper distribution but were significant at the lower (35th) and middle (55th) percentiles, primarily increasing hedging at these levels. Two out of five interaction models showed significance, indicating that Malaysian PLCs with higher FOREX exposure are more engaged in hedging to mitigate risks while capitalizing on growth opportunities. The other three models were insignificant, hence partially supporting the H_4 model. As a robustness check, H_1, H_2 and H_4 were estimated using system GMM. The results were mostly consistent with our baseline, showing a more reliable result hence H_1, H_2, and H_4 were accepted.

This study enriches theoretical understanding by providing novel insights into the relationship between FOREX exposure and hedging practices. Earlier research predominantly relied on indicators such as foreign sales, total export, and import, owing to the FRS 7 and 139 regulations for Malaysian firms in 2010. By incorporating foreign cash flows as an additional indicator, our study contributes to supporting the underinvestment cost theory, demonstrating the intricate link between FOREX exposure and hedging. Building on established methodologies like the GMM system, commonly used in prior studies (Ayturk et al. 2016; Bartram et al. 2011; Magee 2009), our findings contribute to the scientific understanding of emerging markets and quantile regression. The results underscore the moderating influence of growth opportunities on the association between FOREX exposure and hedging and as such contribute to narrowing the knowledge gap in this field.

This study has significant implications for Malaysian firms and policymakers. It stresses the importance of considering FOREX exposure indicators for investors and analysts. These metrics are crucial for firms to gauge their overall FOREX exposure. Firms must assess the extent of their FOREX exposure and the benefits of hedging practices. Malaysia's Securities Commission (SC) promotes disclosure of FOREX exposure and hedging activities through Financial Reporting Standards (FRS) 7 and 139, although it's not mandatory for all listed firms. The study recommends SC Malaysia to establish uniform reporting guidelines for all Malaysian firms. This would help SC advise firms on managing FOREX exposure effectively to safeguard their value.

Consider these study limitations when interpreting findings. Firstly, the dataset, comprising publicly listed non-financial firms in Malaysia, may limit generalization to all emerging countries. Secondly, the absence of a standardized format for providing secondary data on FOREX exposure hedging in Malaysian firms' annual reports results in varying levels of reporting. Some firms partially reported while others did not. Thirdly, this study used a COVID-19 crisis year dummy to gauge its impact on Malaysian non-financial hedging practices, potentially limiting the crisis's influence assessment. Lastly, the analysis focused solely on currency derivatives. Future research may explore other emerging countries and additional COVID-19 crisis-hedging indicators, like borrowing costs and hedging practice expenses. Additionally, assessing derivatives of stable commodities in Bursa Malaysia Derivatives Berhad could offer more reliable factors for evaluation.

NOTES

1. We use FOREX risk or exposure term interchangeable throughout the paper
2. (Abdul-Rahim et al. 2022; Butt et al. 2018; Buyukkara et al. 2018; Herawati & Abidin 2020; Hsu & Lee 2018; Mo et al. 2021; Seok et al. 2020; Yudha et al. 2022)

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Adilah A. Wahab (corresponding author)
Department of Finance
Faculty of Business and Economics
Universiti Malaya
50603 Kuala Lumpur, MALAYSIA.
E-Mail: adilahw@um.edu.my

Rozaimah Zainudin
Department of Finance
Faculty of Business and Economics
Universiti Malaya
50603 Kuala Lumpur, MALAYSIA.
E-Mail: rozaimah@um.edu.my